

Sustainability education in the Master Science Education & Communication at Utrecht

University

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Collected data can be accessed via one of the supervisors of this study.

Abstract

Sustainability is an important socio-scientific issue for which university education is thought to be important in training both future teachers and other professionals on the subject. This study explored the need for a separate course and its contents on sustainability in the Master Science Education and Communication at Utrecht University. Three focus group interviews were conducted with stakeholders close to the course materials (teachers, students, PhD/alumni) where the groups were asked about their preferences regarding such a course on sustainability. The interviews were transcribed verbatim and coded according to a coding scheme constructed with a combination of a bottom-up and top-down approach. From the results, course guidelines were distilled. Next to that, other Science Education and Communication masters from Dutch universities were reviewed on their sustainability education contents, as well as the course Sustainability Education already given at Utrecht University at the Graduate School of Teaching. It is recommended to create a course focused on changing both attitude in students and give them competencies specifically regarding sustainability education and communication, with the aim to let students pass that knowledge on to next groups and generations. With the guidelines from this study, a first pilot course could be created and tested in the master program Science Education and Communication.

Keywords: Sustainability, Education, Competencies, Behavior change, Attitude change, Curriculum formation

Introduction

Sustainability has become an issue on the global agenda over the past few decades because of an increased awareness across societies regarding climate change and increasing pressure on the world as we know it (Wiek et al. 2011 & 2015, Burrows et al. 2022, Goller & Rieckmann 2022, Kidman et al. 2019). It has become evident that we as humans need to take action to sustain ourselves on Earth, where resources are not infinite and where we as humans are the biggest consumers. Sustainable behavior and mindsets are already stimulated by many institutions and initiatives, and the amount of attention sustainability gets in media and governmental institutions shows it is a globally important socioscientific issue that science educators and communicators need to be able to adequately address. Scientists argue that an interdisciplinary approach to science communication and education regarding an increase in sustainable behavior in citizens is most helpful (Burrows et al. 2022). Researchers such as Wiek et al. (2015) looked at the competences people need to think about and make decisions regarding sustainability. This includes increased agency regarding behaving sustainably. In society as it is shaped today, people need to understand complex issues regarding sustainability where successful problem-solving is the main skill to be acquired (Wiek et al. 2015). For this, key competences were identified by Wiek and colleagues (Wiek et al. 2011) in a literary review study, after which Wiek et al. (2015) linked these to learning goals. The competences are systems thinking, anticipatory thinking, normative thinking, strategic thinking and collaboration. Recently, three more competencies were added to that list, namely the intrapersonal, implementation and integration competencies (Wiek & Redman 2021). Both persuasion and education routes are considered in encouraging a change in behavior according to Monroe (2003). They found that ‘environmental literacy’ and a nudge towards sustainable behavior can be stimulated by two defined avenues. One is through an increase in sustainability education in formal educational settings, another is through science

communication in more informal settings. The Freudenthal Institute at Utrecht University wishes to stimulate both routes in their master program Science Education and Communication (further mentioned as MSEC). Students from this program within the science faculty can follow one of two tracks. The first is the teacher track, where students are mainly educated to become upper-secondary science teachers. This track will further be referred to as ‘the education track’. The second is the research and development track, where students are mainly prepared to design for formal and non-formal educational settings and be researchers and designers of science education. This track will further be referred to as ‘the communication track’. To help future professionals become competent to handle large-scale socioscientific issues such as sustainability, science communicators and educators need to be well-equipped and educated on the matter. Students from science education and communication programs play a key role in distributing knowledge about the subject matter and become professionals in dealing with their audiences. We must then ask ourselves: do they know how to approach a subject such as sustainability? Is it adequately represented in the current curriculum of MSEC? Or does MSEC need a separate course on sustainability in its curriculum? As of now, some courses at Utrecht University address some aspects of sustainability education and communication in both formal and informal settings. It is however not known to what extent sustainability is taught and if that is enough to train skilled future professionals. As future science educators and communicators, students at the Science Education and Communication (SEC) master's program need to be competent in handling a topic with this amount of social impact when continuing their professional careers. Therefore, this study intends to look at the possible need for more sustainability education in the SEC master’s program at Utrecht University. The aim is to identify what is already being taught about sustainability, what still needs/is necessary to be taught and how any discrepancies can be addressed. From this, possibly new design guidelines will be extracted for a course on

sustainability education and communication in the master SEC. The research question is therefore:

What is the curriculum of the SEC master required to contain regarding sustainability education and communication to empower SEC students to address the topic in their future careers? Sub-questions are:

- What do different stakeholders express as needs for a course on sustainability?
- What are recurring learning goals/outcomes from other universities/courses regarding sustainability education?

Theoretical framework

Before getting into education regarding sustainability education and communication, it is important to look at the definition of sustainability and how that is used in society. According to The Oxford Dictionary, sustainability has two definitions: *'the use of natural products and energy in a way that does not harm the environment'*, and *'the ability to continue or be continued for a long time'*. For this research, a combined definition of sustainability is used, in which natural resources are used in a way that can continue for a long time without harming the environment. This definition is based on the work of Brundtland (1987), who philosophizes on the history and meaning of sustainability in society. This includes acting in a sustainable way, which is different for each situation and individual circumstance.

Secondly, the Sustainable Development Goals (SDGs) as defined by the United Nations (2015), 'Transforming our world: the 2030 agenda for sustainable development', are often used as guidelines on which to act in large institutions such as Utrecht University. As this study is conducted for the Freudenthal Institute at Utrecht University, these SDGs are used as guidelines for this study too.

Researchers defined Education for Sustainability (EfS) by providing a theoretical framework regarding different definitions of sustainability and showing what is needed for EfS (Kidman et al. 2019). They propose many different views and definitions of sustainability, such as mentioned above as well. EfS is therefore seen as a process in which individuals develop to be contributors to change towards a more sustainable attitude and become competent enough to be active agents in the process (Kidman et al. 2019). These researchers imply that formal learning environments should make changes in both curricula and pedagogy (among others) to achieve the sustainability goals set. This includes a change

towards skill and competency development in individuals and a mindset change towards acting sustainably (Kidman et al. 2019).

Thinking and learning about sustainability at university has been traditionally done in specific courses or programmes regarding technology and innovative solutions. Research by Hammer and Lewis (2023) shows that students from Bern University prefer being taught competences, rather than methods or innovations, in order to get empowered to understand large and complex subject matter. The study introduces several different competencies, which were rated of different importance by participants (students, graduates, and supervisors). These expert groups agreed that the most important competence in regards to sustainability is to be able to communicate to your target group in a way they understand your message, which is believed to be the main goal in educating professionals such as SEC students.

Teacher educators are thought to be key actors and therefore multipliers in preparing future teachers for Education for Sustainable Development (ESD), who in turn spread their knowledge as well (Goller & Rieckmann 2022). Research suggests that future teachers are educated on three dimensions of ESD; economic sustainability, ecological sustainability and social collaboration. Contextual education and therefore systems thinking is a key competence that is developed with ESD, both for future teachers and their pupils (Goller & Rieckmann 2022).

Next to competences and introducing sustainability in learning content, pedagogies around sustainability education are developed to help teachers develop these competences in their pupils. A pedagogy that is often emphasized is an action-oriented transformative pedagogy, where elements such as collaboration and transdisciplinary learning are used (Leicht et al. 2018). Here, emphasis is put on cultivating action competences in pupils.

A study conducted at Hanoi National University of Education (HNUE) describes that Education for Sustainable Development (ESD) is necessary to achieve the SDGs and create a

basis towards a more sustainable world (Nguyen et al. 2022). In the study, 429 course syllabi were analyzed on their contents based on learning goals, outcomes and teaching approach regarding ESD. It was found that a systematic input of ESD was lacking. ESD studies focus on the content of sustainability education, while pedagogies for learning methods are just as important to get a message across. An action-oriented pedagogical approach as mentioned in studies (such as Leicht et al. 2018) helps develop competences needed in pupils and students to understand the challenges at hand.

There are however some difficulties when thinking of increasing ESD in classrooms. Teachers perceive it as a challenge due to multiple factors; either finding a connection to their subject, a lack of time, or a lack of knowledge on the subject. Since ESD is seen as transdisciplinary of nature, teachers might not feel comfortable or competent enough to speak about it in class (Goller & Rieckmann 2022).

MSEC students will not all pursue a career in formal education, many will come to work in an informal educational or communicational environment such as a museum or science magazine. Many theories exist on target audience influence, where the audience can be helped to make their own decisions or where they are ‘nudged’ in the most sustainable course of action. Research done by Flygansvaer et al. (2021) shows that a positive attitude towards sustainability and in this case recycling does not directly mean an increase in recycling behavior. Factors other than attitude seem to weigh more heavily on decision making in regards to recycling. It is found that using psychological tools where the audience is nudged towards sustainable behavior is more effective than educating them on the matter.

Curriculum content and therefore design seems to be dependent on the actors present in the process of formation and the social power they hold (Lau 2001). It is therefore seen that when involving a broader audience, curricula stay relevant for longer periods of time. For

implementation to be successful, teachers should be involved in the formation of a new curriculum (Alsubaie 2016). Other influential groups may include students and alumni.

Changes should be made to both curriculum and pedagogy to develop the necessary skills regarding thinking and acting sustainably in training future professionals. They need to be trained on ESD to feel competent enough to be multipliers on sustainability subjects. Next to that, stakeholders should be involved in this process of change to make it successful.

Methods

To answer the research questions, a qualitative research approach was adopted, consisting of two interacting parts. First, focus group interviews were conducted with three target groups, to gain insight into the needs and wishes of these stakeholders. Focus group interviews were chosen since this study is of an explorative nature, where group interviews gain the most insight due to their interactive nature (Kelly 2003). The interviews were transcribed verbatim, coded and analyzed based on the factors and scheme deduced from the literature study. Second, 'common practices' were studied from other sources such as other courses from Utrecht University in MSEC or other universities to see what can be learnt from those practices. The study was not linear but rather cyclical of nature, where the parts interact. Literature was used as input into the focus group interviews. The focus group interviews were expected to shed light on new literature to explore. The separate parts of the research will be explained in depth below.

Part 1: Focusgroup interviews

Experts on education and communication studies at Utrecht University were asked to participate in focus groups. Three separate groups were identified as stakeholders regarding education and educational content in MSEC;

- Teachers in SEC (N=5)
- Students in SEC both from Teacher track and Research and Development track (N=4)
- Alumni/PhD students (N=3)

The teacher's group is the group making the curriculum for MSEC and teaching the courses. Their input and attitude on a new course are therefore important to gather. The student group was asked to participate in the focus groups to see how a new course on sustainability would be received by the ones taking the course. The Alumni/PhD group was

asked to participate because they were expected to discuss more about how useful a course on sustainability would be to add to the curriculum for their professional careers.

The participants were sent an email through the study counsellor with information on the study and a call to participate with two dates of choice. People could sign up through a google forms and fill in a preferred date. For the teacher focus group, this led to the 5 people that responded and participated. For the student focus group, this resulted in 2 participants. After that, a class of first year SEC students was asked during a lecture whether they were willing to participate. Two more participants enrolled. For the alumni/PhD group, this email resulted in zero applications. Therefore, three people were directly messaged who agreed to participate. These people were known to be interested in sustainability and were suggested by faculty members of the Freudenthal Institute.

The teacher's group was a mixed group of people teaching both education and communication courses. Time at Utrecht University and experience in the field varied. The student group had education and communication students, containing both first year and second year students. Two of the Alumni were PhD students at Utrecht University, one pursued a career in other institutions and had recently graduated.

The focus group interview for the students was conducted in English, while both interviews with the alumni and teachers were conducted in Dutch. The focus group interviews with both students and alumni were held online, the interview with the teachers was held in person. All participants will remain anonymous and gave their permission to record the session either via camera or recorder for further processing purposes.

The focus groups were moderated by the researcher of this study. The study is interested in the view of the focus groups and their honest opinions and wishes without prior preparation. For the interviews, an interview scheme was made (table 1) to streamline the conversation and keep coherence between the different interviews. The questions asked in the

focus groups regarded their needs; what did they miss in their education in the MSEC regarding sustainability and why, what do you think is important or necessary and why? They were also questioned about their thoughts on competencies vs. knowledge, what could be possible learning goals for a course on sustainability and what they think is most important regarding sustainability in their respective roles. Information gathered from literature was used as a perspective for the interviewer as background information on the spectrum and timeline of sustainability education across the world, but no guiding questions were asked. At the beginning of the interview, participants were asked to fill in a worksheet (Appendix A) with some questions individually, after which we discussed those with the whole group. The questions are also shown in the interview scheme. The post its activity in the interview scheme was only executed in that way in the teachers focus group, since that interview was in person. For the other focus groups, a variation was made where the answers were immediately discussed with the group. The teacher focus group took about 1,5 hours, the other two took about 1 hour.

Table 1

Interview scheme

Time	Activity	Questions
5'	Introduction	Who am I? Why are we here? Is everyone okay with the conversation being recorded?
5'	Filling in the worksheet, individually	See questions below.
15'	Discussion of the worksheet	<ul style="list-style-type: none"> -Do you think a course specifically on sustainability is necessary? Why, or why not? - Is sustainability already present in MSEC? If yes, where? What do you still miss? - Does a new course on sustainability need to be open for all tracks? What about C-profile students? What are the advantages and disadvantages of your choice? - How can we best deal with the challenge of finding a balance between education and communication in this new course?
5'	Fill in Post-its	- What are the most essential elements for a course like this? (Which are not yet present in MSEC)

Time	Activity	Questions
15'	Discussion of the Post-its	Different elements, are there overarching categories, are elements that occur more frequently also more important? Or are these more obvious? Possibly rank the elements on importance.
10'	Learning goals	- If we combine all this information, what are the most important learning goals for this course? Name 2/write 2 down on your worksheet. After a few minutes, discussion.

Data analysis

The recordings and transcriptions are stored on university servers in a safe environment according to university policy and in line with GDPR laws. After the interviews were transcribed verbatim, the transcripts were coded following a mix of bottom-up and top-down coding. First, inductive coding was done where guidelines from the literature search were used for a first round of coding. From both the first round of coding and the interview transcripts, more (specific) codes were distilled from which a round of deductive coding was done. This means the research moved from a phase of open coding (breaking the transcripts into separate parts), to axial coding (connecting all different codes) to selective coding (categorizing different codes). This bottom-up approach helped identify focus points to create criteria for a course according to different stakeholders. No second coder was asked to review the work, because of the timeframe of the study. The coding scheme is shown in table 2.

Table 2

Coding scheme

Code	Explanation/example quote
<u>1 reasoning</u>	Why this course is necessary on both professional and moral level
<u>2 sustainability education and communication in MSEC</u>	a) examples of what is already present in MSEC or at UU (Utrecht University) b) the participant expresses a wish/want/need for more sustainability education
a) examples as is now b) as wanted (future)	
<u>3 practical guidelines</u>	a) conversation about methods in class or teaching methods

Code	Explanation/example quote
a) didactical approach	b) time spent, number of ECTS, compulsory or elective
b) process/necessities	c) open to all or not
c) tracks	d) mentions of
d) education vs. communication	
<u>4 contents/learning goals</u>	a) should/must be in the course
a) necessary subjects	b) outside of the scope/beyond the course
b) unnecessary subjects	c) talking about scope, what are the boundaries to sustainability relevant to MSEC or relevant to learning goals but not A/B
c) scope	
<u>5 needs of stakeholders</u>	Someone explains a need for the course
<u>6 other remaining</u>	Anything that is mentioned that might be of interest

Part 2: Common practices

Some other universities also teach SEC courses with a focus on sustainability. The universities and studies selected for reviewing in this study are shown in the table below

(Table 3). The selection is made based on the next criteria;

- Must be a Dutch university master program
- Must regard a program on science education and/or communication

For this, course descriptions were reviewed on their learning goals and content by checking the course descriptions for the term ‘sustainability’. Upon finding that term, the context was looked at to see whether the course description gave any information on the contents of the course regarding the subject sustainability. The courses reviewed were the ones directly linked to the curriculum of its corresponding master's program. I.e., minors at other faculties or master programs were not considered for this study.

Table 3

Masters courses reviewed for the ‘common practices’ study

University	Masters
Rijksuniversiteit Groningen	Science education and Communication
Technische universiteit Delft	Science education and Communication

University	Masters
<u>Technische universiteit Eindhoven</u>	Science education
Universiteit Twente	<u>Science education</u>
Universiteit Twente	<u>Educational science and technology</u>
<u>Universiteit Leiden</u>	Physics and science communication and society

Next to that, the course ‘Sustainability Education’ from the Graduate School of Teaching at Utrecht University was reviewed for its contents as shown in the course description. This course is already taken by MSEC students but is mainly aimed at education students.

Results

Focus group interviews

From the three focus group interviews, transcripts were made, and these were coded according to the coding scheme as seen in table 2. The results per code are shown below.

Reasoning on if and why this course is necessary for the MSEC

The alumni focus group agreed that a course on sustainability is necessary and useful to address the subject as an educator or communicator. They say it is our duty to have skills in communicating sustainability related topics to our respective audiences. They also agree that both MSEC students and their audiences from both formal and informal educational settings are probably going to be interested in sustainability.

Next to that, they argue that it is a mandatory subject in secondary schools, but that teachers are not always directly responsible for implementing sustainability in their classes. It would be useful to teach future secondary school teachers how to do that. Next to that, we have the expertise already present in the MSEC regarding researchers linked to Utrecht University which would be a shame not to utilize.

The student focus group, however, was divided. They did not all agree on the need for such a course on sustainability. It might be a nice addition to MSEC, but not as an integral and mandatory part. They do agree on the urgency of the issue.

The teacher focus group all agreed that sustainability is one of the most important themes in society because of what is happening to our Earth and therefore should play a large role in education. It is embedded in all exam programs in the Netherlands, not just in biology or geography.

'I think it's the biggest problem right now, the biggest social scientific issue. That makes it totally worth it to dedicate its own course to it and how to communicate about it' – students

"It is our responsibility. Not just our wish, but our moral duty" - teachers

Table 4

Summary of reasoning if and why a course on sustainability is necessary

Alumni	Students	Teachers
Necessary & useful, mandatory by national curriculum	Nice addition, no need for a full course	Very necessary, moral duty

Sustainability in MSEC

Examples of what is already present

Alumni say sustainability as a subject is not yet present in the master as it is not actively promoted. There is some room in MSEC to choose your subject for a project or essay, so you can choose to focus on sustainability there.

Students have a similar experience in the availability of the subject sustainability in MSEC. In the course Issues and Theories a few lectures are dedicated to sustainability.

The teacher focus group mentions the ‘Sustainability Education’ course given at GST and some courses at the Earth Science department, these could be chosen as electives. There were also mentions of a sustainability academy and a course in the bachelor, STEM education for a sustainable society.

Wish/want/need for more sustainability education

The alumni focus group agreed that because of their interests, a platform exists to expand on sustainability as a subject in MSEC. A student brought up the topic of sustainable product creation where they expected teachers to give the right example by not printing out worksheets for example.

Teachers agreed that they would like to extend the amount of sustainability education regarding the communication perspective, since the expertise in researchers is already present in the Freudenthal Institute.

"I have done a lot with sustainability in my education, because I was interested in it myself, but you must go after it yourself" - alumni

"I feel like it should be at least one class where they talk about how to create a sustainable product or even just to mention like, when you're creating the product, think about how to make it sustainable. That should be part of your product too. You don't want to like, keep printing out worksheets and handing them out" - students

Table 5

Summary of reasoning on sustainability already present in MSEC

Alumni	Students	Teachers
It is there when you look for it, but not very apparent.	Available, but hidden. Would like more sustainable product creation information	More sustainability education towards the communication perspective

Practical guidelines

Didactical approach

The alumni focus group agreed that customization of lectures per track would be a good idea to keep everyone interested. Some of the didactical approaches would be interesting for both tracks to learn, such as Socio-Scientific Inquiry Based Learning (SSIBL), that could be taught in lectures together. For other subjects it might be better to split the tracks and go more into depth for that track.

In this focus group interview, the lifelong learning platform commonly used at Utrecht University was discussed as well. In this platform, teachers can create learning lines, upload documents and post videos. It is an interactive platform for discussion and feedback as well. This could lend itself to this more customized learning idea mentioned above. They agreed that if you have several themes related to sustainability on the platform from which students can choose their interest, multiple types of students can be catered to.

Another initiative that alumni spoke about was more student-driven education where students could pick their own sustainability-related subject and differentiate between education and communication per group. This way, you give students ownership of their product and the ability to follow their interests. The lectures are then room for general learning theories and function like a shopping window for students to find theories to implement in their projects, ‘puzzle pieces’ according to alumni.

The student focus group would not like lectures on theory, since that does not represent what their working days are going to look like. They would prefer more practical assignments than lectures.

The teacher focus group agreed that this course would be great to work on in groups. This could help differentiate between education groups and communication groups. They agreed that the basis between education and communication is the same regarding theories. Both groups need different tools or instruction methods to reach their target audiences, which should be catered to. It was agreed that if giving background information would take too many contact hours, a few online videos would be a great solution.

Process/necessities

Regarding the weight and size of a course on sustainability, alumni agreed that a full mandatory course might be too much. They do, however, like to go deeper into the subject if that is what you plan to do later in your career. They agree the subject is important enough to at least create a mandatory introductory course. Alumni like the idea of creating more choice in the MSEC curriculum. The mandatory course should not hold too much space, since there are so many important subjects. Sustainability is one of them and does have a place in the curriculum. Alumni mentioned that mandatory courses are more susceptible to critique from students that are not interested.

Students find the idea of mandatory courses less likeable. They do, however, see the importance of the subject.

Teachers agreed the course should be taught in English. They also say that it can start out as an elective course as a pilot, where the teachers work towards a mandatory course in the curriculum of MSEC about sustainability. Some even argue that sustainability and environmental communication and education should be a separate masters track.

"I like the idea of having a mandatory introduction course, and the option to go deeper into the subject" – alumni

"I think from a practical standpoint it should be an elective, but I guess from a moral standpoint you could argue for it being relevant enough to everybody that it should be a mandatory course. I think there are arguments to be made for both" - students

"The course can be significantly large in my opinion" - teachers

Open to all tracks or not

When discussing if a course on sustainability should be open to all tracks of MSEC or if it should be limited to only one of the two, all target groups agree that both education and communication students can benefit from each other's knowledge. Alumni say it is best to differentiate between the two tracks in the assignments given.

Students do think they would like the course more if it were given separately. That way, both groups can dive deeper into the subjects that interest them most.

Education vs. communication

One thing many alumni and students mentioned was that courses usually focus more on formal education. Mixing both groups is experienced as difficult so far. They see a lot of inspiration from one side to the other and vice versa.

Teachers ideally see both groups together. Not only because MSEC is open to both, but also because otherwise the number of students following the course would be limited.

They also mention C-profile students as a possible target group, these are students that do a minor within MSEC but do the rest of their master's degree in another science department.

Teachers discussed the differences or overlap between education and communication in MSEC.

'You could construct it in such a way that you can pick your own sustainability question and then dive into that, do a project on that so that everyone can choose what interests them. Here, you can specify going into more communication or more education in the different groups with different subjects and goals for the project' - alumni

"I think if you do assignments for this course, and it's in group work, it's really nice if you're in a group with people that also only like communication, because all the group work so far I've done has been dominated by teachers, and it's been really education focused, which are just not my interests" - students

"Our students need to teach their pupils to act as citizens and consumers in sustainability issues. In communication we have one less step. They deal with direct communication that leads to a behavioral change. Both groups might not be that different after all" - teachers

Table 6

Summary of reasoning on practical guidelines of a course on sustainability in MSEC

Alumni	Students	Teachers
Differentiated group work, lectures used for background info.	Little lectures on theory, more in-depth practical assignments.	Group work with like-minded students, lectures for theories and info on sustainability.
A small introductory course which is mandatory, and a more in-depth course additionally per choice.	Do not like the idea of a mandatory course but see why it could be important.	Course taught in English, can start as an elective pilot and maybe even build into a separate master's track.
All tracks together, differentiate in assignments.	Would like the education and communications tracks to be taught separately but see importance and value in learning from each other.	Would like both tracks together, especially because

Alumni	Students	Teachers
		the groups are not that large.

Contents & learning goals

Necessary subjects

The alumni had a few suggestions for literature background that could be provided for a course on sustainability, such as Wiek (2011, 2015). Focus on the conversation was given to acquiring competencies and agency regarding sustainability issues.

The most important learning goal according to them would be to learn how to convey knowledge or competencies regarding sustainability to your target group. It was also mentioned that attaining a behavioral change in the target group would be something to strive for. Testing whether that goal is accomplished is recognized as difficult by the alumni.

Alumni see the need for students to also be given the time to think about their own attitudes and beliefs regarding sustainability, after defining what sustainability is in the constraints of this course.

The alumni would prefer to fit in some context about sustainability education and communication. Theories about the action competence or the Theory of planned behavior (Ajzen 1991, 2011) find their place in this course. If guest lecturers could step in to talk about their expertise, the course would be more interesting.

Students find the impact of language important and learning about that interesting. What words have what impact and how and when you use them is something they would like to see in the course.

Teachers say that they would want to increase agency in students so that these students can spread that feeling of influence with their target audiences. They agree with the alumni that the course first needs to give technical information on sustainability. One teacher

said that they want students to know some basic information about natural cycles and models.

Next to that, teachers talk about different theories and principles students need to learn in the course. The theory of planned behavior (Ajzen 1991, 2011) and the main goals stemming from transformative learning are good starting points. They would also like to add theories on storytelling and personalizing the message to your target group, such as framing. Last, teachers want to stimulate agency and accountability in students regarding sustainability issues.

"I think it works on two levels, both for the students of MSEC themselves as the target group with which they communicate or which they teach. So, both educator/communicator competencies and their target audiences. How do they get that competency development in their target groups?" - alumni

"What do I find important and why? Wat does someone else find important and why? Both exist; you do not have to convince each other. It is something you could put into such a course, maybe even should" - alumni

"For example, framing. An economical frame regarding sustainability would fit people that are sensitive to financial stimuli. Or a health-based frame about why people need to eat more plant-based foods" - teachers

"Either an aspect of a course or an entire course about how to deal with this weird way of communicating that is not how we normally communicate or how we are supposed to communicate. Other people are playing dirty. It is hard to follow up when you play by the rules. So how do you approach this? I think that is a big topic" - students

Unnecessary subjects

Students are generally tired of hearing about general learning theories (behaviorism, constructivism and cognitivism). Other more specific learning theories on sustainability

might be interesting, if taught in practical form. Teachers agreed that the course should not become a course on the technical details of sustainability. There should be a basis on what we think sustainability is and when you act sustainably in the course so that all students start from the same basis.

Table 7

Summary of reasoning on the contents and learning goals of a course on sustainability in MSEC

Alumni	Students	Teachers
<p>Most important learning goal: learning how to convey knowledge and competencies regarding sustainability to your target group. Also find it necessary to give time and attention to the attitude of students themselves.</p> <p>Add guest lectures about specific subjects where necessary for context.</p>	<p>The impact of language is something they would want to learn about.</p> <p>No standard lectures on standard learning theories, this is already overdone in the masters. More specific theory they could use in practice would be better.</p>	<p>Increase agency in students regarding sustainability. Do think they need a basis in technical information on the subject first, maybe a few lectures/videos. Learning theories, but also theories on storytelling and framing would be good to add.</p>

Needs of stakeholders

Students said they needed to communicate with ill-informed people about the subject.

Both misinformation and science skepticism are important subjects for them.

Teachers mention that they need the students that will follow the course to change their mindset as well so that they better understand what their target groups need. Students need to be made aware of the complexity of sustainability in different contexts.

Other remaining

One other interesting comment made by the alumni was that they feel sustainable thinking is a skill to be acquired. You can understand what sustainability is but to be able to act on it is a whole other level.

A student mentioned that they think MSEC has a lot of good content, but the theory becomes quite technical. They would appreciate theory to be put into practice. One of the students added that they would like to learn how to inspire people on sustainability.

"Sometimes I feel like in this master's, very interesting topics can lose their sparkle once you try to fit them into boxes of learning theories or competencies. Even though it matches very well, and you can use them very well" - students

"The power of language in sustainability communication and that, for example, the term climate change is very neutral because change can be both positive and negative, and that global warming sounds more alarming, but somehow, we don't use that as much. It talks about how you can shift those phrases to create this sense of urgency. It's called language for transition. I would have loved to learn something more about that" - students

Teachers expanded on other subjects that correlate with sustainability, but are not directly linked such as social security, justice, citizenship, care for our democracy, artificial intelligence, and health communication.

"That mindset must change in students first to understand that the world outside of their ivory tower does not work like a linear model from knowledge to attitude change to behavior change" - teachers

When creating a new and broader course on sustainability, we should consider the existing course: Sustainability education. Teachers also agreed that it should be a process of cocreation between education and communication.

"It should be a process of cocreation. I think that us teachers often miss each other when talking about education and communication. I think there is a lot of overlap" - teachers

Another contextual addition teachers made was the terms and conditions of acting sustainably. If you, for example, want to recycle, but there are no locations you can repurpose

your stuff in your range of motion, it is not going to happen. Communication and education are only useful when these terms and conditions are met.

Common practices

The table below (table 8) shows what universities have master's courses on Science Education and/or Communication, or something very similar. It is also shown what courses mention the word 'sustainability' in its course description. As can be seen, only the course 'Citizen science' from the Rijksuniversiteit Groningen meets that criterion. Here, 'sustainability' is only mentioned once, in close relation to the Sustainable Development Goals from the United Nations. Here, they were used as reasoning on why citizen science was needed to engage society in science. This course is a mandatory course and is 5 ECTS. It could be that courses at other universities offer space for students to pick a sustainability subject for projects. However, this is speculation.

Table 8

Masters courses reviewed for the 'common practices' study

University	Masters	Course
Rijksuniversiteit Groningen	Science education and Communication	Citizen science – course description
Technische universiteit Delft	Science education and Communication	None
Technische universiteit Eindhoven	Science education	None
Universiteit Twente	Science education	None
Universiteit Twente	Educational science and technology	None
Universiteit Leiden	Physics and science communication and society	None

The course '[Sustainability Education](#)' given at the Graduate School of Teaching at Utrecht University is a course on how to teach about sustainability as a secondary education teacher. The learning goals are described as goals regarding learning for/about sustainable

development, where students are taught to develop educational materials in their classrooms as secondary school teachers. The course is fully aimed at Education students.

Conclusion & Discussion

The aim of the current study was to investigate what the curriculum of the SEC master is required to contain regarding sustainability education and communication to empower SEC students to address the topic in their future careers. This is done by combining an exploratory literature research, as well as focus group interviews of stakeholders close to the education and seeing if there were recurring learning goals/outcomes from other universities in the Netherlands regarding sustainability education.

A course on sustainability education and communication is useful and necessary in the master Science Education and Communication at the Freudenthal Institute at Utrecht University. Stakeholders agree that it is an important subject for both aspiring teachers and communicators.

Education students found it difficult to find a connection or a place for it in their courses and respective subjects, since thinking about sustainability is inherently multi-disciplinary. Their classes are already full of more subject-related matters which do not leave much room for additions. It is however clear that sustainable thinking and acting is important to all interviewed groups.

Guideline 1: a course on sustainability is necessary and useful and must be added to the curriculum of MSEC.

The subject of sustainability can already be put in the current curriculum of MSEC, when a student wants to insert it themselves. It is not specifically taught, therefore a new course on sustainability would have a place. Students would like it to be more explicit, especially regarding creating a sustainable communications product.

Guideline 2: a course on sustainability should contain information about creating a sustainable product.

When regarding practical constraints of a course on sustainability, all focus groups agreed that they want a course where education and communication students can learn from each other. At the same time, a need was expressed for differentiation between the tracks, so that both types of students could get more in-depth information on their respective specialties. It was suggested to create an opportunity for students to follow their interests and specialties in the assignments.

Guideline 3: education and communication students can follow the same course, but differentiation in assignments between the two is essential for depth in the respective specialties.

The focus groups agreed that the course can be mandatory after a trial period of testing and improving on the course. The alumni focus group thought that a smaller introductory course could be made mandatory. Next to that, an elective course could be created next to that for students that want to know more.

Guideline 4: a (small) course on sustainability can be a compulsory part of the MSEC curriculum.

Guideline 5: the course should be taught in English.

The contents of the course were also discussed in the focus groups. As was also seen in literature, the focus groups agreed that competency development is an important subject to incorporate. It should not become a course on technicalities regarding sustainability, but some introduction to the matter is necessary according to the focus groups. A student noted that they would like to learn more about the use of language when writing popular science articles for example. Teachers would like to talk about framing, and students would like to learn about misinformation and speaking to science skeptics.

Guideline 6: competency development must play a central role in the course, both for students and their respective target audiences.

Guideline 7: the course needs to contain information on conveying information for a specific target audience, such as framing.

Guideline 8: dealing with misinformation and science non-believers should be addressed in the course.

Other mentions of focus groups were that not only knowledge needs to be conveyed in the course, but also a mindset shift in the students. The course must inspire students and teachers to work together and gather the necessary tools.

Guideline 9: the course must aim to inspire students and teachers to work together and create change in both attitude and behavior.

Practices from other master studies at universities in the Netherlands showed that ESD was less present than expected. At the Graduate School of Teaching (GST) at Utrecht University, the course ‘Sustainability Education’ is aimed to teach future teachers on ESD. The course is purely focused on education students.

Guideline 10: a course on sustainability at the Freudenthal Institute must include sustainability communication as well.

Limitations and data saturation

This research was conducted in a university setting at Utrecht University and the constraints for common practices research was limited to the Netherlands. Other science education and communication studies outside of The Netherlands could give an increased insight into sustainability education for MSEC students. It is possible that studies other than university education can provide additional insight as well. For further research it is suggested that the constraints set for the common practices research is broadened so that more can be learned from institutions that already implemented ESD in their curricula other than just from research.

Regarding focus group interview research, it is thought that focus groups optimally consist of about 10 people (Kelly 2003). Since the focus groups from this research were considerably smaller, it could be that not all arguments were brought forth. The nature of the focus groups did feel open and safe enough to express differences, which was done sparingly. Focus groups generally agreed and complemented each other's arguments, therefore the range of participants is thought to have been large enough to draw conclusions. It is however thought that a larger number of participants would be helpful to deepen the understanding of the needs of the focus groups and therefore increase understanding of the limits of a course on sustainability in MSEC.

Research in context

Research on the use of ESD has been widespread (Wiek et al. 2011 & 2015, Burrows et al. 2022, Goller & Rieckmann 2022, Kidman et al. 2019). In line with guideline 1, education on sustainability for future teachers and communicators is necessary to increase knowledge and change attitudes about sustainability. Skills and competencies development is valued in the focus group interviews (guideline 7) and in literature (Wiek et al 2011 & 2015, Mogensen & Schnack 2018). Developing the action competence seems to be most important in increasing a lean towards more sustainable behavior (Sass et al. 2020). It is shown that ESD and mainly teaching an action competence approach is effective in increasing awareness and development of competencies related to the subject (Chen & Liu 2020).

The results from this study provide a starting point to create a course on sustainability which could be piloted in MSEC. It should be noted however that the course should significantly differ from the Sustainability Education course given at GST. Even though that course is not part of MSEC and students from the communications track need to ask permission from the examination board to have it in their exam program, they can follow the

course. It is not the wish of the Freudenthal Institute to interfere with the target audience of that already existing sustainability course.

Education on sustainability in higher educational settings with the aim of changing beliefs and attitudes and creating agency for future professionals is seen as essential in a world where sustainability becomes an important issue on the global agenda. If sustainability goals are to be accomplished, education should be prepared on the subject and implement it in their curricula.

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Appendix A; Worksheet

Worksheet general questions sustainability educ. In MSEC**Do you think a course specifically on sustainability to be necessary? Why, or why not?****Is sustainability already present in our master? If yes, where? What do you miss?****Should the course be open to all tracks? And C-profile? What are the advantages or disadvantages of your choice?****How should we deal with the challenge of finding balance between education and communication in this new course?**

