An intersectional perspective: Broadening Critical Reflection on Diversity through the Boundary Crossing learning mechanisms of identification and reflection

Case study research: Master's program in Environmental Sciences

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MSc Thesis in Environmental Sciences

2023, July

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Preface

I would like to express my sincere thanks to Karen Fortuin and Melina Czymoniewicz-Klippel. Without their companionship and encouragement, I could not complete the thesis. Thank you for allowing me time and space to delve into the topic that matters to me, and reflect myself in the research journey. Initially, I would not dare to choose a topic related to education, if not having an explorative meeting with Karen, when her kindness, passion, and support instilled the confidence in me.

I have learnt that embarking on the thesis journey, it will be rewarding to work on a topic of my interest. However, the diverse fields that capture my attention often pose a challenge when deciding which area I should pursue. At times, I have attributed this indecisiveness to my "diversity" – encompassing interdisciplinary backgrounds and to some extent, transdisciplinary work. My previous background lies in Gender studies, and my current focus is on Environmental Sciences. This mixed position raised the feeling that I have missed certain perspectives by immersing myself in one of the fields for long. I have noticed the absence of feminist perspectives and humanity approaches in environmental sciences education. Also, my work for non-governmental organizations, travelling to ethnic communities in the North-West of Vietnam have taught me to value the local knowledge, and agency of these communities. Yet, their types of knowledge and wisdom are often underestimated.

Looking back, it is pretty a long journey leading me to my thesis subject on diversity and boundary crossing. Perhaps philosophical, but it makes sense to me why I find myself here and now, and how I have traversed boundaries to embrace diversity.

I am truly grateful for the interview participants who joined me in this research. Their openness and willingness to share with me have provided me with a deeper understanding of the program I have been engaged for the past two years. It was my pleasure to have conversations with the teachers from whom I learn so much, to realize their enormous consideration behind and dedication to our courses. I also want to express my heartfelt gratitude to my friends, my classmates, for participating in the interviews with me. Your thoughtful, critical mind and activism are vital in striving for our education improvement. I was proud learning about your thoughts and visions, and that we are all graduates of the Wageningen environment program.

I want to thank my loving husband, Marton, who is so patient listening to my moments of struggle while doing the research, especially at the start of the thesis. Thank you for giving me hugs, always, to comfort me that after all, everything and anything will be all right. I am also thankful for my family, both in the Netherlands and in Vietnam, though they may not know about my thesis.

I would like to extend my thanks to dear friends Astrid, Diana & Camilla, and colleagues Sverre, Sarah, and many teachers at ESA, who have been aware of and supporting me in my thesis work. A simple cup of coffee, lunch, a chat or hang-out with you meant a lot. Thank you for moments of relaxation and sharing.

Hanh Tran

Arnhem, 30th June, 2023

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Summary

In the context of exclusion and inequalities persisting worldwide, diversity is increasingly seen as important in environmental sciences education. Graduates from an environmental sciences program, such as in Wageningen University & Research (WUR), are expected to become responsible scientists and professionals, capable of critically reflecting on social embedding and consequences of their actions, in terms of respect for diversity, equity, and social justice. Critical reflection on diversity, thus, becomes an essential competence for future environmental scientists & professionals.

However, the concept of "critical reflection on diversity" remains unclear. Diversity can be perceived differently according to various theories. The Boundary Crossing (BC) theory views diversity as a valuable learning resource derived from socio-cultural differences. From the intersectional perspective, on the other hand, diversity refers to a variety of differences among people, including gender, race, socio-economic class, ethnicity, age, (dis)ability, religion, migration, etc. These identities do not separate but intersect, to create a system of inter-dependent social constructed identities that inform us about the possibility of being privileged and/or marginalized of individuals or groups of people. Critical reflection on diversity, from the intersectional viewpoint, implies being aware of socio-cultural identities and experiences of inclusion/exclusion.

While students' capacity of reflection on diversity has been strengthened through BC learning mechanisms, specifically, identification and reflection, little is known about how critical reflection on diversity can be implemented in an environmental science education program. Since both the BC and intersectionality scholarships examine diversity, it might be possible to broaden critical reflection on diversity through the BC learning mechanism of identification and reflection.

This research focused on investigating the possibility of broadening critical reflection on diversity, through the BC learning mechanisms of identification and reflection. The case study selected was the Master's program in Environmental Sciences (MES) at WUR. To achieve the objective, I conducted a literature review and 17 semi-structured interviews with the teachers and students involved in the MES program.

The literature review resulted in the original conceptual framework, in which I operationalized the concept of critical reflection on diversity into the three delineated components. I drew upon various scholarly perspectives, mainly from the work of Jenkins (2018) and Valle (2021) who embrace intersectionality. Moreover, the application of this framework was investigated empirically through interviews with the students and teachers.

The findings from the interviews revealed a variety of reflection practices in the MES courses. Out of the six selected courses, only the European Workshop Environmental Sciences and Management emphasizes BC learning explicitly. Thus, reflection on diversity is practiced explicitly in BC learning mechanisms. For the remaining courses, reflection practices are implicit, without mentioning BC and its learning mechanisms. Furthermore, the findings showed that the integration of critical reflection on the three proposed components is necessary and potential, though with the challenges often mentioned.

Despite the obstacles, the interview participants have suggested various approaches and initiatives. The recommendation frequently indicated was careful planning and preparation, aligning reflection practices with the courses' learning objectives or issues, and fitting it in the MES program. The program level adjustment was considered important to strengthen critical foundations for students on responsible research & sciences. The interview participants also emphasized on creating a safe, open and inclusive environment for sharing experiences. Integrating reflection should be based on the needs and contexts that arise in the courses. Finally, the finding indicated the extending reflection practices beyond just students, suggesting that professors/teachers and the university itself should engage in the critical reflection effort to address issues of biases, decolonizing knowledge, and responsible research and sciences.

Based on the findings, several important points were discussed. Firstly, the conceptual framework of critical reflection on diversity is original, and should be further examined. Secondly, there is the possibility to enhance the existing reflection practices, by making critical reflection more explicit, in which BC plays a role. BC can suggest methods for integration, i.e. to elucidate assumptions & beliefs, while the contents of reflection would be provided by the critical reflection framework. As such, BC learning mechanisms help address the frequently mentioned challenge on fitting critical reflection in a packed course. Nonetheless, when the components of critical reflection were identified as structural issues, and thus, referred to various disciplines, further research is needed to deepen our understanding of the critical reflection components within the specific study fields and beyond.

1. Introduction

1.1. Context

Science, engineering, and technology have developed rapidly and transformed forever the nature of life and its operation. Civilization advances the comfortability of our living on Earth by providing technological and information systems serving human needs. However, in times of the Anthropocene, we find ourselves confronting complex global challenges: climate change, water, air pollution, biodiversity loss, refugee crisis, migration, and multiple forms of inequality - gender, race, ethnicity, social-political and economic inequalities (Kayumova et al., 2019). Meanwhile, the white nationalist, xenophobic, anti-Black, anti-Asian, anti-Semitic, anti-Muslim are resurrected within Europe and the United States (Vakil & Ayers, 2019). Yet, across the globe, Black Lives Matter movements gain strength in fighting against the system of discrimination, racism, and racial inequality (University of Pennsylvania School of Arts & Sciences, n.d.). The international social movements bring diversity and inclusion issues into a central focus (Lie et al., 2022).

In this context, discussions in Europe about responsible research and innovation call upon the reform in science education to response to the global social challenges. Science education should play its role in preparing new generations with an understanding and engagement in addressing the challenges, often intertwined with discrimination, marginalization, social injustice, and inequalities (Kayumova et al., 2019).

Diversity, thus, is increasingly recognized as a significant factor in science education, given the broad picture of the globalized world, and persisting forms of exclusion and inequalities worldwide (Lie et al., 2022; Kayumova et al., 2019). However, there is an underrepresentation of minorities in both science & science education (Medin & Lee, 2012), where environmental sciences are not exceptional. Underrepresented groups are lacking in the environmental fields, both in workforce and positions of influence (Smith et al., 2017). In addition, there is a lack of diverse voices from minorities, their values, cultures and practices (Medin & Lee, 2012).

Wageningen University & Research (WUR) is one of the leading universities in Europe providing life science education. Diversity is embraced in the internationalization process of the university. WUR values diversity in cultures and perspectives from multi-disciplines and stakeholders in solving global and social challenges. Every year, WUR receives students from all over the world, making it a diverse student population (Wageningen University on Internationalization - WUR, n.d.). WUR students learn in international classrooms, where they interact with their teachers and peers from different sociocultural backgrounds, in multicultural contexts, and with various perspectives. Furthermore, like other Europe's higher education institutions, WUR wants to adapt its curricula and methodologies (Claeys-Kulik et al., 2019), to enable students to learn more from contrast, develop more reflexive mind and understand diversity (Teichler, 2009). According to the report by Wageningen University Board of Education: *"Wageningen University wants to train students to become responsible professionals and honest scientists. This means they are aware of the social embedding and consequences of their actions, also in terms of equity, social justice, and respect for diversity. They know and endorse the Scientific Code of Conduct and know how to integrate replication into daily practice. For both, the capacity for critical reflection is essential, as well as the willingness and ability to account for one's choices"*

(Bergsma et al., 2019), p. 4). From this status, critical reflection on diversity is recognized as an essential capacity for WUR students or future professionals in directing their actions and accountability.

WUR has been offering Environmental Science education as one of the Science, Technology, Engineering and Math (STEM) programmes since the 1970s. Environmental sciences study the interactions of natural systems and human systems; thus, it draws knowledge from both natural and social sciences. Since its emergence in the seventies, environmental science research and education have been widely acknowledged as multidisciplinary, interdisciplinary, and today, transdisciplinary, because of its involvement of varied scientific disciplines and inclusive non-academic knowledge (Fortuin, 2015). Graduates from the WUR environmental science education are expected to perceive multiple facets of environmental social issues, even conflicting views, when aiming at solutions (Wageningen University & Research, n.d.). Aligned with the WUR's core mission of education, (future) environmental scientists should be capable of critical reflection on diversity, inclusion and inequalities embedded in environmental social issues and learn to act upon them. Among others, training future professionals the reflection capacity on diversity becomes of importance in creating essential values for responsible environmental scientists and engineers (Bergsma et al., 2019).

1.2. Reflection on diversity according to Boundary Crossing theory

Over the past decades, diversity in education and work poses a significant challenge that needs a better conceptualization, particularly in educational theory. Many educational scholars have attempted to study and address the challenge by employing the notion of Boundaries and Boundary Crossing (Akkerman & Bakker, 2011). A boundary is defined as "a sociocultural difference leading to discontinuity in action or interaction" (Akkerman & Bakker, 2011, p. 133). Boundary crossing (BC), hence, refers to how a professional transits and continues actions and interactions across diverse sites, despite socio-cultural differences (Akkerman & Bakker, 2011, p. 134). Although diversity is not defined, it is highly appreciated in the BC theory. This idea of cultivating diversity as a learning resource differs from most of the educational theories, emphasizing learning as a vertical process of enhancing knowledge and capacities within only a specific discipline (Akkerman & Bakker, 2011). Diversity can be seen equivalent to "boundaries", representing socio-cultural differences among (future) professionals.

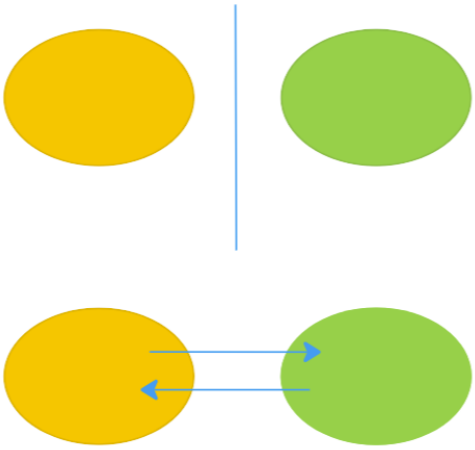
Since 2018, Boundary crossing competence development has been introduced in WUR in the university-wide Comenius Leadership project (*Boundary Crossing @ WUR*, n.d.). The project aims at training WUR students to learn from diversity and across boundaries. In the classroom setting, i.e., group work, students experience boundaries, which could impede the collaboration; however, diversity encountered regarding different ways of seeing, could stimulate their mutual understanding, and learning from each other (Akkerman et al., 2006). Students learn to cooperate with others from a variety of cultures, disciplines, and non-academic backgrounds (Fortuin et al., 2020). The classroom environment has become increasingly diverse through interactions of students-students, students-teachers, students-stakeholders, and so on - each having their own socio-cultural background, discipline, and perspective.

In WUR, students' capacity of reflection on the boundaries - diversity has been trained via two BC learning mechanisms: Identification and Reflection. BC learning mechanisms refer to how the learning process happens at the boundaries. Learning here is used in a broad sense, meaning not only new understandings, or change of practices, but also identity development (Akkerman & Bakker, 2011).

Identification (learning mechanism) happens when students become aware of their own expertise, assumptions, norms, values, and how these shape the ways they see and interpret their experiences. Simultaneously, this starts the process of identifying how their experience differs from other expertise, norms, values, and the ways they act (Akkerman & Bakker, 2011; Fortuin et al., 2020).

Reflection (learning mechanism) refers to perspective-making and taking. Perspective making is about making explicit one's understanding, knowledge and assumptions that are implicit or unstated. Perspective taking, on the other hand, refers to taking other perspectives into account, such as of a person with a cultural background divergent from our own. This process creates the possibility to see one's own practice through the eyes of others. It helps enrich students' learning by broadening and deepening their perspectives (Akkerman & Bakker, 2011; Fortuin et al., 2020).

The figure below suggests some related questions which can be asked, when practicing Identification and Reflection, adapted from Fortuin et al. (2020).



Identification

- What are my assumptions, norms and values? And what are the other assumption, norms and values? How do these shape our different perspectives and practices? What expertise do I have, and do I miss? What expertise does the other bring?

Reflection (perspective-making & taking

- What can I learn from the other? What would I do when standing in the other's shoes?

Figure 1 – Suggested questions of BC learning mechanisms of Identification and Reflection, adapted from Fortuin et al. (2020, p. 5)

1.3. Reflection on diversity through Intersectional lens

Apart from the framework provided by the BC theory, other scholars have attempted to conceptualize diversity, and apply this concept in teaching and learning of various disciplines, including STEM education.

Diversity refers to a variety of differences among people: gender, race, socioeconomic class, ethnicity, age, (dis-)ability, religion, migration status, and other identities, such as education, personal characteristics, socio-economic backgrounds, etc. (Ramiah et al., 2022). It is important to acknowledge that these identities are not separate, but intersect – called intersectionality - to create a system of interdependent social, cultural, and political identities that result in inclusion and exclusion of individuals (Ramiah et al., 2022, p. 290). Crenshaw (1990) was the first legal scholar who introduced intersectionality scholarship, which has become influential for examining the power structures and privilege.

Considering diversity from the intersectional perspective enable us to understand the possibility of being privileged and/or marginalized that individuals, as well as groups of people might experience.

From this intersectional perspective, we can see that, in education, certain groups of students or individuals are experiencing marginalization and/or privilege, because of their socially constructed identities. Research in the Dutch higher education shows that students with non-western and migration backgrounds yield less success than white students (Ministerie van Onderwijs & Cultuur en Wetenschap, 2020). Most Dutch teachers still repudiate the importance of diversity, do not consider diversity in their daily teaching, or its effect on student achievement (van Middelkoop et al., 2017).

When some students or student groups are privileged and others are marginalized, inclusion and equity in education are threatened. Education is the basic human right and this principle should be achieved but not neglected, by considering: "every learner matters and matters equally" (Ainscow, 2020; UNESCO, 2017). Diversity among all learners should be welcomed and discrimination based on race, social class, ethnicity, gender, etc., should be recognized and eliminated. Diversity, thus, is closely intertwined with inclusion, meaning "a process that helps overcome barriers limiting the presence, participation and achievement of student learners" (Ramiah et al., 2022; UNESCO, 2017, p. 7).

The fact is that the current Dutch educational system often ignores students differing in their start points and success, due to social identity differences between student groups. Thus, the same opportunities can be offered, though, it is not totally up to their talent, motivation or effort invested to grasp the chances. This perspective problematizes the meritocratic approach (van Middelkoop et al., 2017). Research shows that where student placement and selection are merely based on merit, for example, test scores, student's ethnicity, and socioeconomic class strongly influence their study performance. Students from wealthy and well-educated families are more likely to end up in higher standard classrooms than students of low-educated and low-income parents. While starting points of an individual or groups of students are not considered, the merit unfulfilled is placed on students' deficiency or incapacity, for they are not good or do not try hard enough (Mijs, 2016). Not acknowledging the social identity differences means that students who do not fit in the dominant education or culture will have to adapt or suffer the consequences. Instead of being recognized or included, they are at risk of exclusion, underperforming or dropping out (van Middelkoop et al., 2017).

In the educational context, diversity and inherently inclusion are of importance when considering how it influences the participation and achievement of diverse student populations, and to help lift barriers and create a more inclusive teaching and learning environment (van Middelkoop et al., 2017; Handelsman et al., 2022). STEM education is not an exemption. In North America universities, 90% students majoring in STEM complained about poor teaching methods, commonly dominated by lecturing. Students felt alienated by the climate and teaching in STEM classrooms. Particularly students from historically excluded groups are more likely to stop their study than white students (Handelsman et al., 2022). In environmental sciences, although employment increases, women and Black, Latin, and Indigenous people are underrepresented (Taylor, 2018c, cited in Caldwell et al., 2021).

Teaching and learning for diversity require educators to be aware of socio-cultural identities of theirs and their students, seeing how the identities affect and form their experience of inclusion/ exclusion, values, and biases. The awareness of teachers will allow critical reflection on socio-cultural identities

to happen in the classroom settings, for instance, by organizing learning activities to develop self-awareness of self and others and challenge assumptions and beliefs (Jenkins, 2018). Students from historically marginalized groups feel more welcomed in STEM classroom if they can reflect and express their personal values (Handelsman et al., 2022). The reflection practice has been recommended by many scholars as a method for teaching, learning or raise awareness of diversity and inclusion (Hartwell et al., 2017; Jenkins, 2018; Ramiah et al, 2022). In the field of environmental sciences, which often involve interdisciplinary or transdisciplinary research, Fortuin & van Koppen (2016) emphasize reflection as a crucial skill for a researcher, to question different forms of knowledge, interests, norms and values.

1.4. Knowledge gap & Problem statement

Looking into how diversity is perceived in BC theory and according to its definition applied in STEM educational context, we can see that the two perceptions have convergence and possibly complement each other.

Situated in the context of training (future environmental science) professionals working with diversity, BC theory emphasizes the importance of learning from social cultural differences. What sociocultural differences exactly are could be very broad and yet, have not been completely described (Akkerman & Bakker, 2011). As recommended by Akkerman & Bakker (2011), further research is needed to examine the boundaries and situate sociocultural diversity in particular contexts. "Who experiences the discontinuity, and how socio-cultural differences play role in knowledge processes, personal and professional relations, and mediation, and in feelings of belonging and identities" should be empirically investigated (Akkerman & Bakker, 2011, p. 153).

On the other hand, diversity looked through the intersectional lens applied in (science) education context considers social cultural identities, and how they could inform the experience of inclusion/exclusion, privilege/marginalization, values, and biases in a classroom. In this sense, the concept of diversity and inherently inclusion would contribute to a more specific understanding of "socio-cultural differences" that BC theory refers to.

However, on the empirical level, little is known about how the reflection on socio-cultural identities works and the critical reflection on experience of inclusion/exclusion, biases, and values, accordingly, are implemented in an (environmental) science education context. It is still a question of how the practice could be possible in a STEM program, if teachers are willing to adopt, or if students are comfortable learning this.

On the other hand, BC identification and reflection is being implemented in WUR, particularly in MSc Environmental Science program. The BC learning mechanisms allow reflection on boundaries/socio-cultural differences/diversity. What could be the possibility to broaden the content of this reflection on diversity, and inherent inclusion, that happens in classrooms or groupwork?

It is worth emphasizing that at the conceptual level, the increasing interest in boundaries is indeed the result of an effort put forward by post-modernism, post-structuralism, post-colonialism, and feminism. These social theories centralize their concern and activism towards the marginalized, the decentered, and the underprivileged (Akkerman & Bakker, 2011). It is reasonable to examine the broader

reflection on diversity within BC learning mechanisms, to not only allow an awareness, acknowledgement, and appreciation of different socio-cultural differences, but also reflection on inclusion and exclusion, as well as barriers to students 'participation in relation to their social identities, and feelings of belonging, among others.

1.5. Purpose of the study and Research questions

This research aims to investigate the possibility to broaden critical reflection on diversity, through the utilization of the Boundary Crossing learning mechanisms - identification and reflection. The case study to be examined is the Master of Sciences program in Environmental Sciences (MES) at WUR.

The main research question (RQ) is: ***In which ways can critical reflection on diversity be broadened through Boundary crossing identification and reflection in MSc Environmental Sciences?***

To answer the main research question, there are the three sub-research questions (Sub-RQs):

- *What is "critical reflection on diversity"?*
- *What are the current practices of reflection on diversity that BC identification and reflection, explicitly or implicitly, employ in MSc Environmental Sciences?*
- *In which ways can critical reflection on diversity be further addressed in the practices of identification and reflection?*

1.6. Outline of the report

The research report is organized into five chapters. Chapter 1 serves as the Introduction. Chapter 2 provides an overview of the methods employed for data collection and analysis. Chapter 3 presents the results of literature review and semi-structured interviews. Chapter 4 is dedicated to the discussion of the results and their limitations. Chapter 5 offers conclusions for each research question and the overall research, along with recommendations.

2. Methodologies

This research employed a case study bounded in the Master's program in Environmental Sciences (MES) in WUR. When the research topic is new and not yet well understood, a case study is used to gain initial understanding (Yin, 2014). This applied to my research, when few study has examined "critical reflection on diversity", as well as "the Boundary Crossing reflection on diversity" practiced in environmental sciences education. The objective of the case study was primarily exploratory, to initially understand the topic, and thus, other pre-determined and more structured strategies, such as questionnaires, would not be suitable for this research (Yin, 2014).

To answer the research questions, I decided to conduct qualitative research methods, specifically semi-structured interviews. The qualitative method was selected because it provides an in-depth understanding of people's perspectives and experiences. As Hennink et al. (2020) put it, the most distinctive feature of qualitative research is that it allows the researcher to understand the study issues through the eyes of the study participants, in this case, lecturers and students, and *"the meanings and interpretations they give to their experience"* (Hennink et al., 2020, p. 11). By developing semi-structured interviews, my aim was to understand the issues through the perspectives of study participants. Since this research was set in an educational context, it was important to explore the viewpoints of teachers and students, who were directly involved in teaching and learning. Moreover, the study focusing on critical reflection on diversity, and BC reflection in environmental sciences education, was new. To investigate an original topic or concept, I believed that qualitative research methods, particularly interviewing, are the most suitable (Hennink et al., 2020).

2.1. Data collection

This research employed literature review and in-depth/semi-structured interview as data collection methods. This table below summarizes the data collection methods I used per research question.

Main Research Question: ***In which ways can critical reflection on diversity be broadened through Boundary crossing identification and reflection in MSc Environmental Sciences?***	
Sub-research questions	**Research methods**
What is "critical reflection on diversity"?	Literature review
What are the current practices of reflection on diversity that BC identification and reflection, explicitly or implicitly, employ in MSc Environmental Sciences?	Course selection Semi-structured interviews
In which ways can critical reflection on diversity be further addressed in the practices of identification and reflection?	Semi-structured interviews

Table 1 – Research methods used for each RQ

2.2. Case study context and research participants

The exploratory case study in MES at WUR was selected based on the possibility to draw valid inferences of the data to a wider context – environmental sciences education. Also, I was affiliated with

the MES program. This allowed me to not only understand the educational context not only as an observer, but also with the insider's views who experienced the teaching and learning environment. Since the research was qualitative, rich data collected through engagement in the context was important. Furthermore, as a MES student, I was able to sufficiently access the data and research populations to illuminate my research questions.

The participants in the research were organized into 2 groups: students and lecturers. Students were currently enrolling in the MES program, mostly in their second year, but also first year. To have a diverse research population, I used race, ethnicity/nationality, and gender for selection of participants. Student participants came from different countries of Europe and outside Europe, white and non-white, Dutch, non-Dutch and Dutch with ethnic minority or migration backgrounds, and mixed gender (women, men, or non-binary people. The diverse student participation was expected to provide different perspectives and insights into the research topic.

The lecturer participants were those engaging in teaching in MES. For divergent opinions, the sampling aimed, also, as much as possible, at diversity of nationality/ethnicity, and gender of teachers. However, this was a secondary sampling criterion, given the fact that the teacher research population was bound to the course selection. After the courses were selected, I obtained the list of possible lecturer participants.

2.3. Literature review

"What is critical reflection on diversity?" To answer the first sub-research question, my primary method was Literature review. Building on the perceptions of diversity provided by both the BC theory and through the intersectional lens, I: i) discussed critical reflection on diversity through the intersectional lens; ii) presented the reflection on diversity that is currently implemented in BC learning mechanism; iii) indicated how the two reflections complement each other, and finally iv) selected the key content of critical reflection on diversity that will be further examined in interviews.

The literature review method was appropriate to apply for this research question. It helped me investigate existing literature on what has already been studied about (critical) reflection on diversity, according to both BC theory and intersectional perspectives. Using this method, I could build up my argument and integrate my findings with the existing body of knowledge (Kumar, 2014). On top of that, "critical reflection on diversity" - part of my research question, would be operationalized essentially for the next research step – interviewing.

The main resources for literature review were writings from journal articles, books, conference papers and the Internet. I primarily searched on Google scholar (accessed via WUR Library search), WUR Library Search, Eric for academic papers, particularly the Journal of Environmental Sciences and Studies, Google website and Edusources.nl (for most of the updated documents on BC at WUR).

A variety of key words was used for searching*: Critical reflection; critical reflection in environmental sciences or studies; critical reflection on diversity; critical reflection on diversity in STEM; critical reflection on diversity in sciences; critical reflection on diversity in environmental sciences; critical reflexivity in environmental sciences or studies, intersectionality in environment; Boundary Crossing, etc.*

2.4. Semi-structured interview

To answer the research questions, I conducted a total of 17 semi-structured interviews with MES students (n=9) and lecturers (n=8), from January to February 2023. Before that, an interview guide was

prepared (see Appendix 1). I conducted three pre-testing interviews and accordingly, revised the interview guide and learned myself to improve my interview skills.

Each interview lasted approximately 1-1,5 hour, and all of them was in English. Ten interviews were in-person, at Wageningen campus, and the rest were conducted on Teams. The interviews in person were audio-recorded, and the online ones were video-recorded via Teams. The demographic questions were asked at the end of the interviews.

With the group of eight lecturers, four were Dutch, four with mixed nationalities (either having dual or international nationalities). Among them, three identified themselves as female, five as males. One of them revealed their (dis-) ability. One followed Christian religion, and one had a Catholic family background.

The other group of participants were nine MES students. Three of them were Dutch; among which, one had the migration background as the first generation of immigrated parents. The rest was international, coming from South-East Asia, East Asia, South Asia, Africa, Eastern Europe, Western Europe and the United Kingdom/Western-Europe. Three of them identified themselves as female, one was non-binary, and five as male. One practiced Muslim. Two revealed their (dis-)ability, such as Autism and Attention-Deficit/Hyperactivity Disorder (ADHD).

Ethics

All the participating students and lecturers gave their consent to be recorded, and on the use of information provided for data analysis.

2.5. Thematic data analysis

After the interviews, data was transcribed verbatim. Transcriptions were initially generated from the recording by Microsoft Office (online version) and Teams. The transcripts were read thoroughly, and checked for accuracy of important information compared to the recording. To conduct thematic data analysis, I followed the steps recommended by (Braun & Clarke, 2006).

In the first step, I generated initial codes, using ATLAS.TI. Codes refer to “the most basic segment, or element of the raw data or information that can assessed in a meaningful way” (Braun & Clarke, p. 88). I employed both deductive and inductive coding approaches. Deductive codes were identified from my theoretical framework, specifically, from coding my main interview questions. Inductive codes were generated from the interview data. I coded through each transcript segments of text that could be relevant.

When all data had been coded, I began to search and organized the themes. I sorted different codes into potential themes. Also, I analyzed the codes and saw their relevance with each other, to create new themes and sub-themes. As an example, figure 2 below illustrated a developed thematic map emerged from the codes, showing one main theme – Necessity for reflecting on assumptions & beliefs on social-cultural identities (Abbreviation - ASS on IDEN: Necessity).

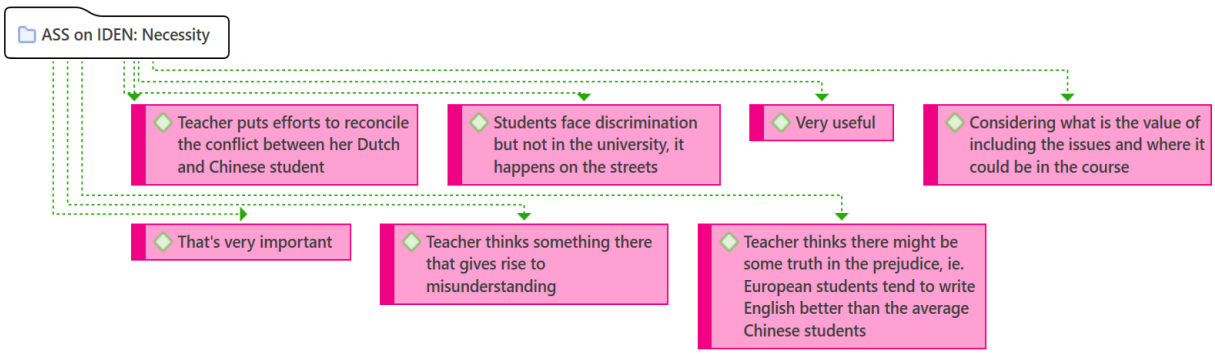


Figure 2 – A developed thematic map, showing one main theme.

Then I proceeded by reviewing – defining – naming the themes. This process involved checking if the codes extracted corresponded to the themes and the entire data set. I refined the theme details, and connected it to the overall story of the data, revising names for each of them. It should be noted that, as a researcher engaged in data collection, analysis, and writing, I deliberately chose to present the storyline that, I believe, best illustrated the unique perspectives of the interviewees, and addressed my research questions.

3. Findings

In this section, I presented the results of this research. I started by operationalizing the concept of "critical reflection on diversity" into more specific aspects. Using literature review, I built up a novel conceptual framework and initially defined each component of "critical reflection on diversity" to be applied in environmental sciences education. In the second part, I presented the concept of "boundary crossing" and its learning mechanisms, particularly Identification and Reflection. The understanding of these notions was further investigated in semi-structured interviews with lecturers and students.

3.1. Operationalization of "Critical reflection on diversity"

3.1.1. The concept of Critical reflection on diversity

Critical reflection is first introduced in teacher education by Dewey (1933). It refers to Dewey's concept of reflective practice. According to Dewey (1933), critical reflection is a process of meaning-making, which includes experiencing, reflecting, and acting to transform our perception towards ourselves and others. From Dewey's perspective, the experience itself does not ensure learning and changes in perception, but the ability to make meaning of experience would generate an understanding or awareness of the self and others. Critical reflection as a meaning-making process, thus, is "the basis of all teaching and learning" (Sharma et al., 2011, p. 11).

Dewey (1933) defines reflection as an "active, persistent, and careful consideration of any beliefs or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends" (cited in Sharma et al., 2011, p. 12). Developed from this notion, critical reflection questions one's taken-for-granted assumptions, beliefs, values, and cultural norms (Banks & McGee Banks, 2009, cited in Sharma et al., 2011) that are normalized and shape one's ways of thinking and acting.

In the context of education, there remains biases among teachers against socio-cultural differences, stereotypes and exclusion of certain students or groups of students by so-called normalized norms (Sharma et al., 2011). Mensah (2013, p. 71) provides quotes from preservice science teachers, who are majority white or from European American backgrounds, revealing their underlying assumptions. As an example, the author wrote: "*Well, I have always blamed the parents of the disadvantaged children for not raising children to be learners… I have never thought that my insensitivity of cultural diversity and discrimination are also other factors that limit educational experience*". Another example is given by Liu (2015), on the reflection of Judy, a white prospective teacher on a bus ride with African students to school. Judy was told by the bus coordinator, who was an African American, that these children might end up in jail if she did not lay down the law on day one, like it was certain that Black students will eventually be in jail. When Judy reflected, she tried to understand where this belief came from, and how such assumption perpetuated the system (Liu, 2015).

Critical reflection offers the opportunities to re-examine one's assumptions, beliefs, values, histories, worldview, and lived experience that impact one's knowledge and professional practices. According to Ryan (2005), critical reflection allows skeptical thoughts, discerning established truth and "assumptions underlying assertions and the interests that motivate people" (cited in Ingram & Walters, 2007, p. 30). The fact that critical reflection brings to the surface social structures and practices that are seemingly rigid makes it an important practice (Ingram & Walters, 2007).

When introducing the reflexive practice, Dewey (1933) suggests that critical thoughts must examine the wider historical, cultural, political contexts, and our "positionality" within social systems (cited in

Ingram & Walters, 2007; Smith, 2011). This perspective brings the issue of power and privilege into focus, asking "*what issues or ways of thinking have been privileged by whom and for what reasons*" (Smith, 2011 p. 217). Critical reflection, from this view, could involve making explicit how the history, culture, and politics have impacts on different groups of students. In the United States, for instance, formal schools and organizations with monoculturalism are biased against students of racial minorities and oppress those who have cultural difference (Ingram & Walters, 2007). In another research on the educational experiences of Moroccan Dutch youth in the Netherlands, it has been shown that the group confronts the structural obstacles, exacerbated by the lack of teachers' informational, practical, and emotional support. Teachers hold low expectations of them and appear not to understand or recognize the challenges they are facing in everyday life. To deal with the obstacles in the educational system, and interpersonal troubles with white teachers and peers, they develop an alternative manner that relies on support from peers, parents, and role models outside the school environment (Turcatti, 2018).

Essed (2004) argues that the Dutch education system have a high cloning culture, meaning the preference for sameness, whether consciously or unconsciously, and thus, exclusion of differences. The university system reflects the tendency to reproduce top educational positions on the homogeneous line of gender, class, and race-ethnicity. Cultural cloning is based on the taken-for-granted assumptions of predetermined qualities to match normative standards, and subsequently, rejecting those who are deviant. This can be widely seen in public or in private organizations generally assuming that women, people of ethnic minorities, refugees, youngsters, seniors, people with disability or without education have or cause problems to an organization. The preferred image of a professional must be "*masculine, white, able bodied, highly educated, pre-senior but not too young"* (Essed, 2004, p. 117).

Corresponding to these perspectives and towards a transformation, Jenkins (2018) emphasizes that critical reflection in open, sincere conversations, and in a safe environment could lead to transformative learning. The learning process takes place when we transform our taken-for-granted frames of reference, biases, dogma, or prejudices. Critical reflection, in this regard, is an important aspect for changing socio-cultural awareness of the self and others (Jenkins, 2018). Given the context of teaching diversity, Jenkins (2018) recommends that teacher educators should critically reflect on at least three interrelated aspects: *assumptions and beliefs of self and others, histories of self and others, and social structures/positioning that impact self and others* (Jenkins, 2018).

In the teacher education context, Liu (2015, p. 144) defines critical reflection as *"a process of constantly analyzing, questioning and critiquing established assumptions of oneself, schools and the society about teaching and learning, the social and political implications of schooling, and implementing changes to previous actions that have been supported by those established assumptions for the purpose of supporting student learning and a better schooling and more just society for all children".* The author adds an important aspect of critical reflection – its goal of evoking changes or actions, to enhance transformative learning and equity for all students.

In environmental studies and sciences (ESS) education, Valle (2021) highlights bringing in "narratives of places" in ESS curriculum. Narratives of places encourage students to "discover or recover their sense of place" (Valle, 2021, p. 130) - meaning the environment where they live, and their embodied experience of the environment. In other words, they reflect on their own stories or lived experience in connection with the environment – the place. This recommendation comes from the fact that students often enter the ESS programs with strong motivations; however, many students of color change

to other disciplines – more diverse and inclusive, because they do not see themselves, their histories, and stories, in the ESS curriculum (Valle, 2021).

According to Valle (2021), students from different cultures demonstrate diverse positionalities rooted in their environmental contexts. They experience and reflect on the environment in their own ways. In one of the course assignments, the author asked students to take pictures of the environment and explain what it meant to them. Many white students had a picture of urban infrastructure, the wilderness, the beach, and ocean, while many Latinx students took a picture of farming or agriculture. Although it is not true that all Latinx students reflect on food-based relationship with their landscape, and all white students choose a representation of pristine wilderness, it is important to notice the distinction. Diverse expressions of human-environment relationship are found within these students. There is no such thing as *the environmental narrative*. Alike learning spaces should be offered to students, so that they can share and validate different lived experiences of themselves and others (Valle, 2021). Valle (2021, p. 136) is convinced that the practices of narratives of places allows the rewritten of history from "lived experience and embodied knowledge of students".

To adopt "critical reflection on diversity" applied in environmental sciences education, I would propose that the aspects of "history of self and others", and "social structures/positioning impacting self and others", can be linked to "narratives of places" – meaning that students reflect on their own history and social positionality connected to the environment or environmental issues. Combining the perspectives of Jenkins (2018) and Valle (2021), I would propose the tree diagram below on the content of critical reflection on diversity:

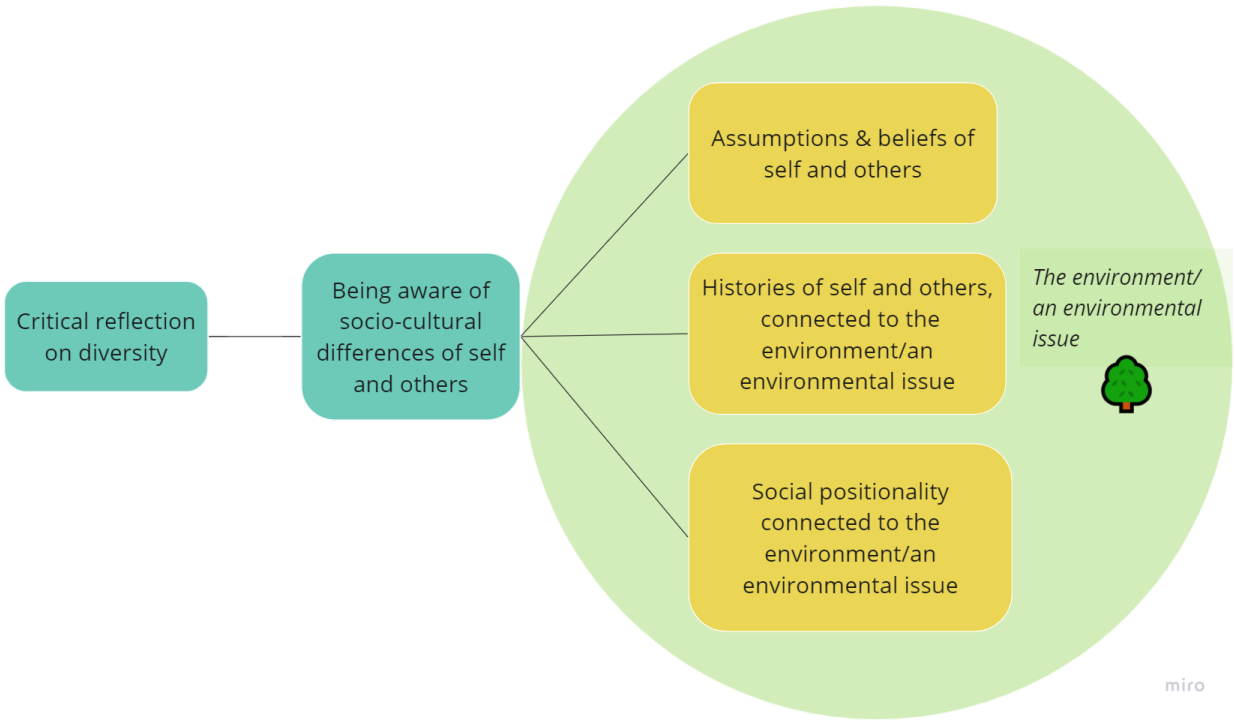


Figure 3 – Operationalization of "critical reflection on diversity" into aspects, adapted from Jenkins (2018) and Valle (2021).

While the reviewed literature for the operationalization of critical reflection found is mostly contextualized in (preservice/prospective) teacher education, hence, as a training for teachers, in the scope of this research, critical reflection is examined as training for students. Teachers, however, should be made aware of, to allow the critical reflection practices in their courses. Since they organize their classroom, develop course materials, activities, assignments, assessment, and deliver training contents to students, they should be the first ones understanding "critical reflection on diversity".

3.1.2. Proposed application of critical reflection practices in the MES program

The MES program is characterized by the diversity and international character of the student populations. 65% of the students was international in the period 2013-2017, of which 18% Chinese (Fortuin, 2018). Figure 4 illustrates the diversity of students coming from the Netherlands, the European countries and outside Europe.

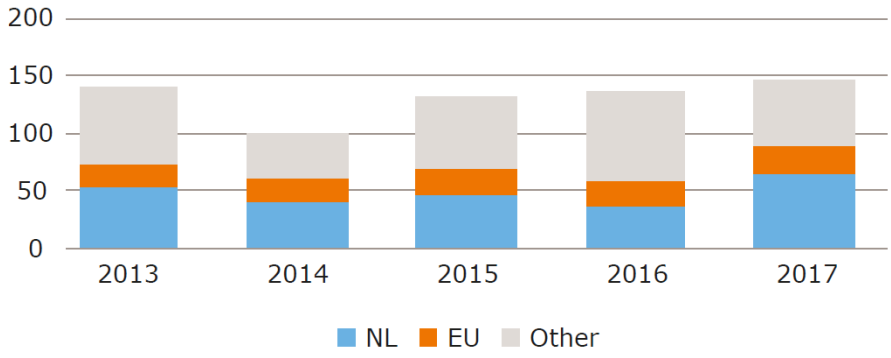


Figure 4 – Enrolment in MES by regions, 2013-2017 (Fortuin, 2018, p. 15).

In all courses, teachers usually organize groups of students to work together on environmental problems. Students can also self-enroll in groups, often based on their same interest in a group topic, taking into account that their groups consist of members from different countries of origins, gender, backgrounds (of their Bachelor, i.e.). Likewise international classrooms, group work also reflects the diversity. The contexts where critical reflection practices can be considered, I would suggest, are in the classroom or groupwork setting.

The following is an explanation for each proposed aspect. Teachers can select one or a set of the aspects to integrate in their course. Students can be asked to reflect on one, two or all aspects, either together with their teachers or peers.

1) Assumptions & beliefs of self and others

Assumptions and beliefs related to socio-cultural identities

As presented, assumptions of teachers can affect their perception of students, the ways in which they teach and their curriculum. Inaccurate beliefs are deeply rooted in our cultural belief systems, and influence the experience of learners (Jenkins, 2018). Some stereotypes in academia are exemplified in (Milkman et al., 2015, p. 1068), i.e.: "Black students are less intelligent and not hardworking; Chinese students are not fluent in English, and/or possess fraudulent credentials, Indian students are foreign and difficult to understand; Chinese and Indian students are a positive academic stereotype of "model minority". The study by Milkman et al (2015) on over 6500 university professors in the United States

found that faculty were significantly responsive to White males than to all other groups of students, when receiving requests for mentoring from the prospective students.

Assumptions and beliefs in the environmental fields

Underlying assumptions and flawed beliefs that are naturalized also exist in the environment fields. In natural resources and conservation, it is a general assumption that people of color do not care about the global environmental crisis, are overpopulated, and not being an environmental steward (Valle, 2021). The study by Leiserowitz & Akerlof (2010) concludes the opposite. People of color - Hispanics, African American, or other races and ethnicities hold the strongest support for policies on greenhouse gas emission reduction, even when scarifying their individual costs. The minorities support responsive actions to the global environmental crisis at an equal level, or greater than the whites Leiserowitz & Akerlof (2010). However, it should be noted that people of color are not one block, but consist of different ethnic groups and identities, who experience environmental issues in various ways (Valle, 2020). Thus, Lloro-Bidart & Finewood (2018)suggest embedding the intersectional lens into ESS, to re-examine such dominant narratives used as a form of oppression to communities with different socio-cultural categories.

Environmental sciences education aims to educate graduates to understand and solve environmental problems, such as climate change, biodiversity loss, deforestation, urbanization & development, etc (Fortuin & van Koppen, 2016). These problems are often complex or wicked, interwoven between social, environmental, and economic dimensions. Different people define problems differently, and perhaps hold conflicting views. In the MES program, student group work reflects an expected collaboration of differing people working together. When students have diverse socio-cultural identities, each may see and experience environmental issues in a different way, and therefore, approaches solutions variously.

However, when a group is mixed of gender, race, ethnicity/nationality, class, (dis-)ability, and other social categories, assumptions and beliefs can take place and are unspoken. As several examples presented, students of certain groups, such as students of color, women, Dutch ethnic minorities with migration backgrounds or low-income families, might face assumptions, stereotypes, or biases by themselves, their peers, and teachers. These assumptions and biases may hinder their equal participation. Furthermore, Valle (2021) notes that in ESS education, many middle-class white students validate their experience in the courses, whereas students of color do not see themselves, their histories, and stories, in the ESS curriculum (Valle, 2021). They turn to silence assuming that their experience is inferior or not the norm. The first step towards changes that should be offered is open and safe conversations on assumptions and beliefs related to socio-cultural identities (Mensah, 2013), and possibly, in connection to environmental issues. Once these assumptions and beliefs are identified, students can assess if they are accurate, valid, or not, against their lived experience (Liu, 2015).

2) Histories of self and others, connected to the environment/an environmental issue

Connected to the places of inhabitance, diverse students carry in their histories to tell in environmental discussions. As Valle (2021) put it, developing this awareness is about embedding oneself in the environment together with others. For students who are marginalized, the reflection practice on histories is important, since it brings back the memories that are perhaps erased, or at risk of forgetfulness in environmental histories. Having opportunities to share, these students can learn that their histories are equally valuable and valid as of their white peers, and white students can also learn the

importance of these histories and knowledge. With the awareness, they can perform or act differently in their environmental contexts (Valle, 2021).

In environmental studies, research shows that the burdens of environmental degradation and climate changes place disproportionately on disadvantaged groups, such as low-income, women, immigrants, racial, and ethnic communities. The unequal access to adequate housing, resources and mobilities make them more vulnerable (Versey, 2021). In the Netherlands, the study by Fecht et al. (2015) reveals that the ethnically diverse neighborhoods are exposed more to air pollution than the white neighborhoods. The causes need further investigation; yet, among others, the authors suggest that in the residence where immigrants settle, they may tolerate poorer air quality to stay in the familiar areas with family and friends (Fecht et al., 2015). The voices of such environmental burden-bearers, such as those of ethnic minorities, indigenous communities are often missed in environmental discussions about our futures or past.

Students with different socio-cultural identities (gender, race, class, ability, and other identities) might originate from countries, communities or families that endure environmental hazards and have direct experience of environmental problems. Critical reflection encourages them to bring in their histories and lived experience situated in specific times and places. As stated by Paul Connerton (cited in Valle, 2021), our experience of the present is varied depending on the different past we have gone through connected to that present. Moreover, reflection practice empowers students, particularly those who are of color, to decolonize history that has been told in the mainstream environmental narrative. Sharing histories in relation to places is to "*re-write the history from the lived experience and embodied knowledge of students*" (Valle, 2021, p. 136).

3) Social positionality connected to the environment/an environmental issue

To understand social structures impacting self and others, we should look back at the concept of intersectionality. Intersectionality is defined as the interactions of social categories, such as gender, race, class, ethnicity, and other identities, to form a system of privilege and oppression resulting in inclusion and exclusion of individuals or groups (Ramiah et al., 2022). In other words, different groups or individuals situate differently in the power structures of privilege and oppression, as the result of their overlapping social identities. In the context of climate change, Kaijser & Kronsell (2014), convince that intersections of power present in all relations on all levels, from individual to institutional practices. Within social structures, power relations are expressed in institutions of various kinds and reproduced social practices (Kaijser & Kronsell, 2014). As such, social structures can be understood as the organization or institutionalization of power relations in society, where they are practiced, maintained, and reproduced, based on social identities of individuals or groups.

From the intersectional lens, we can analyze how particular positions in power structures enable or limit individual agency. The finding by Holden and Linnerud (2010) shows that environmentally minded Norwegians do not change their energy use and transport behavior for the environment, despite their environmental beliefs (Kaijser & Kronsell, 2014). The desire to indulge in consumption and the sense of powerlessness fit in the general norm of a "desirable" life, modelled by a small group of wealthy white men in Western countries – which Soper (2009) echoes as "wasteful and polluting forms of personal consumptions and mobility". The study points out that behavior is situated within power relations and subject to social structures reproduced "in the way they have always been done" (Kaijser & Kronsell, 2014).

Nonetheless, it should be noted that these social categories are not fixed, but constantly being constructed and changed in different historical and spatial contexts (Kaijser & Kronsell, 2014). This idea brings in a person's situatedness in specific locations and contexts that makes him or her perceive and experience power relations differently. As Kaijer & Kronsell (2014, p. 422) put it, "*situatedness gives rise to knowledge originated from particular circumstances, sometimes coming out of a struggle against dominant power practices*". Accordingly, the authors give an example of women who live in and use the forest for their food-, seed-, and fuel- resources. These women gain insights into the forest environment through their daily practices. It is certain that not all women would claim this position, and the knowledge generated by these women is not a universal aspect of being female. Another example is the knowledge emerged from a female farmer living in a low-income country is varied from a female academic in a Western country. In climate change context, this is to say that how individuals relate to climate change depends on their position and context-specific power structure (Kaijser & Kronsell, 2014).

Taking the discussion into ESS curriculum, Valle (2021) suggests enabling students to learn about their positionality, and how people encounter the same environment differently, depending on how power and privilege play in the social structure. In one of the assignments, Valle (2021) asks students to visit an environment where they do not have the same privilege as they are used to, for example, privilege to access. The students go to golf clubs, city downtown or different beaches. With different levels of feeling discomfort, they are all aware of their social positions, and how distinct we are when experiencing even the same environment. Such assignments enable students to learn that there is no universal truth and provide space for different voices to be heard, especially those who are at risk of being marginalized. Eventually, this experience is important in the environment field, since (future) environmental professionals need to learn that including more diverse voices, perspectives, and worldviews are crucial in solving complex environmental problems.

3.1.3. Reflection on diversity implemented in BC learning mechanisms (explicitly/implicitly)

In recent decades, education scholars have attempted to address the challenges of participation and collaboration between professionals across diversity of sites by developing the concepts of boundaries and boundary crossing (Akkerman & Bakker, 2011). Based on literature review of the previous scholars, Akkerman & Bakker (2011) elaborate further these concepts and the learning potentials of encountering and crossing boundaries. *Boundaries*, defined as "sociocultural differences that cause discontinuities in interaction and action", is considered an enriching resource for learning rather than obstacles (Akkerman & Bakker, 2011, p. 133). Accordingly, *"boundary crossing"* refers to the effort to restore continuity in action or interaction across different practices. Different from most of the educational theories seeing learning as a vertical process of accumulated knowledge and capacities within a single domain, and do not consider heterogeneity, the BC learning theory appreciates diversity generated from multiple perspectives and parties (Akkerman & Bakker, 2011). Equivalent to "boundaries", "diversity" regarding socio-cultural differences is valued for its learning potential (Akkerman et al., 2006). It is worth noting that the BC theory acknowledges discontinuities caused by socio-cultural differences; just like diversity, boundaries exist when people with diverse socio-cultural backgrounds work together. Yet, the learning potential resides in crossing the boundaries, and this can be trained. As Akkerman et al. (2006) put it, the effects of diversity cannot be presumed, but to generate its resource, diversity needs to be worked on, starting by perceiving each other as real "others".

Working on diversity, provoking negotiations between divergent socio-cultural practices has always been central to the BC theory. To emphasize the potential learning processes taking place at

boundaries, Akkerman & Bakker (2011) indicate four learning mechanisms, summarized into *Identification, Coordination, Reflection* and *Transformation (I-C-R-T)*. Reflection on diversity is particularly practiced in *Identification* and *Reflection*, which is the focus of the thesis.

Briefly speaking, *identification* refers to the learning that happens when a professional becomes aware of their own expertise, assumptions, values, and how these influence their interpretation of what is going on. It simultaneously starts the process of recognizing the other's assumptions, values, and norms. The understanding between self and the other can lead to an appreciation of each other's expertise and perspectives, and the reconstruction of one's own practices – "a renewed sense making of different practices and related identities" (Fortuin et al. 2020; Akkerman & Bakker, 2011, p. 143).

Reflection indicates perspective making and taking. In the first step of reflection, one makes explicit their understanding of an issue, especially when the knowledge or assumptions are implicit or unstated. The second step focuses on "looking at oneself through the eyes of other worlds", meaning taking the other's perspectives into account while reflecting on one's own knowledge (Akkerman & Bakker, 2011, p. 145). The reflection learning mechanism enriches one's identities and perspectives, as an example is given on high school village students, learning from both scientific knowledge, and traditional wisdom in the Republic of Trinidad and Tobago. BC allows students in traditional settings access scientific knowledge and compare it with their traditional world view (Akkerman & Bakker, 2011).

BC is considered as a generic competence applied in various contexts within and outside academia when challenges emerged from encountering boundaries. Within the Comenius Leadership Fellow project in WUR, "boundaries" are classified into three types: disciplinary, cultural, and university-society boundaries. Accordingly, students develop their BC competence by applying the BC learning mechanisms to cross these three sorts of boundaries mentioned. They are not all kinds of boundaries but indicated as an example to be practiced in a specific context. With the loose-end, a lecturer or a course coordinator can adopt one or a set of three boundaries and ask students to use the BC learning mechanisms (I-C-R-T) to examine them (Fortuin et al., 2020).

Diversity, given equivalent to boundaries, can also be classified into the three aspects: disciplinary, cultural, and academic versus non-academic knowledge. Subsequently, reflection on diversity practiced in BC is the application of the two BC learning mechanisms - identification and reflection, to identify and reflect on diversity regarding disciplines, cultures, and scientific & societal knowledge.

It should be noted that not all I-C-R-T learning mechanisms have to be utilized, and the focus on only one or two more than others is possible. Within the scope of the thesis, I focus on only identification and reflection. Importantly, the learning mechanism should be made explicit and repeated in multiple learning situations in a study course (Fortuin et al., 2020). Nevertheless, since BC is a recent project in WUR, the practices of "boundary crossing" might be already implied in the courses without stating, given the context of diverse student population, disciplines and stakeholders participated. Hence, reflection on diversity could also pre-exist without stating explicitly. For an easy classification, all reflection practices that are named BC will be considered "explicit", and the rest of reflection practices without mentioning BC will be classified as "implicit" practices. The figure below illustrates the operationalization of reflection on diversity practiced in the two BC learning mechanisms.

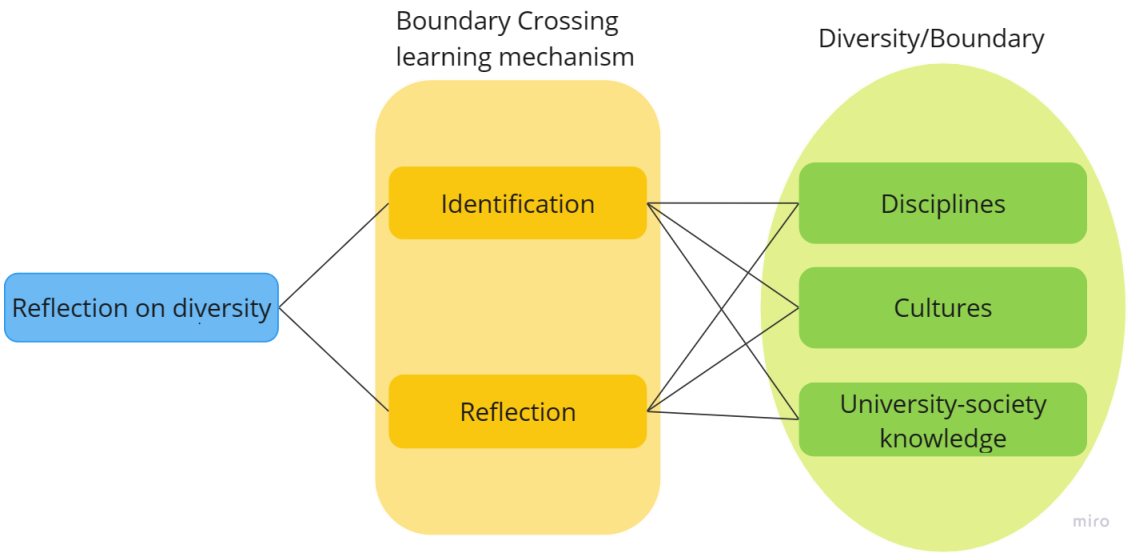


Figure 5 – Explicit reflection on diversity practiced in the BC identification and reflection.

3.1.4. Concluding remarks:

To answer this research question, literature review was conducted. The finding showed that the concept of critical reflection encompasses a variety of definitions. Initially introduced by Dewey (1933), critical reflection is referred to as "reflective practices" in teacher education and has been further discussed over the years by numerous scholars, including Liu (2015) and Jenkins (2018). These definitions emphasize the awareness, analysis, questioning and critique of *assumptions & beliefs* for the purpose of promoting changes, transformative learning, and equity. In Environmental sciences and studies context, Valle (2021) introduces a reflection practice that connected to students' sense of places, enabling them to tell their stories, histories and lived experiences connected to their situated environmental, or the environmental issues that matter to them.

Combining the perspectives of Valle (2021) and Jenkins (2018), I operationalized the concept of critical reflection on diversity into the three components, and initially provide an explanation for each of them, which are: i) Assumptions & beliefs of self and others, specifically delineated into: a) assumptions & beliefs of socio-cultural identities, and b) assumptions & beliefs in the environmental fields; and ii) Histories of self and others connected to the environment/an environmental issue; and iii) Social positionality connected to an environmental issue/the environment.

Also, reflection on diversity is practiced through Boundary Crossing learning mechanisms, specifically identification and reflection. Identification helps an individual recognize their own assumptions, values, expertise, as well as those of others. Reflection involves expressing one's own perspectives, understanding, and considering the perspectives of others. It should be noted that the integration of BC practices in the courses in WUR can already be implied without explicit announcements, hence, allowing implicit reflection practices.

3.2. Current practices of reflection on diversity in the MES program

3.2.1. Course selection

The MES courses selected for further investigation include Principle of Environmental Sciences (ESA 20806), Environmental Quality and Governance (ENP 35806), Research Methods Environmental Sciences (YRM 20306), European Workshop (ESA 60312), Academic Consultancy Training (YMC 60809) and Environmental & Sustainability Education (ELS 31806).

Three of these courses are compulsory to all MES students, with only few exception for students who already took similar foundational courses in their Bachelor. The rest is restricted optional, meaning that they are mandatory to (most of) the students, who take certain specializing tracks. Every MES student is mandated to follow at least one of them. The table below indicates the elected courses, together with an initial examination based on the data obtained from OSIRIS catalogue, and in discussion with the BC team.

Courses	Compulsory or Restricted optional
Principle of Environmental Sciences	Compulsory to all MES students
Environmental Quality and Governance	Compulsory, to all MES students
Research Methods Environmental Sciences	Compulsory, to all MES students
European Workshop Environmental Sciences and Management	Restricted optional, mandatory
Academic Consultancy Training	Restricted optional, mandatory
Environmental Education and Learning for Sustainability	Restricted optional, mandatory

3.2.2. Results of semi-structured interviews

This section presented the current practices of reflection on diversity reported by the interviewed teachers and students in the examined courses. I attempted to categorize into two groups: those explicitly mentioning BC/learning mechanisms, and those implicitly integrating reflection on diversity without labelling it as BC. The themes as follows mapped the current practices of reflection on diversity in the courses, based on the explication and implication of BC.

1) ***Explication of BC and explicit reflection on diversity***

- ***European Workshop Environmental Sciences and Management (EUW)***

According to the EUW coordinator and the interviewed students, BC is emphasized explicitly in the European Workshop, along with its learning mechanism of identification and reflection. Students attended lectures on (cultural) differences, which helped raise their awareness & mutual understanding of working in international groups. To understand further their different personalities, students did a Belbin test, from which they gained insights into their roles in a group depending on individual personalities. Additionally, students engaged in an assignment to discuss their various opinions on a statement, such as those regarding good leadership, decision-making and teamwork. This exercise allowed students to recognize how diverse cultures and educational systems could influence their perceptions and behaviors in a team. Anna, the EUW coordinator and one of the EUW lecturers, shared her insights on what students learned:

"That is really revealing for them because they have been working together for two weeks, and they suddenly realize that somebody else has an entirely different opinions about leadership and decision-making" (Teacher Anna).

As Boundary Crossing has been integrated in the course, the BC project team introduced a self-assessment on BC competence development, using the BC rubric (see Appendix 2). Students were asked to complete the BC competence self-assessment at the middle and the end of the EUW. They scored themselves on their progress in crossing boundaries, such as gaining new perspectives, or learning from others, and enabling others to learn from them. In addition, they wrote a brief reflection paper on their BC self-assessment, choosing one of the skills suggested in the BC rubric that they wished to improve, and reflected on it. According to teacher Anna:

"It is not about good or bad, right, or wrong answers. They do it in week three, and then week eight, to see whether they think they have improved on these BC competences. Sometimes they realize that they have not improved at all, and they may be overestimated themselves the first time they do it. It helps them to reflect" (Teacher Anna).

The European Workshop was often first mentioned by the student who had participated, when they were asked to name "any practice of reflection on diversity". As indicated by the BC self-assessment rubric, students in the EUW were encouraged to consciously identify their own and others' expertise, interest, perspectives that were relevant to project execution. Furthermore, they were expected to explicate and integrate various perspectives, as well as to show willingness to learn from others, initiate reflective actions between people, and encourage other people's learning. This process is known as BC learning of identification & reflection, where reflective practices are intentionally facilitated.

The participating students appreciated their experience of learning from diversity, where they were immersed in the study environment with others, who have different backgrounds, perspectives, working styles, communication, behaviors, and so on. Students learned in a large group of about 30 people together in two months, to implement a real-life project abroad assigned by a commissioner. For example, one student, Haku, described his positive experience:

"I really enjoyed the ways they (my group mates) discussed it, because I realized that standing on my pure science does not completely solve the complex problem, so we have to see from multiple perspectives how their disciplines could also contribute to solve the problem" (Student Haku).

The student was aware that BC was something they had to learn, and it did not just happen. "Boundaries" between students create tensions. One student, Wang, reported that his big group became very complex – everyone wanted to talk. He shared about the challenges of working with an "*aggressive person*" in his group, "*an annoying teammate*" who was in the management team. Communication was blocked between the team leader and the rest of the group. When they were in an outgoing event, a party in Copenhagen, he and his teammates were able to talk and understand the team leader personally. After the informal talk, she was also getting better and able to listen to others.

The informal interactions and environments that happened during the EUW also became the site for boundaries to manifest, and the learning opportunity from boundaries for students, besides formal

classrooms. In other words, alongside deliberate reflection practices that can be assessed using the BC rubric, students reflected while immersing themselves in the various interactions with their peers, who came from diverse backgrounds, cultures, or countries; yet, in less explicit ways. As an example, one student, Haku, faced a cultural boundary due to his religion, which discouraged alcoholic consumption, in contrast to "normal" drinking culture among Dutch students. However, he was able to develop mutual understandings with his friends who drank. Haku shared an experience during the EUW in Copenhagen, where his Dutch friends frequently invited everyone to socialize and drink:

> *"I remember in European workshop we went to Copenhagen and every night somehow they invited people, let's go to this spot! It was just not familiar for me. So I was with some of my friends just stayed at hostel and then we read. But at that moment we built our mutual understanding. They understand us that we cannot drink, and also we understand them that they have the kind of culture" (Student Haku).*

For student Hema, she observed that not everyone in her group felt comfortable speaking up. She often approached those who were not pro-active, and found that they could have great own ideas, but hardly found a moment to introduce theirs. Language barriers, such as English proficiency could be the cause, but rather than that, they were rooted in the culture which emphasized politeness and respect for authority. This was to say that interfering with your own ideas when someone's discussing could be seen impolite in some cultures. Student Hema, who was raised up with her Indian culture, shared her practice of BC:

> *"In terms of speaking up, I feel like even in our culture, to be honest, it is seen as impolite when someone's discussing their ideas, you pop up with your own ideas. But it took me a while to learn that I also have my ideas, which have to be heard. So I was already very conscious of it, that's why I kind of forced myself to do that. And when I saw someone not doing that, I always felt like I wanted to know if it's because they actually did not have something to say, which is also fine, or it is because someone's from an Asian background" (Student Hema).*

The interviewed lecturers also identified a boundary originating from differences in communication styles between cultures. In the EUW, teacher Anna highlighted the variety in direct & indirect communication styles that she observed among her students from various countries of origin. This divergence did not necessarily depend on their nationalities/cultures, but also on individual personalities.

> *"We once had a guy from Israel and he was like, so direct in his communication that even for the Dutch it was like very, very direct. And so, yeah, some people are just super direct, and others have difficulties with that. Also, what challenging is, I've seen in some people the fear of making mistakes. And especially, like students from China, they very often don't dare to express themselves in the plenary, because with 30 people, it's too scary to speak up and to say something" (Teacher Anna).*

Reflecting herself while teaching a diverse student population, teacher Anna tried a proactive measure to alleviate the issue. She divided her students into smaller groups of five or six individuals, and encouraged each student to present, especially those who were less vocal. To motivate and inspire her students, Anna shared her personal journey, from being a shy person afraid of making a mistake once

in the past. Eventually, she overcame her fear to become more communicative, expressive, and confident.

Although both the teachers and students recognized the existence of the boundaries, they were not always the subjects of explicit reflection. Instead, it was the responsibility of the students and lecturers themselves to recognize and draw insights from them. The main reason is the boundaries are not considered relevant to the projects or problems at hand. Among the three exemplary boundaries: culture, discipline, and university-society, cultural differences are most frequently indicated, and least intentionally addressed. It is noteworthy that boundaries mentioned were not restricted to the three sorts, although they were frequently repeated. To name some culture-related differences, interviewees also brought up communication, learning styles, punctuation habit, etc. Boundaries were mentioned and interpreted in various names and forms, such as differences in thinking speed, personalities, power dynamics, age, and structural problems, etc.

Learning in diversity vs. learning from reflection on diversity

Based on the conducted interviews, I identified two ways in which learning can take place: 1) learning through exposure to diversity – meaning that students were learn through experiencing the differences between them and others, and 2) learning from reflection on diversity, where students deliberately identify and reflect on differences, with the purpose of increasing awareness of self and others. Both processes occurred in the EUW.

While the first way occurred without any formal assessment, the second way included an assessment, to some extent. In the EUW, students evaluated their own capacity for perspective-making and taking, using a BC rubric, and graded their teammates on listening capability or respecting others. However, according to feedback of student Hema, the assessment could result in people masking their behavior, because they know that they are being assessed i.e., on their respectfulness. Student Hema shared her view:

> *"When you're outrightly saying that this is why you should do this, people can also mask it, right? As for what I feel like, during the course, two people who seemed a little disrespectful, but they were trying their best to not be, because they were outrightly told that you're not supposed to do this. So, there was also little scope for correction because they already knew they're being evaluated on that" (Student Hema).*

The student was not sure if intentional learning through lecturing, reflection and assessment really achieved "boundary crossing" between students. In Hema's opinion, "making us aware of our own backgrounds all the time can backfire". Personally, she did not always think about it, such as where she or the other came from, and connected this to a certain behavior. Hema thought that focusing on individual strength and good communication was more important than discussing and being graded on respectfulness.

2) Implicit reflection on diversity without labelling BC

- ***Academic Consultancy Training (ACT)***

Similar to the EUW, in the ACT course diverse student groups provided academic consultancy to external commissioners. According to the interviewed teachers, ACT had the elements of BC, but it was not in the way that the term BC was stated to students. ACT coordinators have been attending training and were aware of the presence of BC. According to teacher Umar, who is one of the coaches and coordinators of the ACT:

> *"I think we do it, but not that we are using those terms. Let me say, it's not the word boundary crossing, but when you look at it, you'll see that some of those aspects are there, and that's why we feel like we really fit into it and have been interested in workshops and stuff like that" (Teacher Umar).*

Students participating in the ACT were required to write their reflection papers, in the beginning, the midterm and the end of the course. On one hand, students chose their learning goals and reflected on that. On the other hand, each students' reflection could be very flexible, and there is no exact requirement for content of reflection as well as grading. Reflection here was meant to support students' personal development and teamwork capacity during the whole process of ACT, rather than for any formal assessment. There were two features of reflection that should be noted in the AC: first, the important role of the coaches in facilitating students' reflection, and second, the flexibility of reflection contents based on individual needs and development.

During the learning process from diversity, coaches played a significant role in supporting students' reflection. It should be noted that diversity per se was not stated. Yet, the ACT offered pretty much everything that can be reflected, including problems students might encounter when working with others. It depended on the team that a coach could ask specifically. ACT coordinator, Ivo, gave his opinion on this:

> *"It depends on the team. So, we don't say exactly what an ACT team should do from day-to-day. All their activities haven't been prescribed precisely, but we do encourage them to have this kind of conversation about, for example, diversity, but also all kinds of issues, difficulties, perceptions" (Teacher Ivo).*

With a flexible content, reflection was constantly practiced during the ACT. Besides handing in reflection papers, students gave feedback to each other and shared their perspectives with the team coach, either in individual interviews, or feedback sessions altogether. Via the individual interviews, feedback sessions, and observing the group dynamics themselves, a coach can see "boundaries" that students might face and help them understand and resolve. For example, coach Umar shared about the challenge her students encountered during their first experience doing reflection:

> *"It becomes really difficult. I discovered that because some people for the first time have to do reflection. They start to get in touch with themselves in a way that they didn't. Some of the problems or challenges that they have had in the past, that they thought they had dealt with, start to come up. And now they have to face or ignore them. Because it is not common that all the international people have gone through reflecting. But for the Dutch, I think it's something that they are used to" (Teacher Umar).*

Reflection explicitly asked was on how students work on their proposal, both their participation in the content and process of group work. Also, each student had to reflect on their personal learning goals with their teammates and the coach. Nonetheless, it is emphasized that reflection was open with no fixed structure. In addition, reflection papers were not graded, but to help a coach understand the students, their personal development, participation, and group dynamics. The needs for reflection differed per team and confrontation of the coach. When a team does not function well, such as someone feeling excluded, a coach should be able to see that and work with the team to tackle the issue. Coach Umar talked about her experience on the subject of inclusion and exclusion. According to her, feeling excluded was not always because of certain disadvantages, it involved personalities and how a student connected with others:

> *"There are different phases that make people feel included or not. Some might feel not included at the beginning, because it takes them a longer time to warm up. Some might feel not included at the middle, when maybe they feel that their expertise is not required. Some students have just maybe one disadvantage that removes them from the majority, that could risk them being marginalized. But maybe they are outgoing. They end up connecting with others in learning. But somebody who was born here and has everything, and then now their expertise is not needed anymore, and they are maybe naturally introvert, without realizing it, they start to stay behind unless you try to improve it" (Teacher Umar).*

Because of their important role, ACT coaches went through periodically trainings and learning opportunities to effectively handle mixed cultural teams, and address inclusion issues, including those within Dutch groups. Additionally, workshops, such as those focused on BC, were provided to ACT coaches. Usually, they practiced first in the coach team the contents of the workshops, for example, different learning styles. Then they determined whether they should apply them to ACT for students, for example, integrating the understanding of different learning styles in Communication & Personal Development (CPD) sessions. However, the "problem-solving" tasks assigned to coaches were not always doable when teams faced problems, such as forming subgroups. The ACT coordinator, Ivo, gave an example on a coach's task:

> *"That's the task of the coach, which is not always doable, to see if it's possible to improve group dynamics so that there are less boundaries and less subgrouping" (Teacher Ivo).*

- ***Environmental Quality and Governance (EQG)***

The primary focus for students in the course was on diverse knowledge, encompassing different disciplines (natural & social sciences), as well as scientific and societal knowledge. The course highlight was the simulation on Eel management, with the participation of multi-stakeholders collaborating to solve the complex problem of eel population decline. Students played stakeholder roles, with different interests and influence on the agenda, directly experiencing the diversity in the simulation. After the simulation, students reflected on interdisciplinary and transdisciplinary approaches to a wicked problem of eel management case study, based on their stakeholder role-play. As part of the assignment, they needed to write an individual reflection paper, which would be graded. While BC learning mechanism was integrated as part of the reflection exercise, it was not all the focus. According to the course coordinator Zoe:

> *"In the reflection paper, we focus on the reflection aspect based on the difference that they experience in terms of how the scientist, or the so-called experts, and the non-experts, approach the issue. They also have to reflect on many other social and natural science concepts, not only about interdisciplinarity and trans-disciplinarity, such as ecotoxicology and so on. So, the reflection exercise is meant to provide a broader reflection, not only about the BC itself" (Teacher Zoe).*

Although cultural diversity is neither part of the course content nor reflection, lecturer Zoe made her personal effort to welcome all students regardless of their identities. She prepared a short presentation at the beginning of the other course she coordinated in MES (not in EQG):

> *"Well, it is not built in the design, because that's not the goal of the course. So what I do at personal level is, I make this diversity explicit, but just very briefly, at the beginning of the course by showing a slide, and welcoming everyone, saying that my classroom is an inclusive classroom, and with this, diversity has to do with cultures or ethnicity or nationalities (Teacher Zoe)".*

Several students expressed their appreciation for teacher Zoe's initative. As an example, student Lise, who came from Eastern Europe, faced challenges of socializing, working and communicating in the Dutch-international context. She valued teacher Zoe's effort of welcoming everyone:

> *"She really tried for us to reflect on how different people behave in an academic context. That's important, because without that class, I wouldn't even be there to reflect on these things, or I wouldn't have the tools to do it, and I think she was one of the people that influenced me the most on thinking about reflecting on diversity in this course"(Student Lise).*

Furthermore, teacher Zoe tried to make students aware of diversity in knowledge and theories that she introduced. Within limited time and space of the course, she included a brief discussion to highlight that a certain theory will illuminate a phenomenon and just show part of it, shedding light on specific aspects, while leaving other aspects obscured. She explained what she had asked students to reflect on:

> *"I tried to ask students to reflect a little bit on this. So how does this theory, which is very specific, how its authors think because of who they are, or they were, including their gender and these are male, white, European, Western European, middle class or high class, highly educated people. And so how does that help us to understand? But then what did we miss? So, what are other theories out there that might put emphasis on other aspects, for example, gendered risks or racial issues, such as environmental justice, which affects minorities more. I have only a couple of minutes to do this. I cannot add lectures and to discuss this, but I think it's important" (Teacher Zoe).*

The introduction could be followed shortly in class, for example, teachers asked students to share their opinions on the topic. No further assignment was required for such reflection.

- ***Research Methodologies in Environmental Sciences***

Neither BC nor explicit reflection on diversity was incorporated in the course, such as through exercises asking students to consciously reflect on diversity. However, the course throughout embraced experiential learning, as explained by lecturer Erik, "forcing students to have certain experience" working with others. No prior training was provided to students. On the very first day, they were randomly assigned in a group consisting of individuals with different backgrounds, gender and nationalities, and so on. Their assignment was to develop a research proposal together, under tight deadlines, and intensively in a short period of time. Lecturer Tomi described the experience:

> *"In the first instance, in the first weeks. They may not have the language for it in the first week. But it would be the first time that they have been forced to see how they might be different from others, and so it's beginning to surface the rock" (Teacher Tomi).*

The learning environment was set up in this way: students revealed themselves in the situation where their old strategies (of learning) did not work, and received insufficient time and directions from teachers. Some students would take leadership, while others would stepped back. Teachers deliberatly stressed the system of learning, and set students under real stress. "*They are put in a real word, not a simulation but a real-world environment*" *(Teacher Tomi).*

At the moment they needed help, a teaching assistant was assinged to play the role of offering support for students to fix the problems, for example, about unequal participation. Additionally, teachers would call out the undesirable behavioral patterns he had seen in the groups, to let students realize how their behaviors reproduces inequality. For example, lecture Tomi shared about his role in this kind of game:

> *"It's my job that particular debrief to pound on the entitled students, so that they're not so full of their own brilliant, and to make the ones who chose to step back feel guilty about it, and so it's to denaturalize the practice" (Teacher Tomi).*

Students were unaware of the learning objective, which aimed to force their ability to collaborate in order to get a good grade. The course teacher were convinced that if students were told explicitly how to work in groups and deal with diverity, they would create an emotional and intellectual distance from their experience. Consequently, they believed that students would correct their performance without internalizing their lesson. Lecturer Tomi provided insights into the approach:

> *"So in the course, a lot of the outcome we're hoping is to improve people's intercultural communications competence. But it's not done with a focus on the dyadic relationship between individuals. It's something that you learn while you're doing something else. While we have a primary learning objective, is the improvement of the intercultural competence, It's not declared, and it's incidental from the students perspective. Learning how to work together is incidental to getting a good grade" (Teacher Tomi).*

The course emphasized the importance of creating an environment, where students discover the values of self-regulating their own behaviors. The teachers made a conscious choice to not address explicitly intercultural competence. Such design of the course was reasoned for by two points. First, assessing students on their capacity to function effectively in a group posed a dilemma. Second, the course focused on scientific research methodologies, rather than how-to-work with diverse people or respect for diversity.

According to lecturer Tomi, every person had a unique background, identity, capacity, and weakness bringing to a collaborative task. Hence, success in group work is relatively dependent on these prior conditions, making it challenging to come up with a fair set of assessment indicator. Secondly, a person might be unaware of their behaviors in a group, such as if they treated others with respect or not, and many of these behaviors were subtle and difficult to assess. Thirdly, collaborating successfully was normative and hence, should not be graded, i.e., grading for being a good person. And finally, the act of grading reinforced authority/superiority of teachers over students, which should be disempowered in science.

Given the teaching content, the teachers attempted to teach "diversity" in an implicit way, and how the sense of diversity and inclusion can affect a "scientific" measurement. They gave an example of operationalizing students' engagement in the class. Students came up with sorts of the same measuring indicators, i.e., asking questions to professors, raising hands, etc. Such selection and use of indicators can exclude "good" students. For example, female Chinese students who did not speak up, or ask professors, seemed not to be engaged, but that could be wrong. First, they came from the education system which values good listening, not asking authorities. Secondly, they could be very engaged, but they were shy, etc. The understanding was developed further in the teacher's words:

> *"Or what happens if somebody happens to be socialized female, and good women are seen but not heard? What happens if somebody is gender dysmorphic? They don't feel comfortable in their skin because who they're, and so, they don't want anybody to look at them. And so, the students discover how science - good science - discriminates. We have that exercise now on diversity within the class. This is how sound empirical measurement can reproduce structural inequality in society" (Teacher Tomi).*

To many students, the intensity of the groupwork was something overwhelming. Some students complained that they were not provided with the training or preparation to work in groups, and it was challenging for them to handle diversity "problems". Although teachers were entirely aware of the boundaries, it was also hard to resolve them as they were not of the course focus, and particularly, if diversity involved structural inequality, or inclusion/exclusion.

- ***Principles of Environmental Sciences (PES)***

In the course, learning happened in diversity itself rather than being explicitly stated. This is to say that neither BC, nor reflection on diversity, were deliberately presented in specific assignments or exercises. However, the lecturer of the course, Ruben, understood BC very well, both via his colleague and through his own knowledge; and he integrated a variety of lecturing contents that introduced "boundaries" in environmental sciences. He wrote the textbook covering social sciences part of the PES, which was mandatory reading to students.

Two of the boundaries that lecturer Ruben focused on were between scientists & stakeholders, and between natural and social sciences. Instead of addressing these as "boundaries", he referred to the relevant use of "trans-disciplinarity" and "interdisciplinarity" terms. According to the teacher, there was a deliberate effort of knowledge integration when natural sciences could not give the only answer. Ruben shared his view:

> *"Let's say, the term for it now not precisely the same, but related is trans-disciplinarity, where you work together with groups, and particularly in nature conservation, or now in biodiversity, it is very much about ways to integrate, for instance, traditional knowledge of indigenous groups into knowledge about nature and ecology, and about ecosystems and nature protection" (Teacher Ruben).*

In the textbook he wrote, he touched upon the difference between natural and social sciences. For many natural science students, this was the first time they had confronted another type of science rather than measuring physical and biochemical things.

> *"What I also do in the very start of the book, I touch upon this difference between natural science and social science, and difficulties of natural scientists to grasp what it is to do social science. There is definitely a boundary to be crossed there, particularly for natural science. It is really difficult, at least for some, to imagine something like social science, and that you can base science on interviews, for instance" (Teacher Ruben).*

The limits of natural and social sciences in addressing complex issues were also pinpointed in the textbook and in the course. Thus, considering the practices of people is important to understand environmental perceptions, such as "nature" and "risk".

> *"So, we cannot just do it by measuring the biodiversity or measuring the probabilistic, but we really have to see and to ask people how you feel about it, what do you think. That is what I do in this course" (Teacher Ruben).*

Moreover, lecturer Ruben indicated, in the textbook and his lectures, how diverse cultures, for example, Western vs. Chinese ones, perceive nature-culture variously. Additionally, he aimed to educate students about the normativity of science, especially, environmental sciences. Nevertheless, different from EQG course, students in PES were not required to reflect on these "boundaries" in assignments. Instead, they were questioned during the lectures to share their opinions with others. They also needed to learn from the textbook, where diversified knowledge was discussed.

Likewise, in most of the courses, students of mixed disciplines and nationalities were assigned in groups to work on an assignment. They wrote a short evaluation of how they work together, but it was brief and at the very end. Teachers did not much participate in guiding group work; however, student assistants were there to support every group. In a few meetings with the groups, lecturer Ruben said that he considered diversity implicitly, when talking to students, for example, by stimulating those who were not outspoken to come up with their opinion.

> *"So, if you have Dutch or US students in a group, they easily start the talk, and then you have other students. Putting it very broadly, they are from more hierarchal educational systems, and they are more cautious. Then what I try to do is to involve them in the discussion, and to ask their views, to check whether they actually agree and understand what the discussion is about, or whether they perhaps disagree and would like to come forward with that" (Teacher Ruben).*

During the interviews, some students showed their appreciation for PES teachers for making them aware of diversity in the program, and cultural differences. PES was one of their very first courses since it is taught in period 1. Students U still remembered an interactive presentation was given, where

everyone could see the graphs indicating the countries/regions from where they came, and their study backgrounds. He found it helpful to understand that we were dealing with different disciplines, and people approaching the group project. Student Hema felt welcome and prepared:

> *"I remember one of the teachers starting off that we are going to have a lot of group work. In the group work, Dutch students usually tend to be quite outspoken. He mentioned that they have to be mindful about the fact that some cultures are not very outspoken. He also mentioned to the internationals that, well, this is something the Dutch people do, it's not them speaking over you, but we like to be heard. Because I'm not used to working in group settings, that's not a format we have in India, I found like a bit of a welcoming thing to already hear that" (Student Hema).*

- ***Environmental Education and Learning for Sustainability***

The course did not require explicit reflection on diversity or provide activities on BC/identification & reflection. This means that there were no strongly guided reflective assignments. Yet, teachers left lots of space for students to reflect. Reflection on diversity, and BC as well, thus, can be seen implicit rather than explicit. Students could create reflective outputs in many forms, such as drawing, painting, performance, in the middle and at the end of the course. Creativity was highly appreciated. During all the lectures, activities and excursions, teachers asked students to generally reflect on their perspectives or feelings, for example, towards sustainability. They were conversational, and reflective afterwards, aiming at opening diverse perspectives on educational situations, events, or approaches.

According to the course coordinator, Kris, diversity was brought in, possibly in the discussion about inequality, and what it meant for education. An example in class was given about e-waste ending in third-word countries, or mobile phones consumed in the Netherlands being fabricated somewhere else. Dutch students might be unaware and took their consumption for granted, while internationals could embody their other perspectives and voice up more on those issues. As the focus of the course was education, students explored diverse educational approaches in different contexts. As the teacher coordinator Kris put it:

> *"We can think of beautiful activities that work very well and is very structured, and well supported in the educational system of the Netherlands. But can it be of any relevance in contexts which are different than ours, and which are, maybe, more important if we're talking about inclusivity" (Teacher Kris).*

According to the teacher Kris, during the excursion, students gained awareness of diversity, inequality, and exclusion during an excursion. They traveled to a "sustainable" neighborhood called Eva Lanxmeer in the Netherlands. On the day after, they could share their views and discuss on the topic, for example, if sustainability is only for elite people or how it should be. Kris believed that through the discussions, it was noticeable that students coming from different places held disparate opinions. For most of Dutch students, it felt very much realistic – a perfect picture of green living, a sort of inspiring model, whereas to internationals, this was utopian. They might feel uncomfortable with luxury, because of the different situations in their countries. However, the elite neighborhood was also felt alienate to many Dutch who came from non-privileged backgrounds. It should be noted that students did not reflect on how their socio-cultural backgrounds could differentiate their perspectives, such as where they came from, but the teachers noticed the differences.

In another learning activity, students went into nature and after that, reflected on their experiences of reconnecting with nature. It was not a reflective exercise with clear guidelines, but rather, a conversational and open sharing. Teachers could notice differences in experiences of students going into nature; but this time, differences were seen less between the Dutch and internationals, and more between students coming from urban and rural environments. As this was reflected by teacher Kris:

> *"You go back to situations where students reconnect to nature. They experience sort of the romantic idea of nature, and also there, you see a difference. There is less between, I think, Dutch and Internationals, and more with people coming from urban environments. There can also be poorer places, or we say, economically poor. Or people that had the wealth to go into nature, next to their comfortable living place, that's another one. More or less the activity sparks reflection, and that reflection in itself shows also diversity in the world, almost so, where they're coming from, and their roots in there, in their identities" (Teacher Kris).*

- ***Other courses & extra-curricular activities:***

Students reported further the practices of reflection on diversity they encountered that were offered in MES as electives. All these practices were not explicitly stated in the term BC. With unclear memory from students, some courses named were mentioned, such as Gender & Natural Resource Management, Modelling Future Water Stress, Educational Design & Teaching for Sustainability, and Environment & Development.

In Gender & Natural Resource Management, student Lise appreciated the reflective practice that indeed was led by a woman lecturer from India. The first lecture was about the lecturer's personal story growing up in a country where women are treated unequally, the double oppression resulting from intersecting social hierarchy and gender. Student Lise valued the experience, as she put it, personally reflecting on the intersectionality between gender and "caste" (social hierarchy). She also treasured the fact that diverse professors were invited to talk about their case, their career, as real-life stories from all over the world:

> *"That was a great example of reflecting on diversity, for example, this intersectionality between gender and caste. And further, the intersectionality of being and sharing that story with so many students from all around the world, with many gender identities, etc. And during the course, there was always an invited professor that would talk about their case, what they work on in their career, and there were examples from all over the world. They were from Kurdistan. There was Z. from Mexico. They were also people based in Europe and so (Student Lise)".*

In the course, students also named the practice of "exploring" papers and their authors' position as a reflective practice on diversity. Students prepared a creative presentation and discussed a paper and its author's specific position, keeping in mind that we might not have the position as the same as other people do. They asked themselves: *"Why does this person think like this? Where does she come from? Where do I think like this? Where do I come from?" (Student Lise).* Student I elaborated on this point:

> *"Am I from a country where people are really attached to the family, or am I in a country where people leave the house at 18, and go to work and live alone? And then we understood that our experiences also have an impact on how we perceive that is good or bad, right? And it just*

doesn't have to be good or bad. It's just a reflection on how people think differently or how people act differently. So, it was a great course!" (Student Lise).

Another practice, as student Nada remembered, was in Modelling Future Water Stress. During the lectures, students learned how different contexts perceived flooding differently. And to her, coming from the Netherlands, she did not realize how important flooding was, since the country lays low. When the example about Bangladesh was given, she apprehended that there was a different system. There, flooding was considered temporary, and people utilized it to irrigate their farm. She learned from sharing verbally during the lectures, for example, when the teacher asked if the students had problems with flooding, if it was common in their country and in what kind of forms.

In Environment & Development, simulation and reflection assignments were also organized. Interviewed students often characterized the practices of reflection on what happened during the simulation as reflection on diversity. To some students, it felt very authentic that they needed to play the role of a stakeholder and think from that perspective. Simultaneously, they were also expected to understand other "stakeholders" for negotiations – standing in the other's shoes. It was exciting, but also challenging for students, especially for those who felt their position so real. Student Lise played the role of woman workers whose livelihood and security were threaten because of corporations. She reflected on her experience in the simulation:

"I don't think that was part of the simulation. I think that was really hard for me because I am also an autistic person. I have a very difficult time understanding other people's ideas if they are different from mine. So, I always stick very much to my ideals and because I'm a very passionate person inclined to justice. Maybe that was even harder for me because I couldn't understand how people can be so up for defending corporations, and so up for everything is going to be managed at the level of the European Union, but why not in Ecuador where people, the workers are?" (Student Lise).

Other practices of reflection can be done through extra-curricular activities. Students reported attending guest lectures given by external partners/teachers both within and outside of WUR. For example, student Haku shared their experience of participating in a discussion at the WUR campus, where indigenous people were invited to discuss the exploitation of their homeland by companies. Furthermore, prior to commencing his study program, student Uma mentioned attending an introductory course called Safe Science Society, which addressed the topic of Boundary Crossing in intercultural communication, including how to approach individuals from diverse backgrounds. In addition, non-structured ACT activities could also create opportunities for mutual learning and unintentional reflection.

3.2.3. Concluding remarks

To address the sub-research question, I selected a total of six courses currently offered in MES and conducted 17 semi-structured interview, mainly with the course coordinators (teachers) and MES students. The findings revealed a variety of practices in reflection on diversity employed by the teachers and students in MES courses.

Out of the six chosen courses, only the European Workshop Environmental Sciences and Management emphasized Boundary Crossing learning. Thus, in this course reflection on diversity was practiced through explicit BC learning mechanisms. As an example, in the course, students learn to identify and reflect on their different perspectives, i.e., regarding their leadership styles, teamwork, while developing their understanding of underlying factors causing the differences, such as their original cultural and educational systems. Furthermore, to assist the development of BC competences, the BC project team has introduced a BC self-assessment rubric, which allows students to reflect themselves on their own progress. It is worth noting that, besides intentional reflection practices that can be assessed using the BC rubric – which can be called "*learning from reflection on diversity*", students also reflect on diversity while engaging themselves in interactions with their peers coming from diverse backgrounds, cultures, or countries. I would name this approach as "*learning in diversity*".

For the remaining five courses examined, reflection on diversity was practiced implicitly, meaning without an explicit mention of BC and its learning mechanisms. However, students' reflection was facilitated through various methods. These practices that offered students reflective moments included: writing reflection papers, engaging in feedback sessions with both coaches and peers, doing personal interviews with coaches, playing roles in simulations with multi-stakeholders and reflecting on that, working intensively in groups with strict deadlines, completing assessment forms, and so on.

The most frequent form of learning that the interviewed teachers employed was *learning in diversity*. In this approach, students were randomly assigned to groups with their peers from various backgrounds, cultures and nationalities. All of the examined courses offered group work, though, with varying extents of intensity. Through self-reflection happening in group work, on the differences and similarities of their own disciplines, cultures, communications, etc., and those of the others, students engaged in the learning process. This type of learning was sometimes referred by the teachers as "experiential learning". Teachers hardly controlled over this process, but played role as a supporter, intervening when conflicts arise during groupwork, or assigning a student assistant to help with group dynamics. Particularly, in the unique course like ACT, where coaching played a significant role in supporting students' personal development, individual interviews and feedback sessions were regularly organized. Furthermore, an assessment of group work was often offered at the end of the courses. This assessment normally consisted of a brief form for students to report on their collaboration in group work, or problems with group mates. The assessment did not emphasize on what students have learnt from the diversity. With the "learning in diversity" approach, reflection by students was not graded, but considered experimental or incidental learning to achieve the outcome with their group mates.

The second approach that was reported by the interviewed teachers focused on *learning from reflection on diversity*, meaning that making reflection explicit. On one hand, in this practice, reflection exercises could be assigned to students, mostly in the form of writing individual reflection papers. Students received a specific assignment to reflect on various aspects, such as integrating diverse perspectives of their peers from different backgrounds, understanding differentiate interests and influences of multi-stakeholders. Some reflection assignments required students to express their perspectives on journal articles, delving deeper into the contexts and positions where the authors situated. The reflection papers either would be graded, or just to provide information to coaches, in order to

support students' development, and their group work. On the other hand, reflective moments were provided throughout some courses. In class, for example, students were asked to reflect on the different practices of water management in various countries and local contexts, and shared their opinions by raising their hand. In excursion, students reflected on what sustainable-living could mean to them. In the forest, students reflected on how they felt connected with nature. As observed by the teachers, these created learning environment often exposed differed students' perceptions according to their family backgrounds, cultures, nationalities, and so on.

It should be emphasized that the course teachers made efforts to encourage the recognition and awareness of diversity within the boundary of their courses. One of the initiatives included integrating the contents of environmental justice into the written textbook. This content demonstrated how individuals from different race, gender, ethnicity, class, nationality, as well as family backgrounds may perceive risks and nature differently. Another practice involved raising awareness about the contexts and positionality of authors introduced in lectures, such as European, male, white, etc., to expose students to the idea that there exist alternative theories and authors.

Some teachers aimed to alert students on diversity aspects closely pertinent to their course content. For example, in the Research Methods course, students were made aware that the seemingly technical operationalization of a scientific concept could ignore multiple aspects impacting people's lives, social justice, and the environment. Efforts were made to introduce the ethical dimensions of scientific practices by examining how doing science can become unethical and irresponsible if not subject to critique.

Additionally, several teachers provided a brief welcoming introduction, highlighting the diversity present in their classroom, while also emphasizing the existence of different styles of communication, studying, working and behaviors expected from distinct cultures or nationalities. There were wishes to do more, however, the teachers were careful of the boundaries set by their course in terms of learning objectives, contents and student expectations. They acknowledged their limitation, yet, considered the possibility to introduce alternative practices with cautions.

In response to the teachers' efforts, some students expressed their appreciation for the welcoming introduction. Some of them expected more introduction of under-represented knowledge and authors. While both learning in diversity and learning from reflection on diversity were valued, several students preferred learning in diversity over learning from reflection on diversity. When BC reflection was made explicit, students could pretend their words and behaviors. On one hand, often students shared that they learned a lot when immersing themselves in an environment with diverse peers, engaging in stakeholder roles, and reflecting on the experiences. On the other hand, they found challenging to handle the diversity manifested in group dynamics and conflicts, especially when the focus appeared to be on the content and knowledge, rather than the learning process of being and working together and respect for diversity.

Summary table:

As presented, reflection on diversity was practiced in various ways, either explicitly or implicitly via BC learning mechanisms. The table below provided a summary of the cross-cutting practices of reflecting on diversity that were reported by the interviewed teachers and students.

	Course	Activity	Examples of how reflection practice happened
Reflection on diversity practiced through explicit BC	➢ The EUW	Lecturing/course contents	• Lecturing about BC explicitly and its learning mechanism (of identification and reflection) • Lecturing about cultural differences & intercultural communication
		Group work	• Doing a Belbin test • Engaging in an assignment to discuss various opinions on statements, i.e. on leadership, teamwork, etc.
		Assessment	• Utilizing BC self-assessment rubric • Writing reflection papers
Reflection on diversity is practiced implicitly (without mentioning BC)	➢ ACT ➢ Environmental Quality and Governance ➢ Research Methodologies in Environmental Sciences ➢ Principles of Environmental Sciences ➢ Environmental Education and Learning for Sustainability ➢ Other courses & Extra-curricular activities	Lecturing/course contents	• Integrating contents reflecting "diversity" in lectures and/or textbook, such as about environmental justice, contexts and positionality of an author and associated theory, ethical dimensions of doing science, critique of science, etc.
		Group work	• "Experiential learning" – assigning students in groups with peers from different backgrounds, nationalities, etc., working together in an assignment • Having individual interviews with coaches • Students giving feedbacks to each other • Reflecting on the content and process of group work • Teachers intervening when conflicts arising in group work or assigning student assistants to help

		Assessment	• Writing reflection papers • Filling in a brief group work assessment form
		Simulation	• Playing stakeholder roles with different interests and influences on agenda
		Teacher's initiatives	• Providing a brief welcoming introduction • Presenting as a role-model • Introducing under-represented authors and theories

Table 2 – Summary of reflection practices in the MES courses

3.4. Further addressing critical reflection on diversity

Critical reflection on diversity was initially operationalized in the three components:

i) Assumptions & beliefs of self and others
   a. assumptions & beliefs of socio-cultural identities
   b. assumptions & beliefs in the environmental fields
ii) Histories of self and others connected to the environment/an environmental issue.
iii) Social positionality connected to an environmental issue/the environment.

After establishing these operational components, I conducted interviews with both lecturers and students. From their answers, I identified the recurring themes emerged from their perspectives on these components. The themes consistently across all three aspects were: the necessity of integrating the components for reflection, the challenges associated when implementing it, and the suggestions for possible integration. Building upon the preceding section 3.3., which identified current practices of reflection on diversity, either explicitly or implicitly through BC, this part delved into the perspectives of teachers and students regarding the possibility of introducing or further integrating these components of critical reflection.

3.4.1. Assumptions & beliefs of self and others

- **Assumptions & beliefs related to socio-cultural identities**

Necessity of reflection

In general, the interviewed teachers hold positive views about reflecting on assumptions & beliefs and considered it important. However, the teachers often had not implemented such reflection in their class, though they believed that it could touch the root of misunderstanding or communication problems. For instance, one teacher acknowledged that their students faced discrimination in their daily lives, although not within the university setting. Some teachers actively tried to mediate miscommunication between students from different nationalities, such as Dutch and Chinese students. Sometimes, the teachers acknowledged the potential validity of stereotypes. For example, one lecturer observed that European students generally write English better compared to the average Chinese

student. Yet, it was also believed that Chinese students could excel in other areas, such a statistics and modelling.

Depending on the courses, the participating teachers attributed varying degrees of importance to the practice of reflecting on assumptions & beliefs. The main concern of the teachers revolved around how the practice could be relevant to their specific course, its learning outcomes, where and how it could be structured in a way that students would not perceive it irrelevant. As teacher Erik explained:

> *"I think it is very useful because I haven't really done this yet. But I think it hits at the core of something. Because very often, we are indeed convinced that there is something there that gives rise to misunderstanding and communication problems. And as long as you don't address the view, it's unresolved. Well, the things I mentioned, it is very confrontational. So, we need to think very well of how you're going to structure this, and how we are going to fit it into the program, and how we're going to let them spread and not spread yourself, right? So, all of those things" (Teacher Erik).*

It is worth noting that while some courses briefly addressed the issues related to assumptions & beliefs, diversity & discrimination, they did not delve into these topics thoroughly or explicitly. There was often more space in the European Workshop or ACT courses, which placed less emphasis on content, and more on interdisciplinary collaboration, cultural understanding, and university-society collaboration, and personal development of students. As an example, coordinator Ivo shared his perspective:

> *"We hope that these points are addressed when we touch upon them. Personally, when I'm not in my role as an ACT coordinator, when I coach a team, quite often when I have students from different cultural background, that is one of the first things that we just discussed to open up. So, how are things different for you? Whether you encounter this culture in this team? And usually I think, at least to me, that they are fruitful, insightful discussions. And I have the impression that a lot of students, when I have these conversations with them, feel like, oh, for the first time someone is listening to what's actually different here" (Teacher Ivo).*

During the student interviewees, there were varying opinions regarding the importance of this reflection. While the majority of students held skeptical views towards the explicit reflection practices in their courses, they acknowledged the existence of stereotypes, and the necessity for action. On one hand, some argued in favor, stating that such reflection practice could be beneficial as they addressed preconceived notions about how diverse groups of people work. According to student Iris:

> *"Definitely some preconceived notions of how different groups of people work are there, and it is good to address them in any circumstance […] Reflecting on some of those preconceived notions is important so that you can get rid of them and also give people the platform to explain why that belief might be wrong" (Student Iris)*.

On the other hand, several opposite views suggested that while some stereotypes might exist, they were not necessarily problematic. For instance, one student, Eva, believed that stereotypes like, *"people from Spain or Italy are more relaxed compared to the stricter Dutch people, may have some truth" (Student Eva)*. However, she was uncertain about the significance of cultural or individual differences, emphasizing that every individual was unique, and that should be the point of attention rather than

nationality. Another student, Wang, admitted the existence of stereotypes and viewed it as "*not a very bad thing*". He observed that European students treated "us" (Asian/Chinese students) differently compared to how they treated local people, as they were unfamiliar with how to approach another culture:

> *"I think every Asian people will face some stereotype in Europe. Maybe sometimes it's hard to say what exactly the stereotype is, but it's there. It's like the elephant in the room and sometimes internal students from Europe, they stay with us in different ways compared to staying with the local people. They just act in different ways, but it's not a very bad thing. We can also work on it as a good sign because of the boundary between the West and the East. Sometimes they may not have a good idea what's the appropriate way to discuss it with us, because we do have a huge gap in the culture or the education experience, and so they just want to act, as polite as possible. Maybe it makes us feel unnatural" (Student Wang).*

Nevertheless, there were stereotypes that were recognized as "negative", yet challenging to remove, particularly when students had negative experiences with specific individuals or groups from another culture or nationality. Student Eva expressed difficulty when faced with a language barrier, sharing an example involving Chinese and African individual students speaking English. While acknowledging the stereotype she had in mind about Chinese and African students speaking English, the student found it challenging to understand their accent. Another student, Nada, believed that the problem with stereotyping raised when a negative experience with certain individual or group led to generalization about all individuals having identities of these groups. Nada expressed:

> *"I've had negative experiences with Chinese students, but I don't want to think every Chinese student would behave the same way. But once you start emphasizing and letting not mathematical like not perfectly functioning brain make those links. You will eventually make your own causal relationship, a bit of economics. So, because it's stereotypes, that's why stereotypes are so harmful because it's based on ideas that are not true or emphasized things that are maybe true, but not necessarily for everybody" (Student Nada).*

Challenges for reflection

The concern that made students skeptical about explicit reflection on assumptions & beliefs related to socio-cultural identities is the fear of potentially hurting people. Students expressed hesitations about vocalizing their assumptions & beliefs about others as they believed it could be offensive. For example, one student, Hema, commented "*I think it is something that should not be said out loud because it does feel offensive, to be honest".* She further expanded her opinions within a working context:

> *"I feel like, especially while working, if I do something wrong or someone does something wrong, I will find it odd if they bring up my background. Is this being caused because of your background? […] I do think like if every shortcoming that happens, you associate it always to someone's background, then that reduces the person do nothing but their background" (Student Hema).*

Similarly, student Bob agreed that it could be beneficial to address these matters in a general manner, but explicitly mentioning specific groups could quickly lead to hurting people. Another student, Haku, also shared the same perspective, stating:

> *"And it's more about if we, whether we have to talk about it or not, yeah, it's a very tricky question because we do not want to hurt people. Because once we talk, we have discussion about this, it might happen. For me, I don't really have an exact answer" (Student Haku).*

In addition, the students articulated that explicit reflection on assumptions and beliefs required a lot of time and effort. According to student Nada, it would take the entire educational path, and that it might be too extensive to fit in the courses. Another student, Eva, did not have a positive experience of reflecting on cultural differences in one of her courses. She found it unclear upon what she should reflect. Moreover, given the short time for each course at WUR, student Lise considered the timing of when reflection should happen. Lise suggested that if there was a workshop dedicated to reflection, the group work phase would have already passed. Lise explained on this point:

> *"For example, if we had workshops to reflect on it, then at the time of the group work we have already done these reflections. Now what happens is that everything goes so fast in this university and its group work, group work, group work. So, what happens is that you try to do that, or maybe unconsciously you do it. You work with these people. You get to know them better. So maybe your assumptions get a bit less strong. But it is at the time that you are working and then when you are starting to get into these people, you have to move to another one, right?" (Student Lise).*

Similar to the students' opinions, teachers found it essential to address assumptions & beliefs related to socio-cultural identities. However, they faced difficulties in determining whether explicit reflection should be integrated into their course to alleviate the issue. The uncertainty arose from the teachers' limited understanding of how to effectively tackle the situation. Teacher Ruben pointed out the challenge, noting that while making prejudices explicit could raise awareness, it could also inadvertently reinforce the biases. He expressed the uncertainty:

> *"I'm not sure if you bring that up and you start discussing it, whether that will take away this image. Maybe, let's say, students would admit that, this is indeed the picture that they have [about Chinese students], and then some Chinese students would say, well, it doesn't fit to me. But all the time we have been articulating that picture in the debate. So it's a bit like you should not think about an elephant. Don't think about an elephant, and then you start thinking about an elephant" (Teacher Ruben).*

Teacher Ruben emphasized that deep assumptions & beliefs took roots in our historical and cultural backgrounds, making them hard to switch or remove. Confonting such issue could be sensitive because pointing out instance of racism or colonism could evoke strong feelings of guilt or conviction.

Most of the teachers believed that organizing explict reflection activities on social-cultural identities required careful preparation. Several concerns were reaised, including "*risks of making it wrong quite serious and realistic*", or "*making socio-economic backgrounds explicit risks generalizing people*". Teacher Erik experienced orginizing a session on diversity. His students become aware of their biases but received no guidance on what to do next. In the interview, teacher Erik emphasized the students'

making themselves vulnerable when engaging in self-reflection. However, they received no further assistance or resources from the course to solve the problem afterwards. That is why caution and good planning aligned with the course was considered crucial in approaching these activities. For example, teacher Erik said:

> *"They have to make themselves vulnerable. They have to reflect on things they have to maybe certainly find out something that then needs guidance and then you don't offer them anything. Oh, so you found out about yourself, that you're biased. Well, good luck with that, right? You cannot have that. That's not a reason why we're a little bit cautious" (Teacher Erik).*

Additionally, the interviewed teachers highlighted a risk of adding more content of reflection without a careful thinking and planning. This would overburden both teachers and students with additional workload, especially when the courses were already fully packed. Most of the courses were not designed for this kind of reflection. Moreover, it was crucial for students to have a clear understanding of the purpose of the reflection activity so as to avoid confusion. Teacher Zoe provided an example:

> *"I know that one of my colleagues included a workshop on diversity in his course for the first-year bachelors last period. Students didn't like it, because they didn't understand what was the function of that. So the actual activity can be nice, but if students don't know what and why you want them to do that. And they want to know if they're going to be graded, or what or why it is for. It has to be designed, communicated and integrated well in the course to have value, otherwise it can actually be counterproductive that people just don't understand what you're doing or why" (Teacher Zoe).*

Suggestion for further integration

The most frequently suggested opinion among the teachers regarding the integration of reflective practice is that it should be approached with careful planning and consideration. In other words, the teachers' recommendation emphasized the importance of structuring and implementing it thoroughly in the courses. For instance, the interviewed teachers questioned themselves: *"how you are going to structure it, how you are going to fit it into the program"*. It should be noted that some courses have more flexibility in this regard than others.

Specifically, ACT was an example where reflection on assumptions & beliefs on socio-cultural identities were already practiced with the involvement of coaches engaging individual students or groups of students in feedback sessions. Coordinator Ivo emphasized that, while further reflection could be encouraged, it should not be prescribed. Coach Umar suggested that reflection should always begin at the personal level. And ACT provides both informal and formal education, allowing for the integration of reflection in various ways.

In contrast, other courses seemed to have limited space for explicit reflection practice; however, they employed different levels and methods of reflection. The extent of reflection on assumptions & beliefs depends on the teachers' effort, and all the teachers demonstrated their effort to incorporate reflection on diversity in their course. However, they did not always perceive their approach fully addressing the issues. These activities continue to evolve and adapt at the course level.

Conversely, two teachers suggested that if the reflection is intended to be recurring theme in every course, it should be implemented at the program level, rather than the current course level.

From the students' perspectives, reflection on assumptions & beliefs related to socio-cultural identities could commence earlier, even prior to the official start of the study program. One student suggested this to be integrated into the introduction week, such as during the AID (Annual Introduction Days). Lise, a MES student, explained her idea:

> *"It could be happened during the AID in the introduction week. Yeah, it doesn't have to be everything about association parties. I mean a true introduction week is for making you feel comfortable in the university, right? To welcome you, and for me, there's no way better to welcome someone than reflecting on these topics of diversity" (Student Lise).*

Regarding the timing for reflection, some students proposed doing it at the beginning of every year, or shortly after the start of a course. However, they were uncertain if this approach suited every course. One MES student, Nada, emphasized the importance of discussing the topic even before any (negative) experience occurs, for example, on "*why biases exist*". She also would like increased teacher intervention when problems arise during group work. Two other students suggested periodic options, such as *"having a diversity workshop",* or "*mentioning stereotypes in general contexts and maybe within group work"*. Some students suggested that the evaluation system should be made more elaborate to include a focus on "learning from diversity". For example, at the end of the group assignments, students could be asked to provide more detailed reflection on what they have learned from diversity.

One suggestion that stood out from the students' perspective was to create an environment where individuals do not have to reflect on this subject but feel free to do so if they choose. Student Eva supported the idea of dealing with differences by experiencing it. Another student, Hema, added that reflection should be experienced through actual learning rather than being evaluated for the sake of assessment. For example, she suggested that the concept of Boundary Crossing could be better learnt by making students do the work in a certain way without explicitly labelling it as BC.

Three students proposed enhancing the inclusivity of the courses by introducing underrepresented authors. A student, Mandela, expressed the expectation of encountering more examples from not only the Netherlands and Europe, but also various parts the world. Bella and Rama reported that current courses that they enrolled in focused extensively on European policy, while neglecting how policy and its plurals are made in other regions. According to Hema, BC could be even taught by introducing reading materials who represent non-Western ideologies. She shared her opinion, stating:

> *"At least in my opinion, it would be nice if you could somehow inculcate boundary crossing in what you're teaching. One of the examples I would love to give is that you're giving us papers to read that are from underrepresented authors. I have read so many Western centric ideas and thoughts, but there are great papers which are not of Western ideologies. Having something like that introduced would be nice. I remember in Environment and Development, I read a paper which I thoroughly enjoyed. Then I realized that the author is an Indian. It doesn't have to be an Indian, but just the fact that it offered me a different thought" (Student Hema).*

- **Assumptions & beliefs in the environmental fields**

Necessity of reflection

While most of the interviewed teachers agreed that reflection, particularly in the environmental fields, should be practiced, they referred to it by different names, such as responsible research & innovation, or ethics. According to teacher Tomi, graduate students should strive to become responsible scientists. In his course, Research Methodologies in Environmental Sciences, he attempted to lay the foundation for this aim. The discussions in the course alerted students that science, in practice, could be an instrument of those who have pollical interests and financial means. However, since most students possibly did not receive sufficient foundations for sociological critique of sciences, he believed that further work should be done at the program level to address these foundations and make them explicit. Another teacher, Erik, who coordinated the same course, agreed with Tomi on its relevance of reflecting on ethical dimensions of sciences. By making certain assumptions or approaching when doing science, scientists can behave unethically. In the course, teacher Erik tried to make students aware of "*those ethical parts of seemingly very technical operationalization decisions.*" He gave an example of using chemicals to clean water:

> *"This problem of what is the best method for water clearing the drumstick seeds and the use of chemical method is seemingly innocent decisions. It has big implications for the populations that are involved. And what are the actual costs? Costs are also the cost to the health of people that have to work with the chemicals and et cetera. And those tend to be the underprivileged people that have no choice but to do these dangerous jobs. To make place for the kind of factories that make those chemicals, you also need to evict people, right? Those are also costs, but they are harder to express in our financial costs and so, you may conveniently leave them out" (Teacher Erik).*

Another teacher, Ruben, related the reflection on assumptions & beliefs to the issue of environmental justice. As he put it*, "environmental problems work out in different shaded and unequal ways affecting different groups*". According to him, we should be careful with the research that generalized a group of people without considering "intersecting" indentities. These research were also based on false assumptions & beliefs.

> *"Let's say, for the US, very clearly environmental problems are hitting minorities much seriously than the white, but again, within white groups, we have also socio-economic precarious groups, which are again hit more than the rich" (Teacher Ruben).*

The teachers of the EUW and ACT considered the necessity of reflection on assumptions & beliefs in the environmental fields depending on the team projects and who the Commissioner was. It was often said that the reflection suits best with the projects involving local people and customs beyond solving technical problems, for example, in Africa or other parts of the world. Sometimes, the Commissioners were Dutch and even prefered a Dutch team, and in such cases, reflection on diversity was often regarded as unncessary.

Apart from the teachers' view, the students considered the idea of reflecting on assumptions & beliefs in their (environmental) fields more controversial. While most of the students supported it, some were unsure. For instance, Eva supported the reflection only when it was necessary, such as problems occurring in group work because of underlying assumptions & beliefs. On the other hand, another student, Iris, believed that the current content should definitely include more worldly views and approaches. Lise shared the same opinion on supporting the reflection, since she was interested in more diverse forms of knowledge and ways of living. She was disppointed by one of the MES courses

that should have disccused more diverse perspectives other than dominant European policies. She voiced her disagreement:

> *"I was so frustrated, with some courses like these of environmental (policy) analysis, that there was only focused on the European Union. And even I didn't hear anything about indigenous peoples, all over the master. We didn't cover anything about ecofeminism. And why is that less important than carbon credit? That is actually something that we are taught one side of the coin of the carbon credit. They are good. They are environmental policy done at the European Union level, but we are not seeing what it is. We are not reading about what these type of policies to people all around the world that actually are causing a lot of damage to these people, only environment, right? We don't focus on diversity, we don't. We don't think there are diverse people living in diverse geographies that maybe have other priorities. We just think about ourselves and that's the new form of colonization. The colonization of knowledge, for me, it's even more dangerous than the physical colonization" (Student Lise).*

Another student, Wang, was uncertain about the usefulness of reflection practice, as he did not find in WUR education, the lecturing content made any wrong assumption about China, where he came from. However, since he left China and came to the Netherlands for study, he realized how social media in China framed the West in a certain (negative) way. Vice versa, in Europe, social media platforms potrayed China as the biggest pollutter, whereas he believed that China built the biggest tree parks in the world. Thus, he supported the necessity of organizing discussions presenting different sides of a coin:

> *"I do see that some news saying about China that emits most of the CO2, but they do not always include another side. In my thesis I get this information: China is the biggest country building new trees. It created the greatest parks of trees in the world. So I think it's maybe necessary to have this discussion from different sides".*

Challenges for reflection

The interviewed teachers believed that reflection on assumptions & beliefs in environmental sciences had been introduced in various ways in their courses. As mentioned, teachers Tomi and Erik integrated ethical dimensions of being a scientist, giving examples of potential harm caused by certain assumptions, even prior to a research question. According to teacher Tomi, the course aimed to make students alert on "*the blindness of science and how science is political*". The teachers assumed that science is political but did not make it explicit to prevent students from rejecting it. Because of the ways the course touched upon the issue, the teachers faced two confrontations: first, students' lack of foundation on critiques of sciences to reflect on the political nature of science; and second, the challenge of not making the political nature of science explicit, but still motivating students to learn and do science. Teacher Tomi explained how reflection on critique of science were integrated, and challenges in teaching this within a framework of the scientific research course:

> *"There's a bunch of work that we do there. But it's not around diversity, it's around the blindness of science and how science is political. And so, our course structurally accepts the assumption that all science is political. But it doesn't make it explicit because a lot of the students would reject it. Getting students to reject the notion that science is necessarily objective, that good science is objective is a lot of work in the amount of reading and the amount of personal development that is required for students. First of all, to come with naive sort of realism, naive*

ideas about science and then to recognize the critiques of science as a social product, social project that is complicit in the reproduction of all sorts of inequalities and then to get them to the point where they're still willing to do science, that is a long journey" (Teacher Tomi).

Furthermore, one teacher, Ruben, pointed out the risks of presenting studies that conclude on the care for environment depending only on the racial identity. There should be many intersecting identities with race, such as socio-economic class, gender, or ethnicity, that were not considered, which could result in invalid findings. In other words, we should pay attention to the complexity when involving or discussing socio, cultural, economic identities in relation to the environment or an environmental issue. The reliability and validity of such research or claims should be examined carefully. Teacher Ruben elaborated:

"It is even more complex, if you measure it according to the general standards. Then it is usually people who are educated, and know what to say, and that could be any sort of ethnicity. But on the average, of course, white are privileged, very clearly. They give the right answers, but it doesn't mean that they care for the environment. It means that they know what to say, to what is the socially acceptable answer. So, we have to be very careful with all sorts of research there" (Teacher Ruben).

Another challenge that was mentioned by several ACT & EUW teachers was the lack of diversity in Commissioners. This resulted in the unnecessity of doing reflection on diversity, since this was not requested by the offered projects. Considering that most of commissioners were "mainstream", there was hardly any request from the commissioners to introduce divergent perspectives, such as different ways of looking at cultural ecosystem services. According to teacher Anna, the Commissioners, predominantly from natural sciences backgrounds, often sought technical solutions like water infiltration, carbon sequestration or air quality regulation. Thus, the important topics such as human-nature relationships, people's well-being connected to nature, etc. remained understudied.

Among the students, the challenge that stood out was the concerns around whether explicit reflection would accelerate ingrained stereotypes and evoke defensive attitudes if people were convicted. "*Then people get more hurt than they already might be*", according to student Bob. The students thought, in general, reflection practice was needed but how to do that was a challenge. As an example, Iris commented: "*There should be a platform for that, but I don't know where you would do that".*

Suggestions for further integration

The interviewed students also showed that they worked on reflection themselves to examine their own assumptions in the environmental fields. Some had opinions that as an educated person, or future (environment) professionals/scientists, they should be able to criticize "false" assumptions & beliefs, such as stereotyping different racial groups in relation to the care for the environment. They cast doubt on claims or research that concluded wrongly on groups with different identities, such as of race, ethnicity, gender, including their own assumptions & beliefs. For instance, Lise shared her reflection and realization when doing field work for her thesis:

"I've been working with indigenous communities, and I also have a lot of assumptions. Well, it was a bit romanticizing, I guess that indigenous communities were very much attached to nature that they see as Mother Earth. That actually is their primary cosmovision that they see nature as Mother Earth, as their collective mother. They have to take care of her. That's what

the literature says. So, in my mind I was going to get there, and every group of indigenous people that I encounter would be super careful with the environment, for example.

And you just see trash on the streets mainly. And you see people applying pesticides. It's not their fault, they are also corrupt by the government, right? It's not because they are indigenous that they are not going to be corrupt, right? It happens as we are. You see that some people can resist it, like the Zapatistas that I was living with. But most people are not like you're reading books. So I also had worked at assumptions within myself" (Student Lise).

Moreover, some students expected changes in the course contents to bring in more diverse perspectives as a point for comparison or reflection. Another student suggested changes should be made in case studies for group work to be more relevant to local contexts of different countries and cultures, allowing students to contribute their first-hand experience.

In addition, one student recommended that short discussions in class of 10-15 minutes about controversial topics would be useful. Another student proposed the online forums in Brightspace for sharing in case it felt too exposed for someone to share in-person. One student preferred organizing the discussions as an extra-curriculum activity, for example, on the topic of environmental propaganda, to clarify the portrays we had about groups of people or countries.

Among teachers, several opinions corresponded to the students' viewpoints. One lecturer, Tomi, emphasized an adjustment at the program level to lay a stronger foundation for students and make explicit critiques of science. This structural change would promote diversity and strengthen the responsibility & ethics of a scientist. Although in the course, teacher Tomi already introduced ethical dimensions of doing science, he looked forward to a robust foundation to be provided to students:

"It is a program level requirement to be able to work with those foundations and to make explicit. First of all, science is political, not so much science itself, but in practice, science is an instrument of those who have political interests and financial means. The sort of niche and like those are all part of the sociological critique of science, which is like Latour [a professor's name] and that kind of stuff. But that kind of sociology of science or philosophy of science students don't have. To handle it properly, they would have to have good training on sociology of science. They would have to understand that science is natural philosophy. And they don't have that, so the foundations necessary for folks who have partial understandings of belief systems are dangerous because they'll cling to the superficial things, and not understand the core principles" (Teacher Tomi).

Besides the inquiry for changes at program level to make science more inclusive, some teachers were interested in exploring further reflection in their course. For example, coach Umar offered this reflection during the meetings with her students or extracurricular activities in the ACT. When wrong assumptions came up, students should discussed. Similar to that, EUW teacher, Anna, expressed her wish to explore more holistic perspectives of human-nature relationships, when the Commissioner were less mainstreaming. Another teacher, Zoe, suggested a different name, which called "framing" for assumptions & beliefs in nature conservation field. She believed this would be an interesting topic to explore if students have those assumptions. Teacher Ruben was willing to introduce other

philosophers, schools of thoughts from different ethinic, cultural and national backgrounds in his course:

> *"So I think because what you say about role models, that's of course a very important thing. So I think indeed it is very good. And I only do that, very gradually and not on a big scale, but what I try to do step by step is bringing in other sort of philosophers, other sort from different ethnic and cultural and national backgrounds, and that helps, I think, in making clear that science is something for everyone and not something for a specific privileged group" (Teacher Ruben).*

3.4.2. Histories of self and others connected to the environment or an environmental issue

Necessity of reflection

In general, the interviewed teachers found reflection on environmental histories of self and others could be of value, but they did not see its immediate applicability in their course. The major consideration was its relevance. For example, in the context of ACT, teacher Ivo did not want to interfere with the exact content of reflection, but enabled students to do it when the reflection was relevant or necessary to their discipline, such as how their culture or context might influence nature preservation. He gave an example of people from Southern Europe treating water differently compared to those in the Netherlands. As he illustrated:

> *"One of the cultural differences that we look at, not specifically in ACT. It's one of the academic things. It's the way in which a culture tries to influence the environment. For example, in Southern European countries, when you have a shower that is dripping, that is completely acceptable, let's say, in Spain or Italy. In the Netherlands, we would immediately fix it. It's not acceptable that showers dripping all the time, it should be fixed, etc.*
>
> *And we have the dikes. We create the country by dikes. In some other countries, they would say, well, there's flooding every now and then, so we build our houses on pillars. They just live with the water that's coming up, and we just want to fix the water staying outside. It's a different mindset and that could also go into nature conservation. So, I guess it's relevant to be aware of your cultural influence and the way you should manage it" (Teacher Ivo).*

Some teachers perceived that reflection of environmental histories could be valuable for students to develop their mutual understanding. As students came from various places and held totally different views, teacher Anna emphasized the potential of misunderstanding, and at the same time, the possibility of enriching students' worldviews when they could realize that "*there is this diversity".* She illustrated by an example on how students could feel differently about connectedness to nature. Asking students explicitly to reflect their connection to nature or their land might not always be relevant, for instance, to those who were always living in an apartment building and not being in touch with nature. Anna explained her view:

> *"We're talking here about connectedness to the land. That's if you have been brought up in a big apartment building, in the city, or in rural Africa, or whatever, then you have a different connection to your environment. I suppose it would be enriching for the students to realize that there is this diversity, but also the challenge in it could be, the people that have been*

brought up in a European city in an apartment building, maybe, find it difficult to step in the shoes to cross the boundary, to the other side, to envision how it must be for somebody else" (Teacher Anna).

Another teacher, Erik, added the point that reflection could help students respect each other better: *"they might form a community and it may help them throughout their studies*". It helped to understand their motivation for environmental studies. Although he could not see immediately an added value of implementing the reflection, he regarded it having a potential benefit. According to Erik, it would be relevant if the reflection tied to the issues connected to research methods, such as methodological choices or framing.

On the other hand, teacher Zoe recognized the importance of bringing diverse voice and story telling in her class, though she was uncertain how she could further integrate the idea, in addition to inviting guest lecturers:

"Definitely, it's very important to have diversity of stories in the class. I agree. And that is also the case with guest lectures. I don't know how I would do it and what do you mean by reflection? Because a reflection can be just raising your hand and saying something in class for a minute, or it can be a formal exercise. But I agree that it's important to have more, more voice represented, more examples, more diversity of history" (Teacher Zoe).

Furthermore, one teacher, Tomi, related environmental histories of self and others to our consumption behavior and its impact on the environment and people – tracing environmental consequences of our consumed products, and how the consumptions cause collective harm to the environment and people. From this point of view, Tomi highlighted our reflection on the collective consequences of individual consumption behaviors on the environment as very important.

On the students' side, in general, they considered reflection on environmental histories to be valuable, as it allowed them to know about the lives of others. Most of the students expressed their excitement, sharing, such as "*I like to exchange with people, so I would say it's nice doing it in groups*" (student Eva); "*I like it when I am able to give an example about where I am from"* (Student Mandela), or "*I feel like, those are the discussions I enjoyed the most, and I look forward to the most, and they're always engaging" (Student Hema).* The students often felt that they could learn a lot from their peers, their motivations, and the local contexts where they came from. For example, student Bob, from the Netherlands, believed the reflection would be enriching for him:

"I think that would be very nice for people like me. I chose this study because I thought it was very interesting, not because I was dealing with an environmental problem at first. So, I did not really see or feel any change. But I can understand the people from, for example, Africa, where there is a lot of flooding or drought. They see these changes and that might be a drive for them to come here to study Environmental sciences. It's good to know, to really feel, and see how these people experience those environmental issues. It could be very helpful for the rest of the study because you know what you're doing it for" (Student Bob).

Student Eva, who also hails from the Netherlands, supported the relevance of reflection and sharing of personal stories and experience in class. To her, climate change and environmental problems could

sound distant. She highly appreciated personal stories as they made the problems feel more tangible. In her opinion, reflecting on personal histories connected students with one another and gained their sense of direction and motivation.

Hema, who came from India, agreed with Eva's viewpoint. She observed that including personal narratives engaged students in discussions. Moreover, this empowered her because she could share her lived experience in India, where many people here were unfamiliar with, and generated their interest in the issues.

> *"That'd be great because, as I said, when I see a lower representation of non-Western thought, I had taken an extra course in the last period which was about social practices. So, what we were taught, I tried to relate it a lot to what I have experienced in Mumbai. And I found a lot of parallels and I could contribute a lot to discussions based on what's happening in Mumbai and in India. And people find it interesting because a lot of people don't know about it, and because I'm talking about something I have lived through and I'm sure that gives them perspective" (Student Hema).*

Another intriguing perspective was indicated by Iris. He connected the reflection on environmental histories to the self-realization of responsibility for the environment, particularly as (future) scientists or professionals trained at WUR. Iris believed that the large majority of WUR students were conscientious about the impact of science and technology on the environment, and aware of their responsibility. He expressed his sense of ownership and accountability:

> *"I mean it's part of the ownership, or do you have not the ownership of problem? We need to be aware of the actions that we are taking. And definitely that's something prevalent in all the courses I've taken. Especially relative to Europe and or Western societies, I have been largely responsible for the climate crisis that we're in. And so, all subjects I have taken about the climate. It's like very clear that there's an aspect of self reflection required, to be aware, and even outside of the academic situation" (Student Iris).*

Challenges for reflection

Among teachers, as mentioned, the major concern was about the relevance of the reflection practice - its learning objective in connection to the course learning outcomes, and how it could be organized. For example, the ACT teachers considered reflection practice meaningful, when students involved in projects that required an understanding of cultural differences. However, often, the commissioners were not diverse sufficiently, such as they did not come from abroad, had few ideas of alternative solutions. In other words, there would not be many case studies or projects about different countries & practices. Thus, ACT coordinator, Ivo emphasized that the reflection practice should not be prescribed.

Coach Umar, also from the ACT, agreed with the viewpoint. According to her, "*identifying specific aspects to reflect does not suit ACT*". Moreover, even when the student population was diverse, it depended on the individuals who applied for the project and their backgrounds. Therefore, the reflection had to be flexible.

Like the viewpoints of teachers from the ACT, the EUW coordinator, Anna, found it challenging to find time and space for reflection. According to Anna, her course was already fully packed with information and assignments. In another course, PES, teacher Ruben raised concern about the time constraint to have an in-depth discussion, i.e., on why students think in a particular way about the environment, including the influence of their childhood. He stated:

> *"It's very difficult what you put. You could ask about someone's background. I do ask. For instance, when I start talking about nature, I ask people about why you want to protect nature, so that it opens a little bit of their background. But I don't have the time to really go back, and ask - why do you think so, and does it match with your childhood experience? Et cetera. Yeah, so that would only happen in group assignments, where it is relevant" (Teacher Ruben).*

Furthermore, the valid concern revolved around the feeling of students who would be asked to reflect on their environmental histories. Not everyone wants to reveal their histories. As teacher Ruben put it, "*personal history is not always glamorous to tell*". He further pointed out the challenge of organizing such reflection: creating a safe and open environment where everyone could feel comfortable sharing if they wished so.

> *"An important fact we know also from research. It is very interesting to tell, but again it should be done in an atmosphere where people feel free to tell it. And I also know because I've also been looking into research on pluralism in the classroom. I've done some work on that, also published different views on nature, for instance. People don't like, let's say so, if you look at migrant children in the Netherlands, they don't like to be taken up every time, now to tell you how it is in Morocco. It was completely different. How is it in this area where you come from? And then with a sort of admiration, of course, with a very good intention. The children don't like to be pinned to their cultural background all the time, and that could be so" (Teacher Ruben).*

Added to this viewpoint, another teacher, Tomi, was convinced that knowing about environmental histories without implementing structural changes might not help. His view emphasized our recognition of collective consumption and their harm to the environment. In his opinion, there was a risk of cynicism when reflecting on the environmental consequences of our behavior. The practice could evoke the feeling of hopelessness, where individuals knew about the situation, but did nothing about it, or they were unable to change it. Tomi explained his standpoint as follows:

> *"And so, there's risks on feeding cynicism. It's hopeless when you introduce people to how their normal behaviors produce huge harm. Then one reasonable reaction is to throw your hands up in despair and become hedonist. Go get stoned, you know. Hey man, we're all dying so I might as well, die happy. You could do harm with it. You can make people aware. It's a classic one. If you, for example, you're working with women in a culture who are oppressed badly, and you make the women aware of their oppression. They're trapped. And so basically what's happened is you've taken a bunch of women who are unaware of their horrible condition and you've made them aware of their horrible condition, but they're unable to change it" (Teacher Tomi).*

From the students' perspectives, while some valued learning from sharing personal environmental histories, and were excited about having had chances to do so; others expressed their inexperienced of critical adverse environmental events, or reluctance to reveal their personal narratives. Wang felt that it would be uneasy for him to speak out if asked to share. He imagined being exposed speaking in front of class. Growing up with the education in China, he was taught to be a good listener rather than a speaker for many years. Listening was always felt safer for him than speaking because of his fear making a mistake. Moreover, he did not see the reason for sharing personal histories, and what he could benefit from that. He explained:

> *"For me, I don't know the reason why we are going to share our history, our environment stories. Why gonna we share it and then what? What benefit can I get from this sharing or after hearing others sharing, maybe? I'm not sure what I can get from it" (Student Wang).*

Another student, Eva, had no problem with sharing her history personnally. Nonetheless, she agreed that it could be challenging when it possibly evoked environmental anxieties. It could become really personal to ask about how one experienced certain environment issues or nature. She emphasized the need of building trust and connection with one another for such kind of reflection, saying:

> *"Personally, I don't think it's a real problem, but I can imagine. For example, during the education course, we really focused on building trust and connecting with each other, because we're also talking about environmental anxiety or climate anxiety. It can be really personal to talk about that. You're afraid that the world is, like, going to disasters, to an end. So it could be really personal to ask" (Student Eva).*

Lise also expressed their concern that sharing personal stories in class would be scary for them. According to Lise, if students were forced to expose themselves, they would reluctant to give feedback, and that would create even more inequalities. Lise explained:

> *"That also could have the opposite effect. I guess if students are forced to expose, maybe they are not going to give any feedback, or they are going to even think that their epistemologies and ontologies, in relation to the environment, and the topics that they think should be covered are wrong, or don't make sense, or that they are going to be joked about. And then that creates maybe even more inequalities. But I think if we would be able to do that anonymously, it would be perfect" (Student Lise)*

Some students indicated the challenge of implementing the reflection when a course was identified as natural sciences, or focused on policy or scientific contents. As Nada put it, *"natural science in general has a tendency not to account for people*". Lise expressed the same feeling. To Lise, when professors decided the course content, there was a lack of the feedback mechanism that allowed sudents to voice up, and give inputs on changing the content.

Suggestions for further integration

Corresponding to the challenge mentioned, one of the prominent suggestions by the teachers was creating an atmosphere where students feel free to talk about their environmental histories, if they wish so, and feel safe. As teacher Ruben raised the point, stating:

"So, it is good to do it, but again you have to be careful, and particularly, look at: Do people feel comfortable, whether they like to do it, do they feel that it enriches themselves in the group, or do they feel forced to tell things that they actually think this is my private business? And that is also legitimate to say, OK, that's my background. So, there is also a sort of right to privacy in these matters" (Teacher Ruben).

Regarding specific contexts where reflection on environmental histories could happen, the interviewed teachers proposed various approaches. According to teacher Ruben, reflection could be incorporated in group assignments when it was relevant, considering if they felt safe sharing their personal stories. In the ACT course, coach Umar believed that personal discussions or interviews with students could offer reflection space. Students could write a reflection paper on the topic, but this should be done with a flexible rather than a rigid structure. Moreover, ACT coordinator Maarten believed that this reflection could be valuable when ACT had projects from the commissioners that paid attention to cultural differences. On the other hand, coordinator Anna of the EUW suggested that personal histories can be shared in extra-curricular activities, for instance, when students were having dinner or playing games together. Another teacher, Zoe, mentioned the reflection could be implemented simply in class when students were questioned and raised their hand to share, or further through reflection exercises. Teacher Ruben suggested an approach to invite students' sharing:

"Well, you could invite people, let's say to just ask people. Can you tell one story out of your life that you think is interesting? And then people can choose and that could help. Then it's not like now you open up your ethnic identity. No, you just tell one story that you think is interesting to share, and you decide for yourself which story you want to share, and which story not. So that could be interesting" (Teacher Ruben).

In another course context, teacher Erik was thinking about integrating the reflection when it could fit in the course, for example, connecting it to methodological choices or framing in research.

''And the other way that I can think of, perhaps using it, is if we can relate to course issues. So, if it brings up indigenous communities or stakeholders that are often not represented well, or whatever, and we can tie this to methodological choices or framing, or et cetera. So, you can tie it to something else in the course that we care about. Then I can also see how that can be used'' (Teacher Erik).

His colleague, Tomi, also shared the same viewpoint, suggesting that revealing environmental histories could help students see external variables which they might not consider – and that was strongly linked with the research methods. He elaborated the idea:

"That would be interesting. I don't know that we can fit it in the course. I think that one belongs in the course on modeling on agent-based modeling. That would be really good, particularly if you had students do it one way and then you flipped the variables of interest, and then you could help them see externalities. Because there's a lot of the environmental stuff trades on external. Those variables which you choose not to consider" (Teacher Tomi).

In agreement with the interviewed teachers, the participating students often emphasized the importance of the environment for this reflection. Students should feel free and safe to reflect and share

if they want. The students gave their opinions such as: *"It is important to know that you don't have to say anything if you don't want to (Student Eva.)*; *You can do it if you choose so (Student Haku)".* Some students preferred reflecting in small groups. For example, Eva suggested a group exercise, where students could think about certain topics (of environment) and how it connected to them:

> *"I like the idea, although it's also important not to focus only on the negative things, but I think it can be valuable. Also, to think more about the topic. When you think about a certain topic in your own life, you will think way more. Maybe if people don't want to talk about it, you can make it an individual exercise, like thinking about this for yourself in your own life and writing it down; or just think about it for 5 minutes during the course. But I like to exchange with people, so I would say it's nice doing it in groups, maybe smaller groups, not like the whole classroom. That could be valuable as well. And people never have to say things if they don't want to, so if you give them freedom" (Student Eva).*

In addition, the students suggested various approaches where reflection could be implemented. One student recommended open forums/discussions either in class or online. This could be very short, for example, questions and answers during lectures or open discussions after lectures. Several students prefered online plaform where they coud be anonymous. This was recommended by Lise and Haku, as an example, Lise explained about the anonymity:

> *"I was immediately thinking about an online platform that is anonymous. I didn't even think about people sharing these things in class because that for me would be scary. But this could be done online where people have, like, the questionnaires that you have a box where you can write. And then, of course, the professors would have to worry the work to analyze it and then to propose the topics based on the suggestions of the students. But it could be anonymous" (Student Lise).*

Furthermore, multiple students proposed that reflecting on environmental histories should happen in introduction courses or at the start of a course. As an example, student Lise suggested that the program like MSc Environmental Sciences should pay attention to our definitions of the environment and how this could be cultural dependent. Lise raised the important points:

> *"It actually should be an introductory course, about how people think about the environment differently, how different people perceive the environment and nature differently? Because it's also culturally dependent. And if we are in a masters called Environmental Sciences: What do we define the environment? Do we define as a thing that has to serve the humanity through natural resources? Do we define it in a more attached to a spiritual meaning of mother earth, or something that is not covered in our courses, but maybe should, because there are people that come from that culture?" (Student Lise).*

Additionally, some students recommended implementing a better feedback mechanism, where students input on the content is allowed and the contents should be changeable accordingly. Student Lise emphasized on having more trust in students' capacity to come up with topics that they think are relevant. Relevant to this, student Hema agreed with the viewpoint. According to Hema, students

should be allowed to choose stakeholders or organizations they feel associated with in the simulation, rather than being assigned a certain role.

3.4.3. Social positionality connected to the environment or an environmental issue

Necessity of reflection

While most of the teachers conceived that reflecting on social positionality can be of relevance, they interpreted social positionality in varied ways. Three teachers understood "social positionality" as a position of a researcher, or of an academic, and thus, considered that engaging in reflection was essential for students when doing research, or developing their profession. As an example, teacher Erik shared his thought on where this could fit in his course:

> *"It may be of value to let them [students] reflect on their positionality. Let's say when you have the data in the sense that, for example, when people do interviews, and they actually have to do the interview, and then interpret the interview coded and etc., then things around positionality really come. You have to reflect on it, otherwise, you will not recognize some biases in that. But of course, it's not restricted to the phase of data analysis and interpretation. It's not restricted to only qualitative research. It is definitely also relevant in any kind of research design. So it might have its added value" (Teacher Erik).*

Furthermore, teacher Erik saw that this kind of reflection was relevant to "*epistemic criteria associated with certain kinds of knowledge, and it might be good to clarify this, indeed*". The courses that suited this kind of reflection were those offering students to do transdisciplinary research, such as involving citizen sciences, or conducting fieldwork that engage various stakeholders.

Another teacher, Umar, believed that reflection is crucial for students to develop their future professionalism. She gave an example of students who aspire to become a consultant in forest conservation. Drawing on her past experience, she emphasized that natural resource preservation would not achieve without involving local communities or indigenous knowledge. As she put it:

> *"It's important for students to reflect on this. So they begin to be aware that I'm an academic. I don't have the indigenous knowledge that the people in the forest have. And I am not complete, or any of my activities is not complete without that knowledge. So, I need those people and they have an important role, just the same way, as they feel, or they need my knowledge of science" (Teacher Umar).*

Likewise, coordinator Ivo of the ACT agreed on the importance of reflection on social positionality. However, both Ivo and Umar believed that it should not be prescribed in the ACT, since it suited well in certain projects but not to apply for all. To Ivo, this reflection examined biases towards the knowledge that one processes, or cultural backgrounds exerting its influence on the environment, for example. His overall idea on this reflection is to make students learn to be humble. He shared his view:

> *"It plays a role in some of the projects, so definitely not all. I would say a minority. I think when we have a project, once in an African country. Then I am very aware of, who is telling what to whom, and where does the knowledge come from? I'm at least, personally, very sensitive to the fact that we cannot, as European white people, tell African people in a nature conservation programme how they should take care of their nature. I mean, that's ridiculous, so we have to*

be very modest. OK, we have some information. You have your information and somehow we can collaborate. In that sense, yes, it's definitely very important to know who you are, and from what position you speak, and what credibility, and what history you have" (Teacher Ivo).

On the other hand, teacher Ruben connected social positionality with personal backgrounds of students, for example, coming from a poor or rich family could influence how they perceive nature or environmental risks. He believed that the integration of this reflection had to depend on the topics. When most topics were still scientific, reflection would not be helpful. He explained the discussed topics where the reflection was applicable:

"I think it can be helpful around issues, like, how do you perceive risks. How do you perceive nature? It makes a big difference in how people think of risk, if you are from a family that really has to work hard just to earn a living. You think very differently about risks than when you have grown up in a situation, where you never had to care about your material welfare. Then you see other risks. You are not even aware of the risks of not having enough food for the next week. Particularly when it comes close to these kinds of topics, it's even of scientific value and to think about these differences, and not just assume that everyone will perceive risks the same way as you do. So if people who have to work hard for their living, their livelihood, are not very much concerned about climate change, maybe it's because they have so much huge risks to cope with" (Teacher Ruben).

Another teacher, Zoe, viewed reflecting on social positionality as an individual reflection on their choices and their consequences on the environment. According to her, the reflection was already embedded in the environmental sciences program by its core nature. She considered this reflection or debates that had happened in her class. She highlighted the viewpoint that being part of WUR, we were all privileged regardless of our backgrounds. Thus, to her, the importance was how we position ourselves to act for the environment, and that was discussions she asked students in her class:

"I think I do that quite a lot in class. We're here all worried about the the climate and the environment. But how do we contribute to that? If you are here in WUR, you're privileged already, no matter who you are, either you come with a scholarship, and from your country, or you were born here, and you can pay for this education. I see more and more students choosing consciously for a vegetarian or vegan diet, or saying no, I'm not going to fly anymore. Or even think very well, what I think is extreme, as not wanting to have children, because of the impact on the climate. So I think these reflections are there because of the nature of the study, the nature of environmental sciences. People have already reflected a lot. These debates that we have in the classroom show that" (Teacher Zoe).

The interviewed students mostly agreed on the necessity of reflection practices on social positionality, although they also have their own understanding of the term. Similar to the teachers' perspectives, social positionality was also seen as a general position as a researcher/scientist, or as a professional/stakeholder having knowledge in a particular discipline/area, or connected to personal identities, such as one's economic class or cultural background. As an example, several comments by the students included:

"I think indeed it is good to reflect on that as the world is getting more international (Student Bob);

"It would be really important for students to reflect on their own positionality – we are kind of forced to do it when writing a thesis in another geography" (Student Lise);

"I think indeed it should get more attention […] It is really important for the thesis. It's also a really important part during your work career, knowing your position and how can this influence your work field" (Student Eva);

"As soon as you realize your privilege, you are motivated to not misuse it" (Student Nada);

"I think that's great. It would be nice to also know whether the person has a personal background related to the topic they're writing about" (Student Hema).

Furthermore, one student, Lise, understood social positionality as the stance taken by the university and its role in decolonizing knowledge. Lise observed that different chair groups have varied levels of concern and engagement in decolonizing knowledge. Some chair groups paid more attention and were more critical on the matter compared to others. Lise mentioned the Communication, Philosophy, Technology and Education Chair group as an example of chair groups within the social sciences domain that actively work on the topic of decolonizing knowledge. In addition, Lise expressed their concern regarding funding to the university's research from corporations having relationships with the university. Lise believed this could consequently lead to "biased" research & publications, which did not reflect diverse voices out there.

Challenges for reflection

The challenges for the reflection to be implemented that was frequently mentioned by the interviewed teachers revolved around the required careful attention, time, and connections to the course contents, or learning objectives. While the courses were fully packed, prescribing the reflection became a difficult task for the teachers. Moreover, not all the teachers agreed on the usefulness and appropriateness of the reflection. For example, teacher Tomi believed that this reflection required prior theory to be provided to students, to make them understand the meaning of such concept. His argument centered on the concern that we cannot reflect on social positionality happening before the point of reflection. He explained in detail:

"If you're working in a lab and you're studying biology, you can have different sorts of theories about the biology of the objects you're studying. Great, that's fine. Those objects are not me. I don't have chloroplasts. You should also not reflect on who you are, there's risks with it. I'm not sure if I do it, but I worry when you encourage people to reflect, you reinforce the idea that they are able to reflect on things which are prior to the reflection" (Teacher Tomi).

Additionally, teacher Tomi was cautious about the critique surrounding "identity politics", which necessitates the identities of a researcher as a condition to capture or understand the studied subjects. As there were many critiques all around, he chose not to introduce this reflection to students. Teacher Erik, who coordinated the same course with Tomi, had a negative experience with many literatures whose authors often used their positionality superficially. He shared his experience:

> *"And I have some experience with it myself, reading through the literature. Sometimes it becomes too much of a trick. Instead of really using it productively and doing it critically, it becomes sort of this: I know that I'm from this background, but of course I've been very sensitive to this in my research. It becomes this sort of self congratulatory thing, I know the positionality matters and reflexivity matters. I'm a woman and I'm from here. And I took all of this into account, but of course, my conclusion still stands" (Teacher Erik).*

At the course level, one teacher, Kris, who coordinates the Education for Sustainability course, felt like he did not have the influence on the integration of the reflection by just introducing some more activity in his course. "*It needs integration, because, otherwise, it does not make a lot of sense"*, Kris stated. By integration, he meant the coherence of an education program that aims to guide students towards not only qualification but also socialization and subjectification. In that context, reflection on social positionality can be a better fit.

Among students, the challenge that was frequently mentioned for the reflection to be implemented is the lack of clarity regarding the purpose, meaning and relevance of the reflection. Many students found it hard to understand and connect their positionality with their research. Moreover, according to Hema, not every researcher felt comfortable revealing their origin, as she expressed:

> *"I'm not sure, especially if you are conducting research on some place which is not the university. I'm not sure what you could extract out of that reflection. I understand someone being able to relate to a certain issue, then working on that, and reflecting on that, and then even the readers will know where they're coming from. But if someone feels uncomfortable... I mean, I don't know what can be extracted from that, what would that reflection contribute to?" (Student Hema).*

Lastly, student Lise and Iris raised their opinion suggesting the absence of reflection on social positionality among the professors themselves and within the university. In Lise's opinion, professors themselves did not often engage in reflection on their positionality, which made it hard to introduce the reflection to students. Also, Lise observed a detachment between chair groups, such as between natural and social science groups. While some groups in the social science domain were working with the topic of decolonizing knowledge, they had limited influence or exchange with other chair groups.

Suggestions for further integration

Regarding where to integrate reflection on social positionality, a wide range of approaches were recommended by students. Several students proposed the reflection in the thesis, including Hema, Wang and Eva. Wang believed that reflection integrating in the thesis would allow him more time for in-depth thinking about the topic, as opposed to within a course. Eva recommended initiating the reflection at the beginning of a research thesis, stating:

> *"It's really important for the thesis, so maybe at the beginning of your thesis, explaining this; if you're going to do research also with people in your own country, knowing your position. And know how you can use this, for example, in interviews" (Student Eva).*

Added to this viewpoint, Hema shared her own experience of incorporating her background in her thesis about global informality in the food system. She highlighted her relevant knowledge of the issue in India and her willingness to reveal it:

> *"Right now, for example, I wanted to write about informality in India, and if I mentioned my background, that would be great, because I'm very passionate about the kind of vendors and informal settings in India with regards to food. But I'm working on global informality, which is kind of related to it as well. It's not boiled down to what I really wanted. So if I talk about myself in that way, I can also mention that: I do not know a lot about the informality in other parts of the world, but I know about it in India. That also gives you some context when you're reading my paper. So, I think that would be super nice" (Student Hema).*

Some students suggested implementing reflection in group work, either in the beginning or the end of an assignment, to encourage an understanding of each other's positions. Other moments for reflection could be organized in the research methods course, or during ACT where different stakeholders were involved. Here, often, reflection on social positionality was interpreted as the perspectives of a researcher/consultant, or in the role play of a stakeholder. One student, Mandela, recommended organizing field trips to learn better the context where environmental problems discussed in class occurred, in locations in the Netherlands. Mandela suggested as follows:

> *"Few trips would also be really good to some of these places that students have never seen, or they've never been involved with. Maybe for the Dutch student they might be used to it because this is where they're from, and they have all these soils {which were introduced in class]. But for international students, they might not know what is being talked about. So, field trip is good? Just maybe one day in the course, in future" (Student Mandela).*

One student, Lise, proposed that reflection on social positionality should be practiced by professors themselves, and then extended it to students. Lise suggested allowing more talks by activists on decolonizing knowledge to be organized at the university, and making sure that professors were also invited. Furthermore, Lise emphasized the need for better exchange and communication between chair groups on the topic, to promote diversity and acceptance of diversity within the university.

Among teachers, some proposed that integration of reflecting on social positionality should occur at a higher level, specifically at the program level, rather than being sporadically incorporated in single courses. The establishment would help direct an education program and shape the development of students to become ethical professionals. As an example, teacher Kris shared his view, as a coordinator for Education for Sustainability course:

> *"It's always a connection to both, but I think integration is established at higher levels. I can't be specific for MES students. I don't have an influence on the integration. I can invite them and spark the question, and I can try to make sure that the students themselves as persons bring the question along in their future. It's a relevant & meaningful question that stirs something. But in their professional development, in a single course, you have no overview, or you have no shaping of integration. I think that's very important. It sums up to an educational program" (Teacher Kris).*

Agreed with a suggestion from the interviewed students, teacher Kris proposed that the integration of reflection on social positionality should be tested in internship or thesis. Moreover, many teachers agreed that they could introduce the reflection when certain contexts required without prescribing it. For example, Umar, Ivo and Anna, teachers from ACT and EUW, believed that reflection could be implemented when the projects that students work on are related, and when group work between students does not run well due to wrong assumptions. As an example, Anna was thinking about the context where the reflection could be useful:

> *"If I find out that the collaboration in a certain group is not optimal, and that the reason for it is because people have certain backgrounds, and certain assumptions or indigenous knowledge. Then I might choose to come up with some assignments. Assignments is bit of a strong word, but still to introduce some kind of reflective discussion to get it on the table" (Teacher Anna).*

Similarly, teacher Ruben believed that he could introduce the reflection when pertinent, such as during a group assignment, when students expressed their plan to conduct interviews. Additionally, with some subjects he found the reflection could be of relevance, such as how personal backgrounds of students influence the way they perceive risks/nature. He envisioned the situation:

> *"I would probably only bring it up if it's relevant to the group assignment. So, you could imagine that, at some moment in a group assignment, when students are looking like they want to do an interview, or something specifically about the subject that you could ask them" (Teacher Ruben).*

Finally, teacher Erik, who coordinated the Research Methods course, considered integrating this reflection for students who do interviews, to help them recognize biases. However, he and his colleague, Tomi, would do it with lots of caution.

3.4.4. Concluding remarks:

From the first sub-research question, I have operationalized "critical reflection on diversity" into the three primary components, which are: Assumptions & beliefs of self and others, including assumptions & beliefs of socio-cultural identities & assumptions & beliefs in the environmental fields; Histories of self and others connected to the environment/an environmental issue; and Social positionality is connected to an environmental issue/the environment. From the interviewees' responses, I identified recurring themes across these three components. The themes consist of the necessity of integrating the components for reflection, the challenge associated with implementing it, and the suggestions for possible integration.

i) *Assumptions & beliefs related to socio-cultural identities*

First and foremost, both the interviewed teachers and students considered addressing assumptions and beliefs related to socio-cultural identities to be of importance. Both groups raised the positive views on the reflection practice to address underlying causes of misunderstanding and conflicts. According to the teachers, the relevance of reflection varied depending on the courses. More space for reflection could be offered in those courses with less focus on the contents, and integrate more, to a limited extent, intercultural understanding. The students also expressed the same concerns with the

teachers, on whether this reflection suited every course. Both the students and teachers acknowledged that integration would require lots of time and efforts, in terms of planning and alignment with the current course learning objectives and student expectations.

The question of how to fit reflection into a full curricula stood out in the interviews. This consideration should be put in the context that the courses were already packed with lectures, assignments and group work. Good timing for integration is an issue – in which way it could be organized that did not overburden the teachers and students. In addition, the interview participants knew little about effective methods to tackle biases & assumptions, bringing it to discussions without hurting people or adversely reinforcing ingrained beliefs that possibly have been taken roots in our histories and cultures.

Despite the difficulties, the teachers and students suggested various approaches and initiatives to incorporate reflection. First, careful planning and preparation for such activity is essential, especially aligning it with the course content & fitting it into the MES program. According to study participants, reflection should start at personal levels and be organized with flexibility rather than with a fixed content. If the reflection activity is organized, teachers should provide students a clear understanding of its purpose, and follow-up assistance or guidance on how to handle situations afterwards, such as biases. Importantly, to enable the reflection, creating a safe and open environment was recommended. At the program level, adjustment should be made to integrate reflection as a recurring theme across the courses. At the course level, recommendations were provided from timing to ways of organizing reflection in various current activities. Reflection can be integrated at the beginning of the MES program or at the start of a course, in group work when conflicts happen, and in evaluation where "learning from diversity" should be more elaborate. Experiential learning to cross boundaries was highly appreciated. Finally, the students brought in their wish of learning more from underrepresented authors and theories from various parts of the world.

ii) Assumptions & beliefs in the environmental field

The reflection practice on assumptions & beliefs in the environmental field, in general, received some positive views from the teachers and students. However, when-and-how to integrate was still a question. Currently, assumptions & beliefs in the environmental field have been touched upon in several courses, but under different names, such as ethical dimensions of doing science, responsible research & innovation, framing, and environmental justice. One of the major challenges in integrating the content was the lack of a solid foundation provided to students on sociological critique of science & how to motivate students to learn science while raising their awareness on ethics and responsibility. The teachers also expressed concerns about the complexity of presenting socio-economic status/intersectional identities of people in relation to environmental issues, as well as the lack of diversity among commissioners, who can offer relevant projects that consider divergent perspectives rather than technical solutions. When reflecting on groups of people who are subjected to assumptions & beliefs, the students raised their concern about if this would perpetuate ingrained stereotypes and evoke defensive attitudes.

Regarding suggestions for further integration, adjusting at the program level was considered important by the teachers, to strengthen the critical foundation for students on responsible sciences and research. Interestingly, the interviewed students demonstrated a sense of responsibility and a

willingness to examine their own assumptions and beliefs in their field of research, study, or profession. Furthermore, the teachers expressed their gradual step forward in this area, such as introducing philosophers and schools of thoughts from more diverse ethnic, cultural and national backgrounds, etc. in their courses. They expected more "less-mainstreaming" commissioners, and they currently offered reflection during individual interviews with students when relevant, and integrated reflection in extra-curriculum. Connected to the teachers' ideas, the suggestions from the students were about organizing discussions presenting opposite or controversial views. These could be organized in 10-15 minutes in class, in extra-curricular activities or through online forum, like Brightspace. Lastly, the students suggested making changes in the course contents and case studies, to bring in more diverse perspectives & local contexts of various countries and cultures.

iii) Histories of self and others connected to the environment/an environmental issue

While most of the teachers and students valued the potential benefits of the reflection, the student group expressed greater enthusiasm for the reflection. They appreciated the opportunity to see the lives of others, understand their motivations, feel more connected, and learn from diverse local contexts. Furthermore, they believed that this practice make environmental problems more tangible as through someone's first-hand experience, and that it also empower them to share their narratives in places where other students might not be familiar. The teachers acknowledged the importance of bringing diverse voices and stories into the classroom, helping students develop mutual understandings, respect and motivations. Some teacher considered the reflection essential, as it looked into our history of consumption, and its impacts on the environment.

Among others, the challenge often indicated was the relevance of reflection to the courses and to the context of each student. Again, how to allocate time and space for the reflection when the course is already busy? And, not all students felt comfortable revealing their history. Some students did not see what the reason for sharing is and were afraid of speaking in class. Another valid concern raised by a teacher revolved around the lack of structural changes, since facilitating sharing without making changes could evoke the feeling of hopelessness. In response, the students also observed that courses with natural sciences or scientific contents tended to overlook reflection, and there was a lack of feedback mechanisms that allowed students to input on changing the course contents.

To enable the reflection, both the students and teachers highlighted the importance of creating an environment that should feel safe, open and free for anyone who like to share. Students should feel trust and connected with one another for reflection to happen. Some students suggested integrating the reflection in introductory courses, in small group exercises, or an open forum online where they can be anonymous, or in questions & answers where they can just raise their hand to share. The teachers agreed on integrating reflection in group assignments when topics are relevant and students feel safe, or in the projects that require an understanding of cultural differences. The most emphasized viewpoint on integrating the reflection was that it should be tie to the issues of the courses. Finally, the students recommended a more responsive feedback mechanisms that enable them to propose content changes and accordingly, the contents should be adjusted. They expressed their wish to have more autonomy in choosing their own topics to work on and stakeholders to represent.

iv) Social positionality connected to an environmental issue/the environment

While agreeing on the significance and possible relevance of the reflection, the students and teachers attributed to the concept of "social positionality" various understandings, thus, its implication for who should do that, and in which ways, depended on the contexts. As a researcher or interviewer, reflecting on social positionality was considered important to recognize biases, and even the epistemic choices for certain types of knowledge, especially in transdisciplinary research. The teachers believed this reflection benefits students in both their personal growth – developing qualities like humility, and professional development – such as engaging different knowledge. Some teachers perceived opportunities for integration in certain topics, i.e. perceiving nature or risks, or within specific projects. On the other hand, it was viewed as personal choices on lifestyles and actions for the environment, an aspect already embedded in the MES program. Moreover, some students raised social positionality as the university stance and its role in decolonizing knowledge.

The primary concern for further integration, as expressed by the teachers, lied in time, attention and effort to align reflection with the course contents and learning objectives, particularly given the already packed curriculum. Furthermore, not all teachers agreed on the appropriate understanding of the controversial concept of "social positionality". In reality, some teachers had negative experiences reading the papers that engaged with the practice in a superficial way. The teachers also believed that prior knowledge should be provided to students before introducing the reflection. In this sense, another perspective from the teachers raised the concern on teachers' limited influence on integrating reflection into the program, since reflection needs to be consistent with the program's direction for educating students and their future development. On the other hand, the students expressed their insufficient understanding regarding the connection between positionality and their research, purposes, as well as the relevance of reflection. They did not always feel comfortable revealing their origin, and also noticed that professors rarely did so. Some students observed the varied levels of concern on decolonizing knowledge among different chair groups, noting a detachment and lack of influence, as well as research and communications exchange. Additionally, the concern of biased research and publication resulting from fundings provided by corporations to the university's research was raised.

Given suggestions provided amidst the discussed challenges, some teachers proposed that the reflection contents should not be prescribed but flexible depending on the contexts, such as relevant projects, topics, group work facing conflicting views, or for students who wish to conduct research interviews. Similarly, the students recommended integrating reflection in group work to help them understand each other's backgrounds, particularly in methodology courses where the perspectives from a researcher, consultant or stakeholder need clarification. Additionally, they wished to join field trips to learn about local contexts. Both the teacher and student group suggested integrating reflection in the thesis or internship experience.

In the long-term and at higher level, some teachers recommended an integration of social positionality reflection into the program. From the students' perspectives, they appreciated seeing professors themselves engage in reflection and then extending the practice to students. In addition, the students recommended inviting professors to join activist talks on the topic of biased research and decolonizing knowledge. It was suggested that more of these dialogues by activists be organized on campus to raise

awareness. Lastly, the students proposed a better exchange and communications between chair groups regarding their concerns and research on knowledge decolonization.

4. Discussions

In the following section – on the first part, I elaborate on the important findings that address the mentioned knowledge gap. Also, I suggest how the findings can inform further practices. I situate my findings compared with previous studies that I have indicated, as well as other literature. In the second part, I discuss the issues encountered regarding my methodological choices and the researcher's position, which potentially impact the credibility & reliability of the research.

1) The original operationalized framework of "critical reflection on diversity":

Although the concept of critical reflection encompasses a wide variety of definitions, there is a lack of knowledge and of practices on what to reflect, and how critical reflection on diversity could be applied in (environmental) sciences education. My findings aim to contribute to a better understanding of the topic through both theoretical and empirical results.

Firstly, based on literature review, I have operationalized the construct of critical reflection on diversity into three components, including: 1) Assumptions & beliefs of self and others, specifically delineated into: i) assumptions & beliefs of socio-cultural identities, and ii) assumptions & beliefs in the environmental fields; and 2) Histories of self and others connected to the environment/an environmental issue; and 3) Social positionality connected to an environmental issue/the environment.

The framework I developed particularly takes into account the context of environmental science education. It draws primarily from the perspectives of Jenkins (2018) and Valle (2021). Intersectionality was strongly integrated in Jenkins' work (2018), particularly in the three recommended aspects of critical self-reflection, thus as a result, my framework embraces intersectional perspectives. In the context that Jenkins (2018) recommends, the reflection is necessary for teacher educators, or precisely, to become culturally responsive educators. However, while my research investigates empirically the possibility of applying critical reflection, Jenkins (2018) largely relies on scholarly work, and did not conducted an empirical study.

On the other hand, Valle (2021) shares a closely relevant context with my study, focusing on environmental sciences and studies program. Valle (2021) applies the reflection practice for students in classroom, and self-reflect on Valle's own teaching experience. Indeed, Valle (2021) emphasizes the importance of embedding intersectionality in environmental sciences and studies program to problematize dominant narratives and amplify the voices of those un-seen or silenced by traditional environmentalism.

Building up on these scholars' critical perspectives and practices, I believe the operationalized framework is original and should be further examined. It embeds the concept of intersectionality and is designed with the aim to response to culturally diverse student population, empowering marginalized voices and perspectives, and enabling individuals to articulate their positionality.

Implications for further integrating (critical) reflection on diversity in explicit/implicit Boundary Crossing learning mechanisms:

Here, I would like to highlight the second knowledge gap that my study aims to address – the potential for expanding critical reflection on diversity through the BC learning mechanisms. In this regard, I would like to highlight two important findings.

First, the findings from the 17 semi-structured interviews revealed a variety of reflection practices employed by the teachers and students in MES courses. However, thus far, only a few courses - one out of the six selected courses - explicitly mentioned BC. In this course, reflection on diversity was practiced through explicit BC learning mechanisms. For the remaining five courses, reflection on diversity was practiced implicitly, without an explicit emphasis on BC or its learning mechanisms.

Second, the findings demonstrated that the interviewed teachers and students expressed the needs to further introduce the mentioned components of critical reflection. Nonetheless, they identified certain challenges at various levels, ranging from the course to program and university levels. One notable question raised by the interviewees pertained to effective methods to tackle assumptions & beliefs related to socio-cultural identities. How to bring the biases to discussions without hurting people, or adversely reinforcing ingrained beliefs that have been taken roots in our histories and cultures? This finding informs us that while inclusive teaching methods already exist, and BC could suggest an integrated method to elucidate assumptions & beliefs, these approaches have not yet reached or convinced the interview participants, especially the teacher group.

Thus, there remain the possibilities to enhance the existing reflection practices implemented in the courses, by making critical reflection more explicit. BC learning mechanism, such as identification and reflection offer the opportunity. To be more specific, BC identification and reflection involve making oneself and others explicit, regarding different practices, perspectives, even implicit or unstated assumptions (Akkerman & Bakker, 2011). As Akkerman et al. (2006, p. 482) point out, "*diversity has to be actively worked on*", meaning to encourage students treat each other as real others – not trying to overcome the differences but rather to "*render each other's argument as strange and new*". To achieve such way of working, critical reflection has to be made more explicit, specifically delineated into the contents to reflect. Then, for instance, through perspective making and taking in BC, students elaborate their different assumptions & beliefs.

Furthermore, employing BC learning mechanisms can address a frequently mentioned challenge by the teachers – which is how to structure critical reflection in a densely packed course. BC learning mechanisms, according to Fortuin et al. (2020), can be integrated in various learning activities. Some exemplary learning activities could include: debating different perspectives, including multi-perspectives in field visits or excursions, etc. It should be noted that differences and diversity need to be elucidated in order to generate the learning potentials.

Importantly, several viewpoints framed the components mentioned as structural issues. For example, assumptions & beliefs against individuals or groups with particular socio-cultural identities were related to implicit or unconscious biases that lead to discrimination. When the challenge is perceived from a structural perspective, more investigations involving different disciplines would be essential to deepen our understanding of discrimination. Several studies have been cited in this research, such as, by Jenkins (2018), Milkman et al. (2015) in education context, Essed (2004) in Dutch education, and Ramiah et al. (2022) in STEM education, among others. While my study embraces intersectional

perspectives to enhance inclusive teaching, and utilize diversity, there might be other ways to examining assumptions & beliefs and reducing biases and discrimination. For instance, additional literatures can be found in gender and organizational studies, social and behavioral sciences, psychology or neuro-sciences, etc.

Also, other components were indicated as "structural issues" by the interview participants, and thus, are referred to various study fields. For example, reflecting on environmental histories and social positionality was situated within the realms of decolonizing knowledge, environmental justice, identity politics, and responsible/ethical sciences. Although the perspectives have been integrated in Kayumova et al. (2019), Vakil & Ayers (2019), Valle (2020), Essed (2004) and reviewed in my thesis, I could not delve deeper into the literature pertaining to these mentioned scholarships. Nonetheless, this suggests the need for further research and pilot practices to generate knowledge and deepen our understanding of critical reflection components within the specific fields and beyond.

2) Credibility:

While I attempted to specify the original construct "critical reflection on diversity", it introduced the new notions, such as reflection on "social positioning", "environmental histories", or "assumptions & beliefs in the environmental fields", and "assumptions & beliefs related to socio-cultural identities". Through literature review, although I explained their meanings, and potential application, I could not cover all possible interpretation and variety of understandings provided by theories. Accordingly, the concepts were not initially delineated into specific variables for measurement. This impacts the credibility, which refers to the extent to which I am able to measure what I aim to measure(Merriam & Tisdell, 2016).

However, because of the qualitative nature of the research, I would argue that the concepts are further investigated through the contributions of the interview participants. The fact that the teachers and students provide their understanding, knowledge and experience of these constructs enriches the initial operationalization based on literatures. This reflect the diversity in terms of understanding, experience and knowledge they give to the meanings of the constructs, as well as their applications. It is particular valuable, as "critical reflection on diversity, social positionality, environmental histories, assumptions & beliefs of self and others, etc." are all relatively original to the (environmental) sciences education and subject to controversial and different interpretations.

To have more points of comparison, the next step for this research can be employing *triangulation.* Denzin (1978) indicates *triangulation* as combining different methods, sources of data, theories and investigators (cited in Merriam & Tisdell, 2016). Triangulation, yet, can "provide richness, complexity, breath and rigor of any inquiry" (Silverman, 2011, p. 371) and to me, it is exploring as a researcher to generate data in different methods and sources.

Reliability:

Reliability indicates the degree to which research findings can be replicated, either by the same researcher or different researchers (Merriam & Tisdell, 2016). While reflecting on reliability, I should ask myself the question: *whether the results are consistent with the data collected?* (Merriam & Tisdell, 2016, p. 251). As Merriam & Tisdell (2016) suggest, in qualitative research, rather than requiring

another researcher to obtain the same result, it would be more pertinent to ask the readers whether the results make sense to them – are they consistent with the data collected? Related to this question, I will discuss the conducted thematic analysis and results presented for the sub-RQ 2, where the findings were organized according to the course perspectives, instead of clear thematic indications. This presentation may be seen as a limitation of the study.

Conducting thematic analysis involves identifying themes within the interview data to answer a research question (Maguire & Delahunt, 2017). Regarding the question: *what are current practices of reflection on diversity that BC, explicitly or implicitly, employs in the MES program*?, after coding, I could initially identified the themes. These include group work process, support & assessment; simulations; lecture contents; extra-curriculum; ACT; the EUW; boundaries (cultures/disciplines/university-society/others); teacher roles, etc. However, every course is organized with certain learning objectives. I realized that merely mentioning group work, simulations, reflection paper, still requires further explanation for the course context, as each has different considerations and focuses. This consideration drove me to include different perspectives of the courses, to justify reflection practices implemented.

Nevertheless, this approach could potentially affects the reliability of the research – the consistency of collected data and presented results. At the moment in time, I have extracted the data, and demonstrated the findings as they are. If more time is allowed, the next step could be to organize the themes across the courses, which I briefly sketched in the summary table. This approach would provide a clearer response to the sub-RQ2.

The researcher's position

The researcher's position refers to "how the researcher affects and is affected by the research process" (Probst & Berenson, 2014, cited in Merriam & Tisdell, 2016, p. 249). According to Maxell (2013), the reason for making the researcher's perspective, biases, and assumptions open to the reader is not to eliminate the researcher's theories, beliefs and conceptual lens, but to understand how a particular researcher's values might influence the conduct and the study conclusion (cited in Merriam & Tisdell, 2016, p. 249). It is argued that our socio-cultural identities, such as young-old, woman-man-nonbinary-cisgender-trans, white-black, lower-middle-wealthy class, and so on, affect the way we see and interpret the world. The researcher as the main instrument conducting the research should reflect on how their socio-cultural identities impact the research process (Jacobson & Mustafa, 2019.)

In this regard, I could perceive that my study and professional backgrounds might affect the choices I have made on the research topic and the qualitative method of interview. Firstly, I embarked on this research with a focus on the issue of diversity and the necessity of critical reflection on diversity in (environmental) sciences field. I looked into the concepts of diversity informed by both the BC and intersectionality theories. The intersectional perspectives resonated to me naturally, because of my previous background and professional work in gender and women's studies. On the other hand, I have introduced the BC learning theory into the discussion. BC was developed with the purpose of generating learning potentials from intersecting identities and practices, instead of perceiving them as "boundaries". The emphasis of BC on the marginal and the decentered gave me the idea that integrating intersectionality with BC could be possible.

Furthermore, when developing the conceptual framework, I attempted to diversify literature from diverse scholarship and their respective authors. Among others, Jenkins (2018) focuses on culturally responsive teacher education, and Valle (2021) situates their work in environmental sciences and studies education. I used the main two framework to operationalize the main concepts of "critical reflection on diversity". I did not intentionally select the theories, rather, it was emerged during the literature review. Yet, I recognize their relevance to my backgrounds in environment and gender studies, and my interest in education and reflection practice. While focusing on the theories, there may be other ones situated in the same or different scholarship, offering the lens that I might be not aware or examine thoroughly.

Often being seen as an international/foreigner, while also obligated to integrate into the Dutch society, I experienced certain tensions. This made the topic of diversity, in its broad sense, personally engaging to me. Besides, the student identity allowed me to access easily the teachers and students within the same program for interviews. As a fellow student, friend or classmate, I had open interviews with my peers, where the interview process indeed enabled them to tell their experiences. On the other hand, stepping out of my student role, to listen to teachers as an interviewer, I noticed that the traditional power distance between a teacher and student dissolved. The in-depth interviews enabled me to understand the teachers' perspectives on the courses in which I myself participated. Being an interviewer, I could evoke the participants to reflect upon, and share their insights about learning and teaching experience, putting myself in their positions. This is, to me, also an boundary crossing experience.

5. Conclusions

The study showed that there are multiple approaches and challenges to broaden critical reflection on diversity through BC learning mechanisms of identification and reflection. Firstly, the concept of critical reflection on diversity was operationalized into these components, which included: 1) Assumptions & beliefs of self and others, 2) Histories of self and others connected to the environment/an environmental issue; and 3) Social positionality connected to an environmental issue/the environment. It should be noted that reflection has also been practiced explicitly through the two BC learning mechanisms - identification and reflection.

Furthermore, I investigated the current practices of reflection on diversity in six courses currently offered in MES. Out of the six chosen courses, only the European Workshop Environmental Sciences and Management emphasized Boundary Crossing learning. Thus, in this course, reflection on diversity was practiced through explicit BC learning mechanisms. For the remaining five courses examined, reflection on diversity was practiced implicitly, meaning without an explicit mention of BC and its learning mechanisms. However, students' reflection was facilitated through various methods. The most frequent form of learning that the interviewed teachers employed was *learning in diversity*. In this approach, students were randomly assigned to groups with their peers from various backgrounds, cultures and nationalities. All of the examined courses offered group work, though, with varying extents of intensity. Through self-reflection happening in group work, on the differences and similarities of one's own disciplines, cultures, communications, etc., and those of the others, students engaged in the learning process. This type of learning was sometimes referred by the teachers as "experiential learning".

The second approach that was reported by the interviewed teachers focused on *learning from reflection on diversity*, meaning that making reflection explicit. On one hand, often students shared that they learn a lot when immersing themselves in an environment with diverse peers, engaging in stakeholder roles, and reflecting on the experiences. On the other hand, they found it challenging to handle the diversity manifested in group dynamics and conflicts, especially when the focus appeared to be on the content and knowledge, rather than the learning process of being and working together.

Regarding further integration of reflection practices on the three proposed components, the participants' responses demonstrated their willingness to do so, given their acknowledgement on the necessity. However, primary challenges were often mentioned, including the already fully-packed courses, the lack of knowledge and understandings on how to fit reflection practices effectively, that align with the course learning objectives, students' expectations, and also with the whole program. Additionally, there were some concerns on the risks of overburdening teachers and students, reinforcing stereotypes & biases instead of addressing them, evoking feelings of hopelessness, conviction, or un-comfortability, and lack of diversity among commissioners and projects offered to students.

Despite the challenges, the teachers and students suggested various approaches and initiatives. The recommendation frequently indicated was careful planning and preparation, aligning reflection practices with the courses' learning objectives or issues, and fitting it in the MES program. It was also proposed that adjustments at the program level would be important to strengthen critical foundations for students on critique of sciences, or responsible research & sciences. Moreover, the interview

participants emphasized on creating a safe, open and inclusive environment for sharing experiences. At the course level, several measures were also recommended, mainly on integrating reflection based on the needs and contexts that arise in the courses, such as in group work, personal interviews, online forum or classroom, relevant team projects, thesis and internship. Furthermore, the interview participants proposed the extending reflection practices beyond students, suggesting that professors/teachers and the university itself should also engage in the effort addressing critical topics, such as biases, decolonizing knowledge and responsible research and sciences.

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Appendix 1: Interview guides

INTERVIEW GUIDE FOR TEACHERS

Introduction

I'd like to thank you once again for being willing to participate in this interview.

My name is Hanh Tran. I am a second-year MSc student in Environmental Sciences, doing my thesis on the topic of critical reflection on diversity in (sciences) education. My study investigates the possibility to broaden critical reflection on diversity in the current practices of reflection. The case study to be examined is MSc Environmental Sciences (MES) at Wageningen University & Research.

You are selected because you are a lecturer/coordinator of the course_____
I would like to understand your perspectives on the topic. This is an important part of my data collection.

The interview will take place in about 1 hour. It has two main parts according to my research questions. In the first part, I will ask you about current practices of reflection on diversity in your course(s), and the second part about possible ways to broaden critical practices of reflection on diversity, applied in environmental sciences education.

Your answers and your name will be kept anonymous. I would like to record for transcription and analysis of the data. The recording will be transcribed, coded, and could be quoted in the thesis. The identifying information, such as your name, will be removed from the thesis, and any publication/presentation.

Would you agree to be recorded?

☐ Yes

☐ No

Please let me know if at any point you want me to turn off the recorder or keep something you said off the record.

Building rapport

- Tell me a bit about yourself: Where do you come from? Where did you grow up, and how was the environment over there?
- You are teaching in the course [name]. Which diversity do you see in your course? How do you feel about diversity?

Main & Follow-up questions

Guidance on the use of this interview guide (in chronological order)

- *Ask the main question.*
- *Listen to the answer from the interviewee.*
- *If the interviewee appears to not understand the question, use the* ***suggestion, or examples.***
- ***Prompt:*** *use as much as possible, to cover the details of a concept (check if all aspects are covered)*
- ***Probe:*** *use as follow-up questions, only ask if an answer is still unclear.*

PART I - *What are the current practices of reflection on diversity that BC identification and reflection, explicitly or implicitly, employ in MSc Environmental Sciences?*

Objective: To find out 1) what current practices of reflection on diversity are; 2) if these practices can be classified as BC identification and/or reflection; and 3) if these practices are explicitly or implicitly stated as BC.

Question 1: When I say, "reflection on diversity", what are the practice(s) in your course that allow students to reflect on diversity?

Suggestion:

Reflection on diversity could include:

- Identifying the expertise, assumptions & values of your own and of others.
- Reflecting:
    - Your own perspectives, assumptions, knowledge, making them explicit.
    - Also taking other perspectives, knowledge into account while reflecting on your own.

Diversity could include diversity in perspectives, cultures, disciplines & the utilization of academic vs. non-academic knowledge. This means that students can be asked to identify and reflect on their own perspectives, disciplines, cultures, knowledge, and those of their peers. However, reflection on diversity can be further than that, depending on the interviewee's understanding of diversity.

- Prompt:
    - Which *diversity* do you ask students to reflect on, or diversity in terms of what?
    - What exactly does reflection practice look like?

- Probe:
    - What are the learning outcomes of the reflection practice(s)?

Question 2: What do you know about Boundary Crossing (BC), or BC identification and reflection?

Suggestion:

Boundary Crossing is a new concept in education. It refers to how people or professionals, coming from different socio-cultural backgrounds, when encountering boundaries/challenges, can continue their collaboration – thus, crossing the boundaries. In WUR, we consider BC as a competence, and train students in this capacity.

So, how can they be trained?

Students learn to identify their own expertise, assumptions, values, principles and how these influence their ways of seeing and interpretation. At the same time, they recognize the others' different expertise, assumptions, values, and realize that "their way of seeing and interpreting of what is going on can differ from the way others do" (Fortuin et al, 2020, p. 4).

With reflection, students practice perspective making and taking. First, they make explicit their understanding of an issue, especially when the knowledge or assumptions are implicit or unstated. Then they learn to look at themselves through the eyes of others, meaning taking the other's perspectives into account while reflecting on their own knowledge.

- Prompt:
  - (In case the lecturer knows little about BC): I will explain what BC is, and BC identification and reflection as well… Can you describe the learning activities in your course that you identify as BC?

Example:

In Environmental Quality and Governance course, we participate in simulation with involves various stakeholders in assessing an environmental risk – which is about reduced Eel population in the Netherlands. We are assigned a particular stakeholder role to play, who has our own interests, values, knowledge. Working together with other stakeholders, we also need to be aware of their interest, knowledge, values & response. In the end we are required to write a reflection paper. In the paper, we reflect on how we understand and solve the Eel population problem from social & natural sciences and transdisciplinary perspectives.

- Probe:
  - What do your students do in the learning activities related to BC?
  - What kinds of boundaries challenge your students?

Question 3: How do your students identify and/or reflect on the boundaries?

For example, differences in perspectives, disciplines, cultures, knowledge from university and society

- Prompt:
  - In which way(s) do students identify and/or reflect on diversity in disciplines?
  - In which way(s) do students identify and/or reflect on diversity in cultures?

- In which way(s) do students identify and/or reflect on the utilization of knowledge from both university and society to solve an environmental issue?

➢ Probe:
- What other kinds of boundaries do you ask students to identify and/or reflect in your course(s)?
- How do they practice that reflection?

---- End of Part I -----

PART II - In which ways can critical reflection on diversity be further addressed in the practices of identification and reflection?

Objective: To find out how critical reflection on diversity can be broadened in the current (BC) practices of identification and reflection.

Question 4: In your opinion, what does "critical reflection on diversity" mean?

➢ Prompt:
- According to your own understanding of the term, is there any learning activity that you ask students to reflect critically on diversity?
- How do students reflect critically on diversity in the course?

Suggestion:

This question can be broad, to capture an overarching idea of the interviewee, and see how far they understand the concept.

Dewey (1933) defines reflection as an "active, persistent, and careful consideration of any beliefs or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends".

Diversity refers to a variety of differences among people: gender, race, socioeconomic class, ethnicity, age, (dis-)ability, religion, migration status, and other identities, such as education, socio-economic backgrounds, etc. These identities do not exist in isolation but intersect – called intersectionality - to create a system of inter-dependent socio-cultural identities that result in privilege and marginalization of individual students or groups of students.

Question 5: I will explain to you what diversity means: [Diversity refers to…]. What are the activities in your course that ask students to reflect critically about socio-cultural identities/intersectionality?

➢ Probe:
- What exactly does critical reflection look like?
- What did you and your students do in the learning activity?

Question 6: What do you think about letting students reflect on assumptions & beliefs related to socio-cultural identities, such as… [giving examples]?

Examples:

Teachers, as well as students, might have assumptions or inaccurate beliefs rooted in our cultural belief systems.

Some stereotypes in academia: "Black students are less intelligent and not hardworking; Chinese students are not fluent in English, and/or possess fraudulent credentials, Indian students are foreign and difficult to understand".

The study by Milkman et al (2015) on over 6500 university professors in the United States found that faculty were significantly responsive to White males than to all other groups of students

When a group is mixed of gender, race, ethnicity/nationality, class, (dis-)ability, and other social categories, assumptions and beliefs can take place and are unspoken.

Students of certain groups, such as students of color, women, Dutch ethnic minorities with migration backgrounds or low-income families, might face assumptions, stereotypes, or biases by themselves, their peers, and teachers. These assumptions and biases may hinder their equal participation.

Valle (2021) notes that in ESS education, many middle-class white students validate their experience in the courses, whereas students of color do not see themselves, their histories, and stories, in the ESS curriculum. They turn to silence assuming that their experience is inferior or not the norm.

The first step towards changes that should be offered is open and safe conversations on assumptions and beliefs related to socio-cultural identities, and possibly, in connection with environmental issues. Once these assumptions and beliefs are identified, students can assess if they are accurate, valid, or not, against their lived experience.

- Prompt
  - How do you see this fit in any course, or learning activity?
  - Or in which other setting can this be applied?
  - If this is challenging, why so?

Question 7: What do you think about letting students reflect on assumptions & beliefs prevailed in the environmental fields, such as… [giving examples]?

Examples:

In natural resources and conservation, it is a general assumption that people of color do not care about the global environmental crisis, are overpopulated, and not being an environmental steward. The study by Leiserowitz & Akerlof (2010) concludes the opposite. People of color - Hispanics, African American, or other races and ethnicities hold the strongest support for policies on greenhouse gas emission reduction, even when scarifying their individual costs. The minorities support responsive actions to the global environmental crisis at an equal level, or greater than the whites. However,

it should be noted that people of color are not one block, but consist of different ethnic groups and identities, who experience environmental issues in various ways.

- Prompt:
  - How do you see this fit in any course, or learning activity?
  - Or in which other setting can this be applied?
  - If this is challenging, why so?

Question 8: What do you think about letting students reflect on their environmental histories connected to the environment, or an environmental issue?

Example:

- Connected to the places of inhabitance, diverse students carry in their histories to tell in environmental discussions. Students with different socio-cultural identities (gender, race, class, ability, and other identities) might originate from countries, communities or families that tolerate the environmental hazards and have direct experience of environmental problems. Critical reflection encourages them to bring in their histories and lived experience situated in specific times and places.

- In environmental studies, research shows that the burdens of environmental degradation and climate changes place disproportionately on disadvantaged groups, such as low-income, women, immigrants, racial, and ethnic communities. The unequal access to adequate housing, resources and mobilities make them more vulnerable. The voices of such environmental burden-bearers, such as those of ethnic minorities, indigenous communities are often missed in environmental discussions about our futures or past.

- According to Valle (2020), the reflection practice empowers students, particularly those who are of color, to decolonize history that has been told in the mainstream environmental narrative. Sharing histories in relation to places is to "re-write the history from the lived experience and embodied knowledge of students.

- Prompt:
  - How do you see this fit in any course, or learning activity?
  - Or in which other setting can this be applied?
  - If this is challenging, why so?

Question 9: What do you think about letting students reflect on social positionality, connected to the environment, or an environmental issue?

Example:

Simply put, women who live in and use the forest for their food-, seed-, and fuel- resources. gain insights into the forest environment through their daily practices. It is certain that not all women would claim this position, and thus, the knowledge they generate given their connection to the environment differs from others'. Another example is the knowledge emerged from a female farmer

living in a low-income country is varied from a female academic in a Western country. In climate change context, how individuals relate to climate change depends on their position and context-specific power structure.

Valle (2021) suggests enabling students to learn about their positionality, and how people encounter the same environment differently, depending on how power and privilege play in the social structure. In one of the assignments, Valle (2021) asks students to visit an environment where they do not have the same privilege as they are used to, for example, privilege to access. The students go to golf clubs, city downtown or different beaches. With different levels of feeling discomfort, they are all aware of their social positions, and how distinct we are when experiencing even the same environment.

- Prompt:
  - How do you see this fit in any course, or learning activity?
  - Or in which other setting can this be applied?
  - If this is challenging, why so?

----End of Part II-----

Demographic questions

- Gender
- Nationality
- Ethnicity
- Religion
- Migration
- (Dis-)ability
- Teaching course in MES

Ending

- This is the end of our interview. How do you feel about the interview?
- Is there anything that we missed or did not talk about? Would you like to add anything?
- Are you interested in my research results or recommendation? If yes, I will share the summary with you.
- Thank you.

INTERVIEW GUIDE FOR STUDENTS

Introduction

I'd like to thank you once again for being willing to participate in this interview.

My name is Hanh Tran. I am a second-year MSc student in Environmental Sciences, doing my thesis on the topic of critical reflection on diversity in (sciences) education. My study investigates the

possibility to broaden critical reflection on diversity in the current practices of reflection. The case study to be examined is MSc Environmental Sciences (MES) at Wageningen University & Research.

You are selected because you are a MES student, who have experienced our diverse study environment in MES. I would like to understand your perspectives on the topic. This is an important part of my data collection.

The interview will take place in about 1 hour. It has two main parts according to my research questions. In the first part, I will ask you about current practices of reflection on diversity in the course(s) you have participated as a MES student, and the second part about possible ways to broaden critical practices of reflection on diversity, applied in environmental sciences education.

Your answers and your name will be kept anonymous. I would like to record for transcription and analysis of the data. The recording will be transcribed, coded, and could be quoted in the thesis. The identifying information, such as your name, will be removed from the thesis, and any publication/presentation.

Would you agree to be recorded?

☐ Yes

☐ No

Please let me know if at any point you want me to turn off the recorder or keep something you said off the record.

Building rapport questions:

- Tell me a bit about yourself: Where do you come from?
- Where did you grow up and how was the environment over there?
- Which diversity do you see here in MES program? How do you feel about diversity?

Main & Follow-up questions

Note: Guidance on the use of this interview guide (in chronological order)

- *Ask the main question.*
- *Listen to the answer from the interviewee.*
- *If the interviewee appears to not understand the question, use the* ***suggestion, or examples.***
- ***Prompt:*** *use as much as possible, to cover the details of a concept (check if all aspects are covered)*
- ***Probe:*** *use as follow-up questions, only ask if the answer is still unclear.*

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Question 1: When I say, "reflection on diversity", what are the practice(s) in the courses that allow students to reflect on diversity?

Suggestion:

Reflection on diversity could include:

- Identifying the expertise, assumptions & values of your own and of others.
- Reflecting:
    - Your own perspectives, assumptions, knowledge, making them explicit.
    - Also taking other perspectives, knowledge into account while reflecting on your own.

Diversity could include diversity in perspectives, cultures, disciplines & the utilization of knowledge from both university and society. This means that students can be asked to identify and reflect on their own perspectives, disciplines, cultures, knowledge, and those of their peers. However, reflection on diversity can be further than that, depending on the interviewee's understanding of diversity.

- Prompt:
    - Which *diversity* are you asked to reflect on, or diversity in terms of what?
    - What exactly does reflection practice look like?

- Probe:
    - What are the learning outcomes of the reflection practice(s)?

Question 2: What do you know about Boundary Crossing (BC), or BC identification and reflection?

Suggestion:

Boundary Crossing is a new concept in education. It refers to how people or professionals, coming from different socio-cultural backgrounds, when encountering boundaries/challenges, can continue their collaboration – thus, crossing the boundaries. In WUR, we consider BC as a competence, and train students in this capacity.

So, how can they be trained?

Students learn to identify their own expertise, assumptions, values, principles and how these influence their ways of seeing and interpretation. At the same time, they recognize the others' different expertise, assumptions, values, and realize that "their way of seeing and interpreting of what is going on can differ from the way others do" (Fortuin et al, 2020, p. 4).

With reflection, students practice perspective making and taking. First, they make explicit their understanding of an issue, especially when the knowledge or assumptions are implicit or unstated. Then they learn to look at themselves through the eyes of others, meaning taking the other's perspectives into account while reflecting on their own knowledge.

- Prompt:
  - (In case the student knows little about BC): I will explain what BC is, and BC identification and reflection as well… Can you describe the learning activities that you identify as BC?

Example:

In Environmental Quality and Governance course, we participate in simulation with involves various stakeholders in assessing an environmental risk – which is about reduced Eel population in the Netherlands. We are assigned a particular stakeholder role to play, who has our own interests, values, knowledge. Working together with other stakeholders, we also need to be aware of their interest, knowledge, values & response. In the end we are required to write a reflection paper. In the paper, we reflect on how we understand and solve the Eel population problem from social & natural sciences and transdisciplinary perspectives.

- Probe:
  - What did you do in the learning activities related to BC?
  - What kinds of boundaries do you or your peers find challenging?

Question 3: In the course(s) you have participated in, how do you and your student peers identify and/or reflect on the boundaries?

For example, differences in perspectives, disciplines, cultures, knowledge from university-society

- Prompt:
  - In which way(s) do students identify and/or reflect on diversity in disciplines?
  - In which way(s) do students identify and/or reflect on diversity in cultures?
  - In which way(s) do students identify and/or reflect on the utilization of knowledge from both university and society to solve an environmental issue?

- Probe:
  - What other kinds of boundaries do you need to identify and/or reflect in your course(s)?
  - How do you and your student peers practice that reflection?

---- End of Part I -----

PART II - In which ways can critical reflection on diversity be further addressed in the practices of identification and reflection?

Objective: To find out how critical reflection on diversity can be broadened in the current (BC) practices of identification and reflection.

Question 4: In your opinion, what does "critical reflection on diversity" mean?

- Prompt:

- According to your own understanding of the term, is there any course that asks you to reflect critically on diversity?
- How do you and your peers reflect critically on diversity in the course(s)?

Suggestion:

This question can be broad, to capture an overarching idea of the interviewee, and see how far they understand the concept. After brainstorming with the interviewee, the interviewer can provide a short definition of diversity and continue with the prompt question below

Dewey (1933) defines reflection as an "active, persistent, and careful consideration of any beliefs or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends".

Diversity refers to a variety of differences among people: gender, race, socioeconomic class, ethnicity, age, (dis-)ability, religion, migration status, and other identities, such as education, socio-economic backgrounds, etc. These identities do not exist in isolation but intersect – called intersectionality - to create a system of inter-dependent socio-cultural identities that result in privilege and marginalization of individual students or groups of students.

Question 5: I will explain to you what diversity means: [Diversity refers to…]. What are the activities in the courses that ask you to reflect critically about socio-cultural identities/intersectionality?

- Probe:
  - How exactly does the reflection look like?
  - What did you and your teacher do in the learning activity?

Question 6: What do you think about letting students reflect on assumptions & beliefs related to socio-cultural identities in the courses, such as… [giving examples]?

Examples:

Teachers, as well as students, might have assumptions or inaccurate beliefs rooted in our cultural belief systems.

Some stereotypes in academia: "Black students are less intelligent and not hardworking; Chinese students are not fluent in English, and/or possess fraudulent credentials, Indian students are foreign and difficult to understand".

The study by Milkman et al (2015) on over 6500 university professors in the United States found that faculty were significantly responsive to White males than to all other groups of students.

When a group is mixed of gender, race, ethnicity/nationality, class, (dis-)ability, and other social categories, assumptions and beliefs can take place and are unspoken.

Students of certain groups, such as students of color, women, Dutch ethnic minorities with migration backgrounds or low-income families, might face assumptions, stereotypes, or biases by themselves, their peers, and teachers. These assumptions and biases may hinder their equal participation.

Valle (2021) notes that in ESS education, many middle-class white students validate their experience in the courses, whereas students of color do not see themselves, their histories, and stories, in the ESS curriculum. They turn to silence assuming that their experience is inferior or not the norm.

The first step towards changes that should be offered is open and safe conversations on assumptions and beliefs related to socio-cultural identities, and possibly, in connection with environmental issues. Once these assumptions and beliefs are identified, students can assess if they are accurate, valid, or not, against their lived experience.

- Prompt:
  - How do you see this fit in any course, or learning activity?
  - Or in which other setting can this be applied?
  - If this is challenging, why so?

Question 7: What do you think about letting students reflect on assumptions & beliefs prevailed in the environmental fields, such as… [giving examples]

Examples:

In natural resources and conservation, it is a general assumption that people of color do not care about the global environmental crisis, are overpopulated, and not being an environmental steward. The study by Leiserowitz & Akerlof (2010) concludes the opposite. People of color - Hispanics, African American, or other races and ethnicities hold the strongest support for policies on greenhouse gas emission reduction, even when scarifying their individual costs. The minorities support responsive actions to the global environmental crisis at an equal level, or greater than the whites. However, it should be noted that people of color are not one block, but consist of different ethnic groups and identities, who experience environmental issues in various ways.

- Prompt:
  - How do you see this fit in any course, or learning activity?
  - Or in which other setting can this be applied?
  - If this is challenging, why so?

Question 8: What do you think about letting students reflect on their environmental histories connected to the environment, or an environmental issue?

Example:

- Connected to the places of inhabitance, diverse students carry in their histories to tell in environmental discussions. Students with different socio-cultural identities (gender, race, class, ability, and other identities) might originate from countries, communities or families that tolerate the environmental hazards and have direct experience of environmental problems.

Critical reflection encourages them to bring in their histories and lived experience situated to specific times and places.

- In environmental studies, research shows that the burdens of environmental degradation and climate changes place disproportionately on disadvantaged groups, such as low-income, women, immigrants, racial, and ethnic communities. The unequal access to adequate housing, resources and mobilities make them more vulnerable. The voices of such environmental burden-bearers, such as those of ethnic minorities, indigenous communities are often missed in environmental discussions about our futures or past.

- According to Valle (2020), the reflection practice empowers students, particularly those who are of color, to decolonize history that has been told in the mainstream environmental narrative. Sharing histories in relation to places is to "re-write the history from the lived experience and embodied knowledge of students.

  - Prompt:
    - How do you see this fit in any course, or learning activity?
    - Or in which other setting can this be applied?
    - If this is challenging, why so?

Question 9: What do you think about reflecting on their social positionality connected to the environment/an environmental issue?

Example:

Simply put, women who live in and use the forest for their food-, seed-, and fuel- resources. gain insights into the forest environment through their daily practices. It is certain that not all women would claim this position, and thus, the knowledge they generate given their connection to the environment differs from others'. Another example is the knowledge emerged from a female farmer living in a low-income country is varied from a female academic in a Western country. In climate change context, how individuals relate to climate change depends on their position and context-specific power structure.

Valle (2021) suggests enabling students to learn about their positionality, and how people encounter the same environment differently, depending on how power and privilege play in the social structure. In one of the assignments, Valle (2021) asks students to visit an environment where they do not have the same privilege as they are used to, for example, privilege to access. The students go to golf clubs, city downtown or different beaches. With different levels of feeling discomfort, they are all aware of their social positions, and how distinct we are when experiencing even the same environment.

  - Prompt:
    - How do you see this fit in any course, or learning activity?
    - Or in which other setting can this be applied?
    - If this is challenging, why so?

----End of Part II-----

Demographic questions

- Gender
- Nationality
- Race/Ethnicity
- Religion
- Migration
- (Dis-)ability
- MES specialization

Ending

- This is the end of our interview. How do you feel about the interview?
- Is there anything that we missed or did not talk about? Would you like to add anything?
- Are you interested in my research results or recommendation? If yes, I will share the summary with you.
- Thank you.

Appendix 2: Rubric Boundary Crossing

to support inter- and transdisciplinary learning in an intercultural setting

by Karen Fortuin[1]), Carla Oonk[2]) and Judith Gulikers[2])

This rubric is developed to support and assess student boundary crossing-learning. The rubric is supposed to be generally applicable for learners (e.g. students) who are part of a multi-disciplinary team that collaborates in an inter- or transdisciplinary project. Learning with and from '*the other'* with a different *expertise* is crucial in inter- and transdisciplinary settings. '*The other'* or *other people* refers to (1) other students (e.g. in the project team), (2) teachers who are involved in the project and (3) external stakeholders (i.e. all kinds of people from in or outside the university who have a stake in the project). *Expertise* in this rubric is understood as the combination of theoretical knowledge, scientific evidence-based knowledge, and real world based experiential knowledge from outside academia (Scholz and Steiner 2015), and the related skills and networks. The rubric is based on the 'boundary crossing' theory from Akkerman & Bakker (2011). Boundary crossing refers to the ability to cross boundaries between the own and others' expertise, and practices, make new connections, learn from 'the other' and co-create towards new practices with 'the other'. The rubric operationalises the four learning mechanisms (read as: learning catalysts) of boundary crossing, at four levels of performance (i.e. observable behaviour). The four learning mechanisms are:

1. *Identification*: to identify one's own expertise and one's own limitations. To specify what expertise is needed to execute a project successfully, and to identify which people should thus be involved.
2. *Coordination*: to contact, and purposefully collaborate with other relevant people to execute the project successfully.
3. *Reflection*: to learn from and with others and (re)consider each other's perspectives. To empathize with others and to reflect and reconsider one's own perspective and expertise, but also to stimulate others to reflect and reconsider their expertise and practices.
4. *Transformation*: to integrate various expertise and practices to co-create new knowledge and / or to generate new, innovative results that can be applied in practice.

A student who is a good 'boundary crosser':

- shows that (s)he is interested in the project not only to pass the course (a good grade) but also to deliver an end result that can be applied in practice and is useful for other people;
- considers what expertise is needed to execute the project successfully and what the limitations and contributions are of his/her own expertise;
- is open to learn from and contacts other people, sees the advantage of using other people's expertise;
- facilitates and stimulates the collaboration of people involved in the project;
- empathizes with other people's perspectives / interests / ideas, also when they differ from his/her own;
- actively searches for ways to learn from others and encourages other people to reflect and to learn as well;
- explicates how multiple perspectives, interests and expertise are used and integrated in the project to deliver a better end result;
- explicates how the end result can be implemented in practice and which steps need to be taken to do so;
- shows enthusiasm and effort to be actively involved in follow-up activities.

References:

Akkerman, S. F. and Bakker, A. (2011) 'Boundary crossing and boundary objects', *Review of Educational Research,* 81(2), 132-169.

Scholz, R. and Steiner, G. (2015) 'The real type and ideal type of transdisciplinary processes: part I—theoretical foundations', *Sustainability Science,* 10(4), 527-544.

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	D **The student…**	**C** **The student…**	**B** **The student…**	**A** **The student…**
Identification 1: Identify one's own expertise and one's own limitations	Does not explicate which expertise (s)he possesses and which expertise might be missing to execute the project successfully.	explicates his/her own expertise in terms of knowledge, skills and network that can contribute to the project.	previous cell + identifies his/her own limitations regarding expertise needed to execute the project.	relates his/her own expertise to that of the other members of the project team and maps what kind of expertise is missing to execute the project successfully.
Identification 2: Identify other perspectives relevant for the project and problem at hand	does not actively explore other perspectives.	shows being aware of the existence of various perspectives, but does not explicitly address these different perspectives in the light of the project.	identifies people including their interests, perspectives, expertise and mutual relations relevant for executing the project.	Previous cell + the student explicates for which aspects of the project he/she needs other people and plans actions to contact these other people.
Coordination 1: Contact other people	does not take any action to contact other people or does take action, but only because it is a requirement of the course.	contacts a small number of other people that are close to the problem and easy to address (e.g. given by the teachers). prefers to contact external people in a digital way.	develops active and face to face contact with relevant other people.	initiates and organises collaborative meetings with relevant other people with the intention to collaboratively share ideas, develop new ideas and tune own ideas.
Coordination 2: Collaborate purposefully with other people	does not actively and purposefully collaborate with other people or is merely frustrated by the challenges that emerge in this collaboration.	carries out activities to discuss a limited number of other perspectives, closely related to his/her own background.	aims at purposeful collaborations with various relevant people to the project. Discovers and /or contributes to the development of a boundary object (BO) relevant for people involved to facilitate collaboration for executing the project.	Previous cell + uses the BO actively to accommodate multi-, inter- or transdisciplinary collaboration and checks whether everybody really contributes to the project. If not, (s)he takes action.

	D **The student…**	**C** **The student…**	**B** **The student…**	**A** **The student…**
Perspective making and learning from each other 1: (Re)consider perspectives	considers the project purely from his/her own perspective and interest	shows limited openness to other perspectives that are relevant for the project and / or, considers the input from other perspectives mainly for his/her own benefit (i.e. what can I use from you?)	actively explicates and/or discusses various perspectives that are relevant for the project and searches for ways to combine perspectives (i.e. how can the different perspectives contribute to and strengthen the project)	Previous cell + explicates how other perspectives influenced his/her own perspective on the project.
Perspective making and learning from each other 2: Learn from other people	merely aims to complete the project, not to learn from other people (i.e. shows no learning attitude at all)	Reflects on own learning process and development in an ad hoc fashion and is able to explicate these.	explicitly shows (the willingness) to learn from other people during the project.	actively searches for ways to learn from others and purposefully develop him/herself.
Perspective making and learning from each other 3: Stimulate others to learn (general)	shows no actions in stimulating other people to learn from each other.	reflects with team members on each other's role, contribution and development during the project, but does not actively transfer the results of these reflections into improved performance of other people during the projects.	initiates reflective actions between people involved in the project aimed at learning from the project (both process and content wise).	Previous cell + actively encourages other people's learning in the light of the project.

	D **The student…**	**C** **The student…**	**B** **The student…**	**A** **The student…**
Transformation 1 (start) Intend to develop a new, sustainable practice	shows an attitude of conducting the project for the sole purpose of passing the course	shows an attitude to want to develop a project result that serves a limited amount of perspectives	shows an attitude to want to develop a project result that serves multiple perspectives	Previous cell + shows an attitude of wanting to deliver a project result that is innovative or inspiring innovation
Transformation 2 (process) Envision new practices during project process	has difficulty and/or shows no interest to think out-of-the-box. Sticks to mainly traditional or obvious solutions	tries to include innovative elements in traditional solutions	shows out-of-the-box thinking serving multiple perspectives through weighing pros and cons of various possible solutions	Previous cell + clarifies a vision for the new to be developed practice, i.e. is able to explicate how the new practice would look like, how it functions and what needs to be done to realise this new practice
Transformation 3 (product) Integrate various perspectives, interests or expertise in a final product	shows merely a compilation of insights of students involved in the final project. Does not explicate the integration of multiple perspectives, interests or expertise	shows how own ideas and those of other students are integrated in the final product. Shows some insights in how other perspectives are integrated and how realistic the final product is in practice	shows convincingly how (s)he weighted multiple perspectives and interests in the final product, and considers its practical as well as its innovative character.	Previous cell + clearly explicates how to effectively inform other external people involved about the outcome of the final product
Transformation 4 (follow-up) Stimulate a follow-up on project results	finishes the project for school and shows no interests in follow-up activities	finishes the project and mentions a few options for follow-up activities	finishes the project, explicates how it can be implemented in practice and which steps need to be taken to do so.	Previous cell + shows enthusiasm and effort to be actively involved in follow-up activities

Personal 'boundary crossing' assessment

Name: …… EUW: …… Date:……

Performance indicator	Personal assessment				
Identification 1: Identify one's own expertise and one's own limitations	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Identification 2: Identify other perspectives relevant for the project and problem at hand	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Coordination 1: Contact other people	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Coordination 2: Collaborate purposefully with other people	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Perspective making and learning 1: (Re)consider perspectives	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Perspective making and learning 2: Learn from other people	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Perspective making and learning 3: Stimulate others to learn	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Transformation 1 (start) Intend to develop a new, sustainable practice	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Transformation 2 (process) Envision new practices during project process	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Transformation 3 (product) Integrate various perspectives, interests or expertise in a final product	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A
Transformation 4 (follow-up) Stimulate a follow-up on project results	*start*	D	C	B	A
	aim	D	C	B	A
	end	D	C	B	A