Engaging youth in the local environment

Promoting sustainability action competence in Danish high school teaching through citizen social science.

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Abstract: Many young individuals experience a sense of disconnection from their immediate environment, which adversely affects their engagement in civic activities. This article outlines experiences with a sustainability actionable approach in a Danish high school, and how it influenced young people's understanding of the local environment. The study entails a three-month collaboration with a teacher and 17 high school students in Copenhagen who were being trained as citizen social scientists. They investigated and proposed youth-friendly sustainable changes in the neighbourhood, which enhanced their sustainability action competence. The article discusses how an action-oriented framework may inspire high school teachers to incorporate citizen social science in planning education for sustainable development that supports youth civic engagement.

Keywords: Citizen social science, youth civic engagement, sustainability action competence

Desarrollando el compromiso de las personas jóvenes en el entorno local.

Promoviendo competencias para la acción orientada a la sostenibilidad en la educación secundaria danesa a través de la ciencia social ciudadana

Resumen: Muchas personas jóvenes experimentan una sensación de desconexión de su entorno inmediato, lo que afecta negativamente su participación en actividades cívicas. Este artículo describe experiencias desarrolladas con un enfoque accionable de sostenibilidad en una escuela secundaria danesa y señala cómo influyó esta experiencia en la comprensión que las personas jóvenes tenían sobre el entorno local. El estudio se desarrolló a través de una colaboración de tres meses con una profesora y 17 estudiantes de secundaria en Copenhague, que se formaron en las ciencias sociales ciudadanas. Investigaron y propusieron cambios sostenibles que favorecían a las personas jóvenes de un vecindario, lo que mejoró su competencia en acciones para la sostenibilidad. El artículo analiza cómo un marco orientado a la acción puede inspirar al profesorado de secundaria a incorporar las ciencias sociales ciudadanas en la planificación de una educación para el desarrollo sostenible que apoye la participación cívica de las personas jóvenes.

Palabras clave: Ciencia social ciudadana, compromiso cívico de las personas jóvenes, competencias para la acción orientada a la sostenibilidad

1.   Introduction

16 % of the global population are young people aged 15–24 years. By 2030, the number is projected to increase by 7 % to nearly 1.3 billion youths (Nations, n.d.). In recent years, dissatisfaction among youth has received attention, prompting a move to empower them as equal citizens (UN Press, n.d.). In 2022, Danish researchers found that the root of this dissatisfaction lies in societal pressures, including an accelerated education system and heightened expectations (Katznelson et al., 2021). According to Hartmut Rosa (2021), the constant acceleration of society is affecting our lives and can alienate us from our surroundings. He asserts that dissatisfaction is not due to a fragile psyche, but because youths are becoming aware that something is wrong with the way society is constructed (Politiken, n.d.). However, these pressures often leave youths with little time for local engagement, which has a negative effect on their sense of citizenship, belonging and recognition (Iwasaki, 2015; Simmons & Harding, 2011). At the same time, climate change is threatening human and non-human identities, and the latest IPCC report calls for urgent action (Langsdorf et al., 2022). Transitioning to a sustainable society requires, among others, engaging the youth and enabling them to take control of their future. Though young people have participated in activism against governments, many still feel powerless and resort to denial-like strategies to cope with climate change (Ojala, 2013). Therefore, it is necessary to investigate new methods for engaging the youth in sustainable development and their local environment.

This article explores how the educational system can serve as a platform to connect youth with their local environment, bolstering sustainability action competence and encouraging engagement. We define sustainability action competence, inspired by Jensen & Jørgensen (2002) and Mogensen & Schnack (2010), as a set of action-oriented and participatory components that foster an interconnected and motivating understanding of sustainability challenges and ability to act. We emphasise that sustainable development requires an understanding of environmental, social and economic perspectives.

Schools are considered essential for building skills and values related to sustainability (Bosevska & Kriewaldt, 2020; Wamsler, 2020), and since the Agenda 21 Report in 1992, suggested linking sustainable development to education, researchers have argued that using educational institutions to promote sustainable development is effective (UNESCO, n.d.). Particularly in high school (when students are aged 16–21 years in Denmark), young people are moulded into individuals and absorb a substantial amount of knowledge, which enables them to think critically (UBU, 2022). However, many young people lack knowledge about their local community. Therefore, active engagement in their neighbourhood can provide valuable insights, which they can reflect on (Gabrielsen & Korsager, 2018).

Educational institutions educate future citizens, giving them knowledge about how to behave in society. Though this is an essential skill, there is a lack of concrete action-oriented approaches in Danish high schools (Christensen et al., 2022). One way of creating action-oriented education is through action research. Conducting action research in educational settings is not new, but it can still be challenging for teachers to include it as an active part of the curriculum. Kemmis (2009) argue that action research can create collective self-transformation, i. e., the transformation of our practices, how we understand them and the conditions that enable or constrain them. Furthermore, engaging students in action research can empower them to influence their social conditions. This approach creates close connections

between understanding and changing the world, where knowledge develops through creative processes and practice cycles (criticism, investigation, reflection, action) (Stoecker, 1999). The inclusion of citizens in research and decision-making processes, in particular, is valuable in action research to create more democratic research. Citizen science (CS) offers a framework that combines research and community engagement. CS has shown potential for transforming participants from data collectors into builders of community knowledge by applying action research methods (Evans-Agnew & Eberhardt, 2019). We argue that the framework of CS can help teachers develop students' sustainability action competence through a framework that engages young people in their local surroundings. Increasing local awareness allows critical questions to be asked, which is essential for developing action competence (Mogensen & Schnack, 2010).

Our collaboration with a Danish high school experimented with an action-oriented didactic approach. However, the rigid Danish education system and time constraints pose challenges to changing teaching methods. Therefore, it is also relevant to investigate the potential of developing new teaching programs and curricula.

The article is organised as follows: Section 2 and 3 review the literature and concepts upon which the study is based. Section 2 discusses the challenges and opportunities in planning teaching for sustainable development. Section 3 explores the feasibility of using the citizen science framework, including citizen social science, to develop sustainability action competence. In section 4 we present the empirical background and describe the case study's methods and data. Section 5 analyses the development of youths' sustainability action competence and their relationship to the neighbourhood. Section 6 discusses the key considerations for supporting citizen social science as a means of developing sustainability action competence. Finally, section 7 presents some concluding remarks.

2. Planning education for sustainable development: Challenges and opportunities

When exploring the role teaching sustainability plays in fostering youth civic engagement, it is crucial to examine the key factors in planning education for sustainable development (ESD) and the associated challenges. When outlining the study, we draw inspiration from several models and studies that have guided our research process. In this section, we describe the importance of understanding sustainability as an interconnected whole, activating practice-oriented methods and action competence and integrating the local environment when planning ESD.

2.1 Fostering interconnected and practice-oriented sustainability understanding

In educational settings, there has been a tendency to primarily emphasise the environmental aspects of sustainability and overlook the social and economic dimensions. To address this limitation, the UN (UNESCO) introduced the ESD-approach, which advocates a comprehensive exploration of all three dimensions of sustainability (environmental, social, eco-

nomic) through the sustainable development goals in teaching. This approach facilitates interconnected learning, emphasising practical action and skill development (UNESCO, 2020). Particularly in Nordic countries, educators tend to adopt an environmental perspective, centering sustainability teaching around the climate and the environment. However, they assert the importance of students gaining a critical, systemic and action-oriented understanding of the world through all facets of sustainability (UBU, 2022). In our study, we applied qualitative methods to enable students to reflect on the interconnectedness of sustainability in a nature geography class.

Given the complexity of sustainability, teachers are uncertain about how to teach sustainable development in practice (Gabrielsen & Korsager, 2018). Usually, teachers have specific topics they need to cover, but teaching sustainable development requires equipping students with certain tools. Garbrielsen & Korsager (2018) analysed teachers' experiences with handling the complexity of sustainable development and found that teaching unfamiliar subjects was challenging. Although the UN developed ESD to ease the educational transition, studies have shown that the approach needs to be more tangible. Christensen et al. (2022) discovered that teachers not only struggle to explain the complexity of sustainability but also face challenges relating climate issues to the students' daily lives. Teaching sustainable development necessitates the adoption of new practice-oriented teaching methods. Furthermore, changes to the curriculum are imperative in order to incorporate a pedagogical approach that promotes hope, action skills and critical thinking (UBU, 2022). To address these challenges, we co-designed a course with a teacher using a structured framework and conducted reflection meetings throughout the collaboration.

2.2   The action competence approach: Motivating sustainability investigations

Mogensen & Schnack (2010) explored the action competence approach as a means of supporting ESD and promoting youths' motivation to address sustainability challenges. Though they have an environmental focus, they discovered that adopting a problem-oriented perspective enhanced teaching, learning and reflection, which was crucial for fostering students' capacity and enthusiasm for action. Central to developing action competence is the promotion of critical thinking. High school students, in particular, should acquire fundamental knowledge that enables them to take a stance on sustainability challenges (UBU, 2022). The ability to ask critical questions aligns with the elements of empowerment outlined by the Brazilian philosopher, Paulo Freire, who emphasises the importance of developing a critical awareness of social, political, and financial contradictions to combat oppression (Freire, 2017). Christensen et al. (2022) argue for the need for tools that encourage reflection and dialogue on sustainability challenges and potential solutions. By nurturing critical curiosity, young individuals can develop the competence required to address sustainability challenges and engage with the local environment.

Jensen & Jørgensen (2002) formulated a framework that elaborates the concept of nature and environmental competence. They highlight four essential components of environmental action competence: 1) Knowledge and insight; 2) visionary and critical thinking; 3) engagement, will, and courage and 4) the ability to interact. Knowledge and insight are vital for understanding the environmental and societal impacts of our actions, their causes, strategies for change and potential solutions (Jensen & Jørgensen, 2002). The second component,

visionary and critical thinking, enables the creation of novel solutions to problems. Engagement, will and courage are essential for building motivation and instilling belief in the potential impact of one's action. The fourth component, the ability to interact, is integral for creating future visions through debate, feedback and the formation of social communities. Consequently, strengthening youths' capacity to interact is crucial for developing action competence. In our research, we have drawn inspiration from the four components of nature and environmental competence, combining them with citizen social science and action research methods to provide a more concrete framework.

2.3 Leveraging the local environment for hands-on learning

Effective sustainability education often requires tangible hands-on experiences as some skills cannot be acquired through lecture-based methods alone (Wiek et al., 2014). One effective approach is to incorporate the local environment as an educational resource. Gabrielsen & Korsager (2018) explored the benefits of integrating the local environment into sustainability education, and found that it fostered a stronger connection to the community and facilitated authentic first-hand knowledge acquisition. However, using the local environment for sustainability teaching demands a deep connection to the area, particularly when addressing societal and environmental challenges (Gabrielsen & Korsager, 2018). A study in an American school that implemented a problem-based teaching approach in sustainability education revealed that students were very appreciative of collaborative experiences. Such experiences motivated them to participate and made sustainability a more concrete and relevant subject (Wiek et al., 2014). Therefore, it is interesting to further investigate the impact of collaboration in this context. Despite its long-standing tradition in natural science education, empirical studies on the local environment as a learning arena remain scarce (Gabrielsen & Korsager, 2018). Due to its relevance and positive influence on youths' understanding of the local environment, we explore how local field studies can foster civic youth engagement and develop sustainability action competence.

3. Citizen social science: Fostering sustainability action competence

As mentioned earlier, CS has the potential to yield valuable insights into the local environment, thereby enhancing participants' local awareness. When combined with action research methods, CS can empower participants to become active contributors to community knowledge (Evans-Agnew & Eberhardt, 2019). According to Kasperowski & Kullenberg (2019), CS is often associated with Alan Irwin's book from 1995 *"Citizen Science: a study of People, Expertise and Sustainable Development"*. In the book, Irwin analyses different forms of deliberative governance in which people who are affected by the consequences of science and technology demand a say in decision-making. Building on Irwin's ideas, actively engaging citizens in scientific processes can offer valuable knowledge.

Because the natural sciences are traditionally emphasised in CS, there is a tendency to overlook social phenomena. This gap led social science researchers to develop citizen social science (CSS) (Albert et al., 2021), which is a relatively new concept that has not been studied

extensively, particularly in educational settings. Perelló (2022) argues that CSS enriches CS by focusing research on social aspects of groups, communities and individuals. In CS, traditionally, citizens have only been included in some stages of the research processes (such as data collection) and not all of them, and there is a pressure on the concept to move past the narrow passive application and involve citizens throughout the scientific process (Cavalier & Kennedy, 2016).

Directly involving high school students in several research processes as co-researchers offers hands-on experience, thereby fostering critical thinking, engagement, reflection and interaction with local actors. Our research delves into how CSS can be applied within educational settings for sustainable development to promote an interconnected and practice-oriented understanding of sustainability challenges, which activates action competence and uses the local environment as discussed in section 2. Furthermore, we draw inspiration from action research methods to enable the students to enter the project as co-researchers.

4. Methodology: Engaging Danish high school students as citizen social scientists

As a part of the EU-funded YouCount project, nine European countries explored hands-on strategies for involving youths (14–30 years) as co-researchers to improve social inclusion through CSS (YouCount, 2020). The Danish case takes place in Sydhavn (South Harbour), Copenhagen. Sydhavn is an old industrial area roughly divided into an old and a new part. The old part of Sydhavn is considered one of Copenhagen's six vulnerable urban areas as it faces challenges in terms of low education and unemployment (YouCount, 2020). In our study, we collaborated with a nature geography teacher, where 17 high school students (aged 18–21) engaged as citizen social scientists. Their task was to investigate the potential of local sustainable community activities to foster youth civic engagement. The collaboration consisted of 17 class modules, which ran from February 2022 to May 2022 and ended with a dissemination activity at a local festival in June 2022.

4.1 Method description

The modules were co-designed with the teacher and drew inspiration from the double diamond design process representation (Design Council, n.d.). We strategically chose this model as a framework for the co-design to provide straightforward and tangible planning steps. The modules were divided into four phases: Discover (questioning challenges and identifying needs), Define (making sense of findings), Develop (creating, testing and refining potential solutions) and Deliver (selecting a single solution and preparing it for launch) (Framework for Innovation – Design Council, n.d.) (see figure 1). These phases align with the practice cycles (criticism, investigation, reflection, action) of action research, as presented by Stoecker (1999).

Figure 1: An overview of the collaboration, categorising it into the phases of the Double Diamond model, the action research practice cycle, and the the components inspired by environmental action competence inspired by Jensen & Jørgensen (2002).

	Phases in the collaboration	Amount of modules
Knowledge and insight	**Discover / Critisism** Bring knowledge about why developing youth-friendly sustainable cities is essential. Provide an insight into the sustainability concept, how it is used, and how the students can investigate it locally. We provide tools and methods for fieldwork and analyse findings to provide insight into the local environment, its actors, and local challenges.	6
Vision and critical thinking	**Define /investigation** Provide tools for defining a problem statement. Communicate the defined challenge to the other research teams and explain why it is relevant for sustainable development in the local area. This phase should increase awareness of the different challenges in the area and create diverse visions for the youths to discuss and reflect on.	4
Engagement, will and courage	**Develop / reflection** Provide knowledge that supports young people discussion about how to participate in society. Furthermore, the phase provides methods for innovation work and stimulates creative thinking and reflection on solving the defined problem statement. The young people must test their ideas with others to secure youth-friendly aspects and courage.	5
Ability for interaction	**Deliver / action** Provide time and methods for the youths to disseminate their ideas to get valuable feedback for further development and reflection. The young people should be challenged in communicating and defending their problem statement and innovation for local actors.	1 +local festival

Each phase served a specific purpose and enhanced the components of sustainability action competence. Figure 1 outlines the purpose of each phase. The course design equipped and trained the co-researchers with the knowledge and tools required to conduct field studies in the local environment, engage in discussions and reflect on challenges and potential solutions. For a detailed breakdown of the collaboration, see Figure 2, in which each square represents a module and describes the content. The outer circles illustrate the co-design and follow-up interaction with the teacher.

The collaboration originated from the high school teacher's interest in a more action-oriented teaching approach that linked education to the local surroundings. The co-design process created a framework that integrated CSS with learning objectives related to the nature

Figure 2: Overview of the collaboration with the high school through 17 modules.
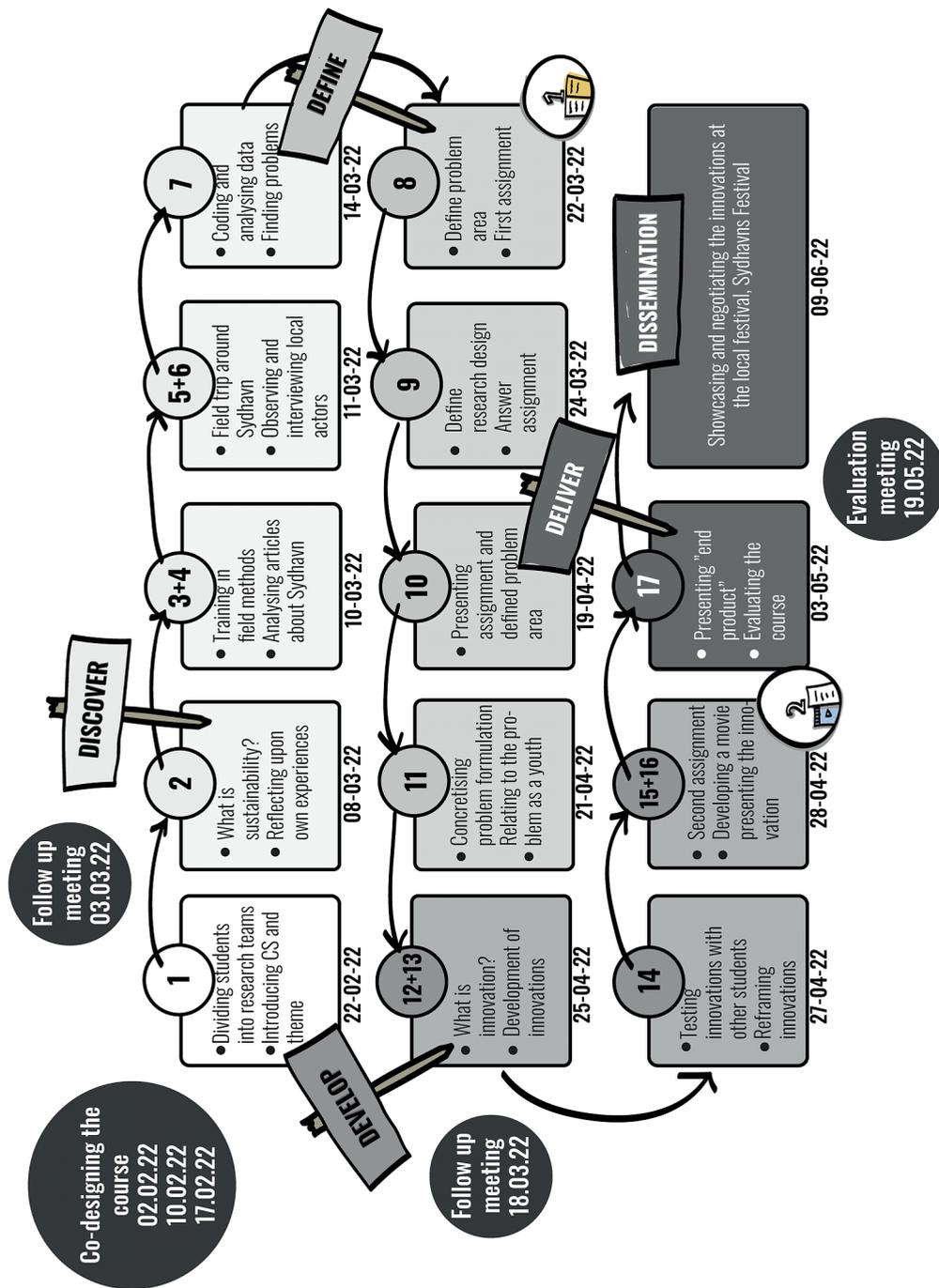
geography theme *sustainable city development.* In addition to investigating, analysing and innovating, the students were required to submit two assignments and a video presentation outlining their problem, research design, data and innovations (see figure 2, illustrated as circles containing documents).

4.2   Empirical data collection

The empirical data utilised in this article comprises two main components. Firstly, we draw on the co-researchers' experiences with various action research methods including interviews, observation techniques, field notes and thematic analysis (Beck et al., 2015). These methods allowed them to investigate and formulate problem statements. Secondly, we collected data through participatory observation (DeWalt & DeWalt, 2011), involving notetaking and observations of reactions, engagement, informal conversations and collaboration between the co-researchers. To support the evaluation, we conducted two focus group interviews, the first during the collaboration and the second afterwards, each with six co-researchers participating.

The 17 students were divided into five research teams, each of which were tasked with identifying a local sustainability challenge to address through youth-friendly solutions. The students provided their written consent to participate in the project.

The data collection phase consisted of six 1.5-hour modules (see Figure 2). The modules incorporated relevant literature and shared experiences from previous small research projects to make the methods more tangible and visual. Each team was provided with a notepad to record questions and observations. During a double module (3 hours), we went on a 4 km bike ride through Sydhavn to conduct field studies, which exposed the teams to various parts of the neighbourhood and existing sustainable initiatives. In the following two modules, students applied the thematic analysis method known as the affinity diagram (Beyer & Holtzblatt, 1997) to categorise their field notes and findings. An affinity diagram organises individual notes captured during interviews, observations and desk research to reveal common issues and themes, thereby providing a tangible and visual framework for coding. To encourage reflection on different sustainability aspects in Sydhavn, we developed an analytical model inspired by Copenhagen municipality's model for sustainable urban development (KK Bæredygtighedsværktøj, n.d.). At the end of the project, we organised a small exhibition at a local festival to facilitate interaction between the co-researchers and local actors, which allowed them to test their innovations.

5.   Analysis: Developing sustainability action competence

This section follows the structure outlined in Figure 1 in Section 4 and focuses on analysing the co-researchers' development of sustainability action competence across the four key elements inspired by Jensen & Jørgensen (2002): 1) knowledge and insight, 2) visionary and critical thinking, 3) engagement, will and courage and 4) the ability to interact. We argue that knowledge is acquired continuously throughout the process through the reading of literature and reflection, which makes it an integral part of the other three components. Our approach to

these four elements involving students as co-researchers is inspired by the literature discussed in Sections 2 and 3.

- Section 5.1(Insight) draws inspiration from Gabrielsen & Korsager's (2018) approach to field-based teaching and creating hands-on experiences, which can make the teaching more relevant to students.
- Section 5.2 (visionary & critical thinking) incorporates Mogensen & Schnack's (2010) concept of asking critical questions and insights from Christensen et al. (2022), who emphasise the importance of stimulating reflection.
- Section 5.3 (engagement, will & courage) takes a cue from Perelló (2022), who claims that CSS can support a social perspective of research objectives. Furthermore, it is inspired by Freire's (2017) work on enhancing tools enabling action and UNESCO's (2020) focus on developing practice-oriented teaching approaches to ESD.
- Section 5.4 (ability to interact) aligns with Wiek et al.'s (2014) ideas of establishing collaborative experiences for motivation.

Besides analysing the empirical data, the following sections illustrate how our study relates to the existing literature. The empirical data is presented through quotes and pictures.

5.1   Creating insight, criticism and identifying challenges

Training the co-researchers to employ research tools for exploring their local environment proved valuable for creating a practical approach to teaching. Before entering the district, the co-researchers read and discussed articles to establish a shared understanding of Sydhavn and its potential controversies.

During the field trip (See photo in figure 3), we facilitated meetings with local stakeholders, which enabled the co-researchers to interview them about issues and sustainable solutions at four locations. This experience allowed them to ask questions, accumulate knowledge about potential opportunities and challenges in the neighbourhood and cultivate genuine first-hand insights: essential for fostering strong connections between the local environment and educational institutions (Gabrielsen & Korsager, 2018).

A focus group interview with a group of co-researchers revealed that the field study left a positive impression on the students, their learning and local understanding.

"The field trip, when we cycled around Sydhavn and engaged with locals, was the highlight of the project. It was interesting to interact with different people in a divided area, as they brought new perspectives to the table." – Focus group interview, Valdemar, co-researcher.

While they were talking with the local stakeholders, the co-researchers took field notes, which served as the basis for discussions in the following modules.

Figure 3: Photo from the field trip.

We observed that most co-researchers utilised the tools provided to document their observations and took photographs during the field trip.

Although the local stakeholders primarily discussed environmental solutions for sustainable urban development, the co-researchers began to grasp the social dynamics within the neighbourhood:

"It was eye-opening to hear the frustration from the old part of Sydhavn regarding the new developments. The loss of old authenticity in new building projects and the resulting cultural differences were discussed. One person mentioned that Sydhavn is one of the few remaining working-class districts in Copenhagen that accommodates unconventional residents. This states the importance of social sustainability" – Focus group interview, Jeppe, co-researcher.

The field trip provided co-researchers with new insights that altered their perception of Sydhavn and, consequently, their ideas for promoting civic engagement in their local environment. This underscores the potential of incorporating the local environment and stakeholders into the educational setting, to cultivate a more concrete and interconnected understanding of sustainability in the area. Furthermore, it supported a real-world context for sustainability, which is essential when making tangible and relatable teaching (Christensen et al., 2022).

5.2 Visionary and critical thinking: Defining and investigating problem statements

After the field trip, we facilitated several modules during which co-researchers actively processed their data and critically assessed their findings. The photos in figure 4 illustrate the co-researchers' analytical processes with the collected data. They engaged in discussions and coded their experiences into problem statements for further investigation.

*Figure 4:* Co-researchers working with the empirical data after field studies.
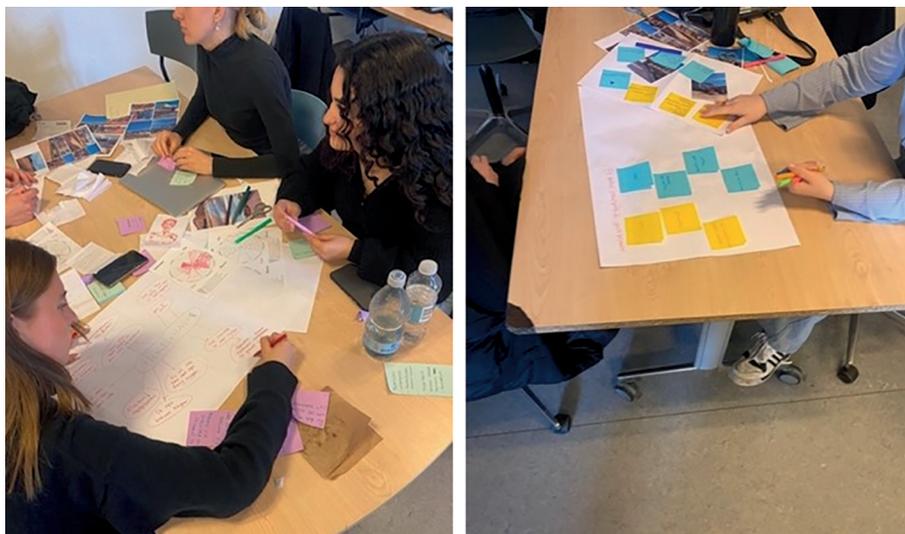
Allowing students to actively engage with the data enabled them to develop their own vision for the projects. Giving them the role of co-researcher gave them a new way to participate in the learning process:

"Giving us tools to investigate the local area helped us establish a background understanding of the problems and ideas of the neighbourhood's residents. It allowed us to grasp how they perceived sustainability challenges, which enhanced our basic knowledge of the area. It gave us new insights that fueled our creativity" – Valdemar, co-researcher.

By coding data and discussing their findings, the co-researchers had the opportunity to critically evaluate the local area and question their observations. Like Mogensen & Schnack (2010), we found that developing critical consciousness can help youths react to the state of the world and take position. As part of the definition phase, we developed an analytical tool that prompted the co-researchers to relate their observations to the three dimensions of sustainability, which made the analytical process more concrete and interconnected (UBU, 2022). This tool encouraged discussions and reflections about the effect the locations that were visited had on the social, environmental, and economic parameters (see figure 5, left side). If the local area supported the sustainability consideration, the co-researchers had to color the whole area in the analytical tool. However, if their observations only partly supported the

sustainability consideration, they only had to color some areas of the tool (Figure 5, right side).

Figure 5: Pictures of the analytical tool, inspired by Copenhagen municipality's model for urban sustainable development (KK bæredygtighedsværktøj, n.d.) before and after the exercise.
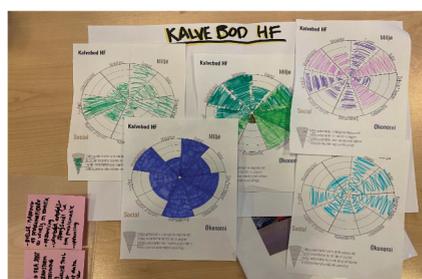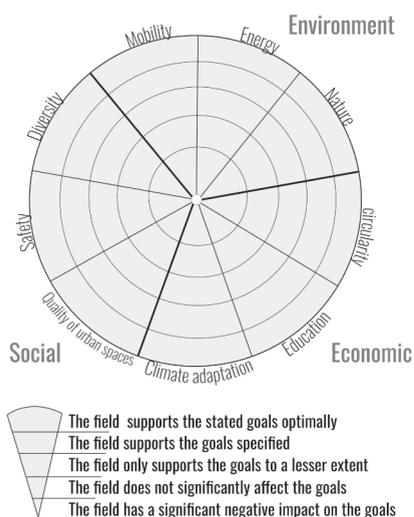
The co-researchers' reflections and the tool helped them develop their problem statements and stimulated further discussion about their findings. The observations highlight the importance of facilitating the analytical processes as it creates space in the educational setting for students to discuss, stimulates reflections on methods and observations, and fosters ongoing dialogue about sustainability challenges and opportunities. Being able to stimulate reflection is also highlighted as an important task to raise in teaching, because it supports developing students' capacity to make responsible choices (Christensen et. al, 2022). The practical approach enhanced the students' understanding of the area, enabled them to view problems from different perspectives and resulted in more complex insights into opportunities and dynamics. Additionally, it provided a tangible setting for considering real-world solutions. Co-designing the course with the teacher revealed that concretising concepts and encouraging students to take a position were essential for their engagement. Field-based approaches expanded the co-researchers' awareness of various aspects of the local environment.

"It has been super interesting because it is so different from what we are used to; Sydhavn is not just a boring place because there are so many different districts and people" – Olivia, co-researcher.

5.3   Enhancing engagement, will and courage: Developing reflective innovations

Engaging the young co-researchers resulted in them gaining a deeper understanding of the neighbourhood's complexities and the way in which relationships influence collaboration between the various districts of Sydhavn. They became aware of demographic divisions, which inspired them to seek sustainable ways to connect the areas. Although the co-researchers only interacted with a few community members, they grasped key aspects of the local dynamics. This social understanding is highly relevant to incorporate in activities in the natural science classes and sustainability teaching. It prompts students to reflect on the challenges of turning sustainable ideas into reality in neighbourhoods. Applying CSS in education enables co-researchers to consider the social dimension of sustainability, because it brings a social focus (Perelló, 2022). This is essential, because understanding the social processes that drive sustainability challenges and developing practical judgment are essential for responsible action that does not harm the community (UNESCO, 2020).

For instance, one group focused on the segregation between the old and new Sydhavn and explored the impact this segregation has on daily life. They also delved into subjective attitudes towards gentrification. The field trip provided valuable impressions of lifestyles in these districts. This engagement with the local environment not only brought co-researchers closer to the local environment, it also shed light on underlying challenges between the old and new Sydhavn. It motivated the co-researchers to explore ways of bridging these divisions through environmentally sustainable activities. Another group wrote the following in their assignment:

"We observed a unique focus on social sustainability in the fishing port in Sydhavn, which stood out from other districts as there was an emphasis on environmental sustainability and energy efficiency. This distinction, combined with the ongoing urban development challenges, sparked our interest. We intend to investigate the tensions between the new and the original residents in the fishing port and explore cultural shifts associated with recent construction projects." – Excerpt from Liva, Sebastian, Cecilie, and Anahita's assignment.

Using qualitative CSS methods in education has the potential to boost motivation and drive change among co-researchers. The co-researchers found it relevant to investigate the social parameters behind the sustainability challenges, which demonstrated that they were taking responsibility for supporting the development of ideas that could guide the neighbourhood in alternative directions. This approach fosters a more interconnected understanding of sustainability, making it tangible for the teacher to facilitate through concrete tools:

"We haven't tried to facilitate the innovation in real life, but it has great potential, we are trying to establish a strong community in Sydhavn between the old and the new, but through an environmental sustainability activity (collecting trash)." – Valdemar, co-researcher. *"It won't necessarily be easy, but it wouldn't take many resources to establish such an event compared to building new greenhouses (referring to another innovation)".* – Frida, co-researcher.

The quote illustrates the co-researchers' engagement with their innovation, and their will to explore its potential further. Some even returned to the field after school hours to present their

innovations to some of the residents in the area. They did this because they needed more information about the district to develop their innovation and complete the assignment. This illustrates the co-researchers' initiative, courage and desire to gain more knowledge about the residents in the area. The process not only equipped them with tools to work with their findings, it also nurtured action-oriented skills, which they could use to tackle sustainability challenges, thereby echoing Freire's emphasis on empowering people with practical tools to drive positive change (Freire, 2017).

5.4   Enabling interaction: Delivering the innovations for action

Throughout the collaboration, the co-researchers enhanced their ability to present and discuss their findings and innovations with each other, which improved their capacity to advocate for their ideas.

"We were not sitting individually in front of the computer, it was very much discussion-based, which gave you the ability to argue for the idea." – Valdemar, co-researcher.

These collaborative experiences are essential for creating motivation and making the subject of sustainability more concrete (Wiek et al., 2014). We witnessed courage to interact with local actors. As described previously, establishing debate, critical awareness and feedback is essential for future sustainable visions and innovations (Jensen & Jørgensen, 2002).

To acknowledge and support the co-researchers' ideas, we organised an exhibition during a music festival in Sydhavn, where the co-researchers showcased the knowledge that they had developed during the 17 modules. This event allowed local stakeholders and residents to engage in discussions and provide input for further development (see Figure 6).

Figure 6: Photo of the festival.

The exhibition consisted of posters which guided dialogue about the collaboration and three movies which presented the co-researchers' sustainable innovations. We also placed poly-

styrene boards which illustrated their innovations and allowed the audience to add their reflections (see Figure 7).

Figure 7: The polystyrene boards illustrating one of the innovations. The audience's additions is seen on the right side and the co-researchers' ideas on the left side of the board.

While only three of the 17 students participated in the festival, it was still valuable for disseminating the co-researchers' work and allowing them to interact with the local community. The event placed their innovations in a real-world context, and demonstrated the potential for creating new conversations. Having an opportunity to discuss with residents outside school stimulated different types of discussions than those that occurred in the classroom:

"We talked to people about how we have focused on different sustainability aspects, and the district in Sydhavn we have focused on. The audience we spoke to told us that they had a close relationship with the area, so it would be nice to have an idea like ours to get started with" – Rachel, co-researcher.

The innovation the quotation refers to is a community garden, the aim of which was to make the new district greener and create a meeting point for residents. Through participating in the festival, the co-researchers gained awareness of the community's interest in their innovations. The exhibition created a space in which the audience took the co-researchers seriously and showed that their ideas could foster inspiration.

By enabling local actors to interact and reflect on the co-researchers' work, we created a tangible way of fostering new perspectives on their innovations.

As a part of our collaboration, we provided the co-researchers with various creative tools such as design games, frameworks and paper-based exercises to stimulate interaction and

discussion within their groups. These tangible materials were well-received by both students and the teacher as they made the process more engaging. The teacher expressed interest in using similar materials in future classes, thereby highlighting the need for additional support in developing new educational materials and tools for sustainability teaching.

6.   Discussion

As the results indicate, implementing CSS in an educational setting has significant potential for advancing sustainability teaching and fostering sustainability action competence among students. The various components of our approach, including field studies, data processing, innovational work and dissemination activities, provided students with tangible, hands-on exercises that increased their engagement with the local environment. In particular, making sustainability teaching more practical is something that is frequently requested by teachers and educational institutions (Christensen et al., 2022; UBU, 2022; Wiek et al., 2014). Furthermore, this approach enhanced their understanding of the neighbourhood, encouraged critical reflection and contributed to their overall knowledge development.

It is important to note that while the positive outcomes are evident, it remains unclear whether it was the action research methods in an education setting, the opportunity to participate in an EU-funded project, exposure to relevant literature, the creative exercises initiated before and after the field trip, or a combination of these that had a positive influence on the co-researchers' engagement. However, one or more of these elements had an impact on the students' connection to the area.

Throughout the project, our aim was to facilitate collaboration by structuring it through the design phases of discover, define, develop and deliver to meet the components of sustainability action competence. While this approach demonstrated its effectiveness in fostering sustainability action competence, further investigations are needed. Collaborating with additional high school classes and exploring different districts may provide a more comprehensive understanding of the potential benefits of the approach and may highlight potential areas for improvement.

6.1   Moving from case to implemented approach.

Developing sustainability action competence among the co-researchers was a time-consuming process which necessitated careful planning, facilitation and collaboration with the high school teacher and external stakeholders. However, constraints on teachers' time due to their busy schedules may make it challenging for them to dedicate sufficient time to such activities. Therefore, there is a need for a well-structured concept and supporting materials to facilitate the integration of CSS and action research methods into educational settings.

In Denmark, many high school teachers rely on online platforms to access teaching materials that align with their specific learning objectives. While this approach is convenient, it frequently lacks action-oriented resources (Systime STX, n.d.). To address this gap, we integrated the action research principles of criticism, investigation, reflection and action

(Stoecker, 1999) into our approach, in order to provide teachers with a more hands-on and interactive approach to education for sustainable development (ESD).

Although we collaborated with a nature geography class and covered the learning objectives of sustainable cities, it revealed that the competencies developed through a CSS approach are applicable to various high school subjects including social sciences, economics, mathematics, language and biology. However, ESD is still in its early stages across educational levels and experimental examples like the ones presented here are crucial for incorporating sustainability action competence.

According to our analysis, the co-researchers demonstrated that they gained competencies through a CSS approach, which allowed them to:

• Move from taught knowledge to investigating a local context
• Define a problem based on field data
• Develop a solution to a defined problem
• Disseminate and discuss a problem and potential solutions

Applying the competencies above to the central components of environmental competence (knowledge and insight, vision and critical thinking, engagement, will and courage, ability for interaction) (Jensen & Jørgensen, 2002) creates a simple framework for supporting sustainability action competence in teaching (see Figure 8).

Figure 8: Illustration of the developed framework of sustainability action competence.
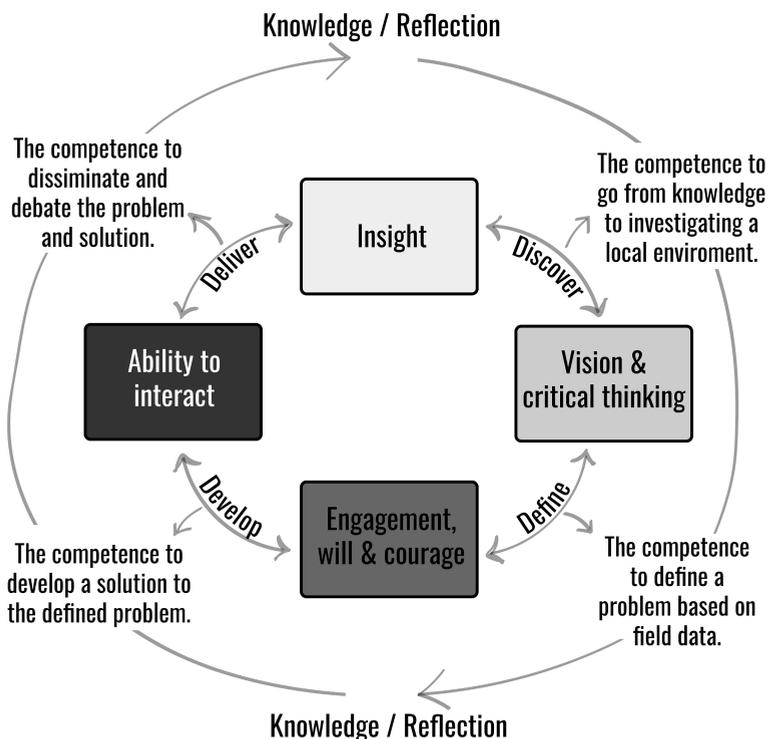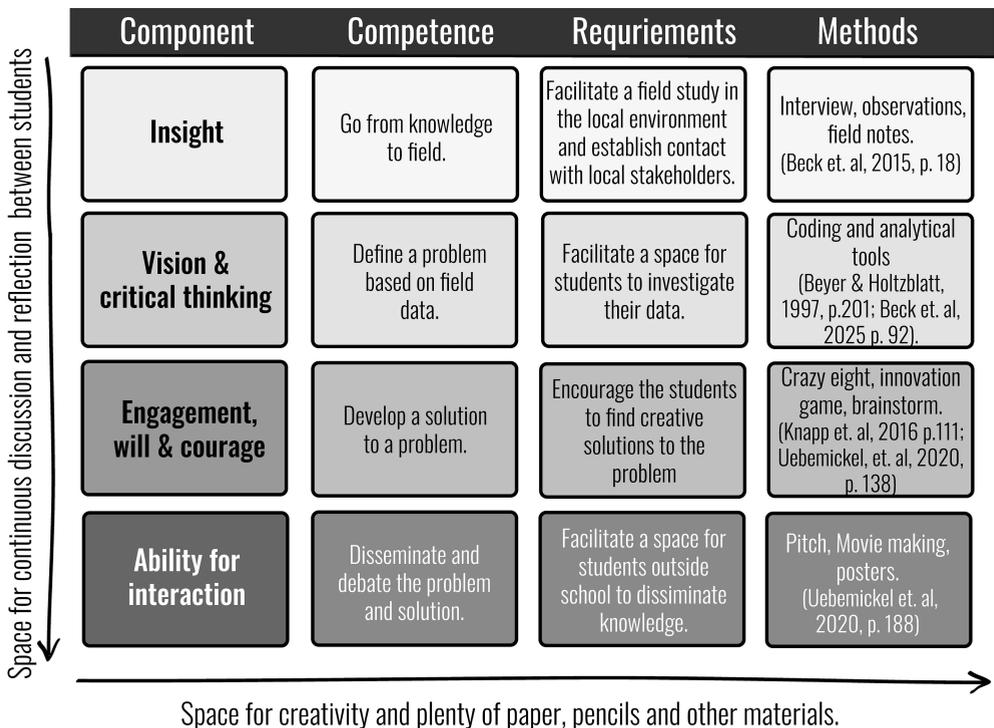
This model allows teachers to integrate their class-specific learning objectives into the framework and use it as a practical tool for inspiration and planning. Each box in the figure contains the main components of sustainability action competence while the arrows between the boxes indicate the skill necessary to obtain the competence. Throughout the process, knowledge must be shared, discussed and reflected upon during all phases. To implement this approach successfully, teachers need to create an environment that stimulates and supports discussion throughout the competence-building process as this encourages the students to be creative and reflective.

Effective implementation also means that the teacher must develop professionally, while adjustments must be made to the curriculum in order to incorporate field studies, action research and innovative teaching methods that foster creativity, problem-solving and critical thinking among the students (Mogensen & Schnack, 2010; UBU, 2022).

Our study demonstrated that involving students in field studies, encouraging collaboration within research teams (Gabrielsen & Korsager, 2018), allowing creative problem-solving and providing opportunities for dissemination and discussion with the local community all contributed to heightened student engagement and motivation.

Figure 9 presents the components, competencies, requirements and suggested methods to enhance sustainability action competence in an educational setting.

Figure 9: Illustration of the components, competences, requirements and suggested methods to enhance sustainability action competence in an educational setting.

Component	Competence	Requriements	Methods
Insight	Go from knowledge to field.	Facilitate a field study in the local environment and establish contact with local stakeholders.	Interview, observations, field notes. (Beck et. al, 2015, p. 18)
Vision & critical thinking	Define a problem based on field data.	Facilitate a space for students to investigate their data.	Coding and analytical tools (Beyer & Holtzblatt, 1997, p.201; Beck et. al, 2025 p. 92).
Engagement, will & courage	Develop a solution to a problem.	Encourage the students to find creative solutions to the problem	Crazy eight, innovation game, brainstorm. (Knapp et. al, 2016 p.111; Uebemickel, et. al, 2020, p. 138)
Ability for interaction	Disseminate and debate the problem and solution.	Facilitate a space for students outside school to dissiminate knowledge.	Pitch, Movie making, posters. (Uebemickel et. al, 2020, p. 188)

Space for continuous discussion and reflection between students

Space for creativity and plenty of paper, pencils and other materials.

However, further research involving various classes, teachers and students is required to refine this framework. It is essential to determine whether the framework can function as an independent educational package, or whether it requires the co-design and support given in this project. In addition, future research should explore the impact of discussion, creativity and physical tools (such as design games and paper-based frameworks, etc.) in educational settings on students' engagement and motivation.

6.2   Supporting youth engagement and local action

Combining action research methods and citizen social science presents a promising avenue for engaging young people in the local environment, fostering their ability to identify opportunities and propose changes to the neighbourhood. As mentioned, previous studies have demonstrated the effectiveness of integrating action research and citizen science, such as the study by Evans-Agnew & Eberhardt (2019), which involved youths in air sampling through photovoice, where they transformed from data collectors to active contributors to community knowledge and drivers of policy change.

In our research, we have identified the potential of combining CSS and action research methods within an educational setting to encourage an interconnected reflection on sustainability challenges. During the local festival, we observed that the co-researchers took pride in their work and engaged in discussions with the audience. This indicates a self-transformation process facilitated through collective knowledge development, which is a fundamental aspect of action research (Kemmis, 2009).

Incorporating educational activities into public settings and involving the local environment and its actors offers young people authentic, first-hand knowledge (Gabrielsen & Korsager, 2018) and empowers them through the educational institution. Though the students did not implement their ideas, they engaged in observation, definition and idea development, which they were able to evaluate at the local festival. This approach aligns with the principles of Paulo Freire (2017), who emphasises the importance of equipping people with tools to address oppressive experiences through reflection, analysis and action. The co-researchers not only had the opportunity to investigate and define challenges in the neighbourhood, they also, and more importantly, had the opportunity to propose actionable solutions. This approach also brought new perspectives about the local environment, which opened up further opportunities for youth engagement.

7.   Conclusion

In this paper, we have investigated the potential of utilising a Danish high school setting to foster civic youth engagement in the local environment. Furthermore, we explored the effectiveness of combining CSS and action research methods as a supportive framework for cultivating young people's sustainability action competence. Our findings suggest that further investigations of this combination are warranted, in order to promote an action-oriented approach within educational institutions when implementing ESD.

Our research underscores the importance of incorporating practise and field-based approaches into the curriculum, as these approaches make literature and methods more tangible for both students and teachers. While it is challenging for teachers to find the time to implement alternative approaches to sustainability teaching, our study presents an opportunity to address the complexity of sustainability and connect teaching to students' everyday lives.

By training the co-researchers in action research methods and hands-on exercises, we equipped them with tools to explore and experience the local area differently. This approach encouraged meaningful discussions and reflection, which developed understanding and built critical awareness. Facilitating learning environments that inspire the students to step out of the classroom and away from their computer screens was shown to significantly increase their engagement.

Our analysis demonstrates that co-researchers developed competencies in terms of insight, visionary and critical thinking, engagement, will and courage and the ability to interact. Incorporating the elements of CSS contributed to an interconnected understanding of sustainability challenges, which is a crucial aspect for successful sustainable transitions. Furthermore, the framework brought the co-researchers closer to the local community by providing them with methods to explore the neighbourhood and gain valuable collective knowledge about the opportunities for civic engagement.

Given that the analysed case, nature geography, combines social science and geomorphology, we see the potential of including CSS in various subjects such as social science and natural science classes to gain a broader understanding of global issues. High school teachers often face pressure to achieve specific learning objectives within a limited timeframe. To facilitate the adoption of this approach without the support of researchers, the framework should be formalised and seamlessly integrated into teachers' daily responsibilities.

8.   Acknowledgements

9.   References

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