

Supplementary Materials

Secondary Science Teachers' Views on Environmental Citizenship in the Netherlands

Michiel van Harskamp^{1,*}, Marie-Christine P.J. Knippels¹ and Wouter R. van Joolingen¹

¹ Freudenthal Institute, Department of Mathematics, Utrecht University, Utrecht, Netherlands; m.vanharskamp@uu.nl, m.c.p.j.knippels@uu.nl, w.r.vanjoolingen@uu.nl

* Correspondence: m.vanharskamp@uu.nl; Tel.: +31 30 253 8251

This document lists the interview questions for the teacher interviews and the corresponding coding scheme. Each code can be given once per teacher, so total number of codes is total number of teachers who answered in that category.

Table S1. Coding scheme for the teacher interviews belonging to question s1: How would you define sustainability? Each teacher was assigned 'Brundtland' or a combination of one maximum of 'People', 'Planet', and 'Prosperity' or none of the first four categories, and one maximum of each of the descriptive categories, if applicable.

Category	Description
Brundtland	Brundtland-like definition, including reference to needs of the present and needs of the future, replaces People, Planet, and Prosperity codes
People	References to people/social side of sustainability, not coded if Brundtland is coded
Planet	References to planet/ecological side of sustainability, not coded if Brundtland is coded
Prosperity	References to prosperity/economical side of sustainability, not coded if Brundtland is coded
Environmental impact	Environment, ecosystems, minimal impact on surroundings, no pollution, deforestation, animal suffering
Container concept	Very broad/vaguely defined concept, contains many meanings
Prolonged use of products	Being considerate with product use, using products for a long time
Sustainable processes	Sustainable processes, production, efficiency, energy, resources
Effects on next generation	Effects on next generation, impact on generations in the future (not selected when 'Brundtland' is chosen)
Recycling	Recycling, reuse, circular processes

Table S2. Coding scheme for the teacher interviews belonging to question s2: Would you say sustainability belongs in your lessons? Each teacher was assigned one of the three main categories ('Yes', 'Hardly', and 'No'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Yes	Yes, it belongs in my lessons
Hardly	Hardly, it partially belongs in my lessons
No	No, it does not belong in my lessons
Task of school	It is a task of the whole school, also in other subjects
Problems are topical	Problems occur now, it is urgent, problematic, topical
Functioning in society	Important skills needed to function in society
Raising awareness	Raising awareness about sustainability, showing alternatives, showing ethical sides

Table S3. Coding scheme for the teacher interviews belonging to question s3: Do you incorporate sustainability in your teaching? Each teacher was assigned one of the three main categories ('Yes', 'Sometimes/hardly', and 'No'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Yes	Yes, I incorporate sustainability in my lessons
Sometimes/hardly	I sometimes or hardly incorporate sustainability in my lessons
No	No, I do not incorporate sustainability in my lessons
Curriculum & time	It is/is not part of the curriculum, there is not enough time
Too little	I do not incorporate it enough, I should incorporate it more
When applicable	Only if it is applicable or topical, not suitable for lower secondary
Recurring theme	It is a recurring theme in my teaching
Interdisciplinary	I approach it interdisciplinarily, with teachers from other subjects, in collaboration with other subjects (not selected if teachers say sustainability is important for all subjects)
Theory first	I focus on theory first

Table S4. Coding scheme for the teacher interviews belonging to question s4: Which teaching and learning activities do you use when you teach about sustainability? Each teacher was assigned one maximum of each of these categories, if applicable.

Category	Description
Discussion	Discussion, dialogue
Research	Research, presentations about results
Video/documentary	Video, documentary, film, animation
Authentic examples	Concrete example, authentic situation, example from teacher's own life, examples of which the students are owners
Regular teaching activities	Normal teaching activities, classroom discussion, no difference with other subjects
Stakeholders, experts	Stakeholders, experts, role playing, showing multiple perspectives
Design/creative	Designing something, creative activities
Footprint calculation	Calculating carbon footprint, ecological footprint
Group work	Unspecified group work, group activities
Theory	Theory, theoretical teaching
Student behavior	Focus on student behaviour, student actions
Solutions	Finding solutions, improving local situation/school building
Game/competition	Competition element, gamification
Not yet applicable	Did not yet teach many sustainability lessons

Table S5. Coding scheme for the teacher interviews belonging to question s5: What learning aims do you have when teaching about sustainability? Each teacher was assigned one maximum of each of the categories, if applicable.

Category	Description
Raising awareness	Raising awareness of current situation
Impact of behavior	Impact of (student) behavior/choices on the environment/the world
Bigger picture	Showing the bigger picture, how things are connected
Opinions and decisions	Focus on decision making and opinion forming
Theory	Teaching theoretical background/concepts
21st century skills	21st century skills such as validity of sources, critical thinking, dealing with media and social media, lifelong learning, academic thinking
Behavior	Focus on behavior, student behavior, changing their behavior
Sustainable way of life	Promoting sustainable way of life

Citizenship education	Citizenship education, taking responsibility, becoming active member of society
Solutions and possibilities	Thinking about solutions, developing solutions, showing possibilities, shifting from negative to positive view
No clear learning aims	No clear learning aims specified

Table S6. Coding scheme for the teacher interviews belonging to question s6: Do you think sustainability is part of the curriculum? Each teacher was assigned one of the two main categories ('Yes' and 'Very little'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Yes	Yes, sustainability is part of the curriculum
Very little	Only very little, but it is part of the curriculum
Should be more	There should be more sustainability in the curriculum
Too theoretical	The curriculum is too heavily focused on theory
Incorrectly represented	Sustainability is not presented in the right way in the curriculum
National exams	It is part of national exams occasionally

Table S7. Coding scheme for the teacher interviews belonging to question s7: Do you feel confident with teaching about sustainability? Each teacher was assigned one of the two main categories ('Confident' and 'Unconfident'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Confident	Yes, I feel confident
Unconfident	No, I do not feel confident; I feel unconfident about certain aspects
Own interest	Teacher is interested/not interested in it
Opinions	Opinion forming, opinions of parents/caretakers
Complexity	Topics are complex/difficult/multifaceted
Not set in stone	Not a hard truth/no clear cut answers
Examples	Can think of many examples, topical, authentic, story/narrative
Interdisciplinary	Interdisciplinary nature of the topic, can always refer to other colleagues

Table S8. Coding scheme for the teacher interviews belonging to question s8: What are the challenges with teaching about sustainability? Each teacher was assigned one maximum of each of the descriptive categories, if applicable.

Category	Description
Student involvement	Doom scenarios of students, hopelessness, boring image, far away topic for students, no prior knowledge of students, students have heard about this too much
Opinions on the subject	Opinion of the teacher/parents and caretakers/the students, extremism, politics, ethics, feelings, opinion-forming
Curriculum	Too little time, full curriculum, wrong interpretation of sustainability in curriculum, examination difficult, national exams, interdisciplinary nature with individual subjects, vaguely depicted in curriculum
Teaching and learning activities	Discussions are difficult to guide, little to no practical assignments or activities, no suitable lesson materials, promoting behavior change is difficult
Traits of the subject	Large scale of issues, complexity, abstract, difficult to define, fast developments of issues, unsolvable, open-ended nature
Conditions at school/in the world	Colleagues are not involved, many bad sources of information, creating a safe atmosphere difficult, unable to practice what you preach because of unsustainable building

Table S9. Coding scheme for the teacher interviews belonging to question c1: How would you define citizenship?

Category	Description
Personal vs society	Dealing with a person's relation to the people around them/their surroundings, a person's place in society
Socially desirable behavior	Behavior that is socially acceptable, that society wishes to see, sticking to social norms
Caring, involved, conscious	Caring for surroundings, actively taking part, caring for self, being aware of impact on surroundings
21st century skills	Skills such as critical thinking, opinion forming, dealing with social media and media in general
Development/maturation	Developing as a person, becoming a mature person, <i>bildung</i>
Complex/difficult	A complex/vague/difficult concept
Norms, values, ethics	About norms, values, and ethics, ethical side, social norms, personal values
Democracy	Democracy, democratic society
Don't know	Does not know how to define citizenship

Table S10. Coding scheme for the teacher interviews belonging to question c2: Would you say citizenship belongs in your lessons? Each teacher was assigned one of the three main categories ('Yes', 'Yes, whole school', and 'No'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Yes	Yes, citizenship belongs in my lessons
Yes, whole school	Yes, citizenship belongs in the whole school
No	No, citizenship does not belong in my lessons
Caring for self and others	Caring for self, for others, for other organisms
Ethics and opinion	Ethics, opinion-forming, ethical subjects or topics
Skills for life	Skills necessary for the rest of your life
Technical skills	Technical or scientific skills necessary for the rest of your life, critical thinking
Maturation	Developing as a person, becoming a mature person, <i>bildung</i>
Effect of topic on world	Shows the importance of the subject, shows how subject affects the world, the relationship between the subject and the world
Social norms	Deals with social norms, socially acceptable behavior
How to approach it	Wonders how to approach it/how to implement it in their lessons
Subconsciously	Does not deal with this explicitly, only implicitly, without thinking about it

Table S11. Coding scheme for the teacher interviews belonging to question c3: Do you incorporate citizenship in your teaching? Each teacher was assigned one of the four main categories ('Yes', 'Hardly', 'Only implicitly', and 'No'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Yes	Yes, I incorporate citizenship in my teaching
Hardly	I sometimes incorporate citizenship in my teaching
Only implicitly	I only implicitly incorporate citizenship in my teaching
No	I do not incorporate citizenship in my teaching
Connected to sustainability	When I teach about sustainability, during sustainability education
Ethics and opinion forming	During teaching about ethical issues, opinion-forming
Health / sexuality & gender	When teaching about health, sexuality and gender
Setting an example	To set an example, practice what you preach
Critical thinking	When focusing on critical thinking, critical attitude
Too little	Too little, wants to incorporate more citizenship
Time / curriculum	Curriculum is full, is not present in curriculum, needs time for other themes
Theoretical / theory first	Laying theoretical foundations first, subject is too theoretical for citizenship

Difficult for lower secondary	Too difficult for lower secondary, only for upper secondary, does not belong in lower secondary
News and current affairs	When subject is in the news, current affairs, mentioning issues that happen in the real world
Does not fit	Has no place in science subjects, belongs with other subjects
Interdisciplinary	In an interdisciplinary fashion, when collaborating with other subjects, not only for science subjects
Nature of science	Explaining or relating to the nature of science, the scientific method, scientific thinking
Connection with nature	Promoting a relationship with nature

Table S12. Coding scheme for the teacher interviews belonging to question c4: Which teaching and learning activities do you use when you teach about citizenship? Each teacher was assigned one maximum of each of the descriptive categories, if applicable.

Category	Description
Discussion	Discussion, dialogue
Regular teaching activities	Normal teaching activities, classroom discussion, no difference with other subjects
Group work	Working in groups
News and current affairs	Based on current developments, issues, news stories
Video and documentary	Videos, film, documentary, news item
Research and experiments	Doing research, experiments, practical
Debate	Debate
Role play/stakeholders	Role playing, stakeholders, experts
Essay and writing	Writing essays, papers, writing assignment
Designing/creative	Designing something, creative assignments, making something
Social science research	Social science research, questionnaires, interviews
None	No teaching and learning activities

Table S13. Coding scheme for the teacher interviews belonging to question c5: What learning aims do you have when teaching about citizenship? Each teacher was assigned one maximum of each of the descriptive categories, if applicable.

Category	Description
21 st century skills	Skills such as working together, communicating, critical thinking, looking for and assessing information, opinion forming, dealing with social media and media in general
Opinion forming/decision making	Forming opinions/making decisions, showing multiple sides to the story/to the issue
Caring for self and surroundings	Caring for own body/caring for surroundings
Raising awareness	Raising awareness about effect of your decisions/your behaviour, here and somewhere else
None	Has no learning aims for citizenship

Table S14. Coding scheme for the teacher interviews belonging to question c6: Do you think citizenship is part of the curriculum? Each teacher was assigned one of the three main categories ('Yes', 'Very little', and 'No'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Yes	Yes, citizenship is in the curriculum
Very little	Only very little citizenship is in the curriculum
No	No, citizenship is not in the curriculum
Connected to sustainability	When I teach about sustainability, during sustainability education
Opinion forming	Related to opinion forming, on ethical issues where you need to be able to form an opinion
Too little, should be more	There is too little of it, there should be more in the curriculum
Other subjects / at school level	For other subjects, at a school level
Vague concept / loose curriculum	Citizenship is too vague, the concept is too vague, the curriculum is too vague
Strong focus on theory	Subject is highly theory driven, theoretical subject, theory is more important
21st century skills	Skills such as validity of sources, communicating, critical thinking, opinion forming, dealing with social media and media in general, scientific literacy, working together
Health / sexuality & gender	Issues related to health, sexuality and gender
Mainly for upper secondary	Not for lower secondary, only for upper secondary, more suitable for upper secondary

Table S15. Coding scheme for the teacher interviews belonging to question c7: Do you feel confident with teaching about citizenship? Each teacher was assigned one of the three main categories ('Confident', 'Unconfident', and 'Never implements CE'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Confident	Feels confident about teaching citizenship
Unconfident	Feels unconfident about teaching (certain aspects of) citizenship
Never implements CE	Does not implement citizenship in their teaching
Guiding discussions	Guiding discussions, conversations, opinion-forming, dialogue
Own interest	Is interested in citizenship/is not interested in citizenship
Prior knowledge	Prior knowledge from teacher education
Inexperienced	Does not teach citizenship, hardly ever happens, has little to no previous experiences with citizenship
Demands preparation first	Not without preparation, would like some update or training first

Table S16. Coding scheme for the teacher interviews belonging to question c8: What are the challenges with teaching about citizenship? Each teacher was assigned one of the three main categories ('Yes', 'Hardly', and 'No'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Feeling unequipped	Difficulties with guiding dialogue/discussion, difficulty with evaluation/assessment, how to interpret it/incorporate it in science, what does it mean, no or little experience with the topic
Influences on opinion forming	Teacher has an opinion too/is not neutral, opinions of other teachers/the school, opinions of parents, students copy other students during opinion-forming
Curriculum	Curriculum is too full, has no time to incorporate citizenship, citizenship is scattered across different subjects
Level of students	Too difficult for lower secondary, students are not interested/are not ready for citizenship

Atmosphere in the group	Atmosphere in the group has to be right, should create room for different opinions to coexist, depends on the class
Sensitivity of the topics	Topics are sensitive, religious, political, ethical, cultural differences
No difficulties	Teaching citizenship is not hard
Not applicable	Does not teach citizenship

Table S17. Coding scheme for the teacher interviews belonging to question q1: Would you say the combination of sustainability and citizenship makes sense? Each teacher was assigned one of the two main categories ('Yes' and 'No data'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Yes	Yes, the combination of sustainability and citizenship makes sense
No data	This question was not asked to the interviewed teacher
Making choices/decisions	Both sustainability and citizenship are about making choices and decisions
Social aspect/part of society	Both sustainability and citizenship are about being part of society, there is a social aspect to them
Effect on surroundings	Both sustainability and citizenship are about the effect you have on your surroundings (both natural and society)
Consumer behavior/decisions	Both sustainability and citizenship are about consumer behaviour, the choices that you make as a consumer
Similar classroom activities	Teaching and learning activities for sustainability and citizenship resemble each other

Table S18. Coding scheme for the teacher interviews belonging to question q2: Do you incorporate societal issues other than sustainability in your teaching? Each teacher was assigned one of the two main categories ('Yes' and 'No'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Yes	Yes, I teach about other societal issues
No	No, I do not teach about any other societal issues
Curriculum	Other issues are (not) in the curriculum
Sex, sexuality, gender	Issues dealing with sex, sexuality, and gender
Technology & society	Issues about the impact of technology on society, genetic modification, radioactivity, cloning
Medical issues	Medical issues, such as organ donation, vaccination
Ethical issues	General ethical issues, unspecified ethical issues
Theoretical subject	Subject is mainly theoretical
Life style	Lifestyle issues, such as alcohol, drugs, smoking, obesity, nutrition
Food industry	Issues related to the food industry, such as agriculture, hunger and poverty, use of antibiotics in food industry

Table S19. Coding scheme for the teacher interviews belonging to question q3: How would you judge your own classroom management during teaching about sustainability and citizenship? Each teacher was assigned one of the four main categories ('Easier', 'No difference', 'A little harder', and 'Harder'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Easier	Classroom management is easier during sustainability and citizenship teaching
No difference	There is no difference in classroom management with other topics
A little harder	Classroom management is a little harder during sustainability and citizenship teaching
Harder	Classroom management is harder during sustainability and citizenship teaching

Discussion and opinions	Guiding a discussion, reaching learning aims during discussion, motivating students for taking part in discussion
Safe classroom environment	Creating a safe classroom environment, building a good relationship with the class, atmosphere needs to be right
Innovative learning activities	More innovative teaching and learning activities, different from before, more diverse set of learning activities
Teacher's own interest	Own interest of the teacher in sustainability and citizenship
Ensuring hearing everyone	Making sure everyone can have a say, creating room for everyone
Student ownership	Students are owner of own learning process, students are taken seriously, responsibility lies with the students, teacher is only supporting
Energetic students	Highly energetic or intensely active students
Contexts and authenticity	Authentic contexts, from the real world, fast developments in the field
Preparations required	Needs preparation, not going in without preparing
Group work	Guiding group work
Assessment	Assessment and evaluation

Table S20. Coding scheme for the teacher interviews belonging to question q4: How motivated are your students when you teach about sustainability and citizenship? Each teacher was assigned one of the four main categories ('Easy', 'Depends', 'No difference', and 'Challenge'), and one maximum of each of the descriptive categories, if applicable.

Category	Description
Easy	It is easy to motivate students for sustainability and citizenship
Depends	It depends how easy it is to motivate students for sustainability and citizenship
No difference	There is no difference with other topics concerning motivation
Challenge	It is a challenge to motivate students for sustainability and citizenship
Closeness of the topic	Topics are close to/far away from the students, they recognize it in their daily lives/it only plays far away, it is about their own future, they have an opinion about this
Specific students are interested	Specific students are interested in this, more at certain levels/with certain backgrounds, differs per class
Depends on topic	Depends on the topic, some are interesting on their own, some less so, some are boring
Authenticity/real world problems	Authenticity, keep it authentic, not from the book, students feel they are being taken seriously
Tired of/knowledgeable about sustainability	Students are tired about sustainability, they feel like they know everything already, boring image, students have a lot of prior knowledge
Students focus on themselves	Students are focused on their own lives/bodies, they are in puberty, not dealing with the outside world
Opinions and discussion	Students like to give their opinion, have an opinion about this, want to share their ideas
Topical, current affairs	These issues are topical, dealing with current affairs, mainly now is this motivating for them, march for climate, it is more motivating for them now than a couple of years ago
Enthusiasm of teacher	Teacher is enthusiastic about the topic, can use their own enthusiasm to motivate students
Emotional investment	Students are emotionally invested with the topic, are very worried, have bleak images of the future, are past hope, desperate
Some resistance at first	There is a little resistance at first, but after that motivation is easy
Open-ended	Many options or examples for the teacher, these issues are open-ended, teachers can use many contexts

Table S21. Coding scheme for the teacher interviews belonging to question q5: How does the amount of teaching and learning activities that you have at your disposal for teaching about sustainability and citizenship relate to colleagues? Each teacher was assigned one of the four main categories ('More', 'Same as colleagues', 'Less' and 'Don't know').

Category	Description
More	I have more teaching and learning activities for sustainability and citizenship at my disposal than my colleagues
Same as colleagues	We have the same amount of teaching and learning activities for sustainability and citizenship at our disposal
Less	I have less teaching and learning activities for sustainability and citizenship at my disposal than my colleagues
Don't know	I do not know how to compare this/I have no idea