

“It feels like I’m touching the soil!” STEAM Gardens for a transdisciplinary and transformative science education

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Laying the foundations

- World facing unprecedented environmental, social, and ecological crises.
- Scientific knowledge and critical thinking skills are crucial – but also ***forging connections across knowledges and disciplines*** which deconstruct racial, gender, and linguistic hierarchies (Holbrook et al., 2020).
- Need to foster interdisciplinarity and transdisciplinarity, and ***relational spaces***, an ongoing challenge for science education (Calabrese-Barton & Tan, 2020)

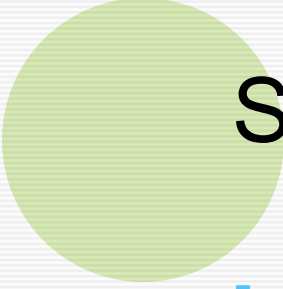
Science Education and STEAM Education

- STEAM (Science, Technology, Engineering, Arts, and Mathematics) practices can foreground relational and material-aesthetic perceptions.
- Shift from emphasis on transmission to cultivation of attitudes and abilities, attending to diversity of modes of knowing (Burnard & Colucci-Gray, 2019).



A Sensorial and Embodied STEAM Education

- Shifting from perspectives environment and wider community as 'out there' - drawing attention to commonalities through direct embodied and sensorial-aesthetic experience (Colombetti, 2014).
- Grounding learning in embodied experience may develop scientific literacies (Kersting, 2021), and encourage community action linked to local and global issues of sustainability (Dutta & Chandrasekharan, 2025).
- Opportunities for exploring how embodied and sensory explorations may encourage engagement in and across subject disciplines often siloed in schools (Fooladi et al., 2023).



Scottish Educational Environment

- Educational policy (Learning for Sustainability Action Plan 2030) and Curriculum for Excellence encourage *interdisciplinarity*, but rarely actualised in practice (Christie et al., 2019).
- Tensions of holistic, socially-progressive approaches and 'mastery curriculum' (Hancock et al., 2023); need to challenge illusion of educational environments as 'politically neutral spaces' (Hunter & Cassidy, 2019).
- How can we foster *transdisciplinary* approaches rooted in issues, experiences, and knowledges that resonate with the local and wider community?

School Gardens, STEAM Gardens

- Gardens can promote modes of science learning that are cognitive and sensorial; evolving as both science (classification of plants, species) and art (colour, design, pattern) (Gray et al., 2021).
- Relationships with community, intergenerational learning (Hancock et al., 2023); but how far are gardens valued in these ways?



▀ School Gardens Research

“Research has established that the benefits of using school gardens in the learning and teaching process have a direct effect on academic performance, positive results of diet in students, and an increase in the intention of students to perform physical activity and develop psycho-social skills.”
(Castillo et al. 2023, p. 2)



Publications on school gardens between 1999 and 2022.

Context of the Study: Sowing the Seeds

- Funded by Horizon Europe as part of the Sense.Steam project, meeting several EU priorities (Green Deal, Health, Work-Readiness).
- Rooted in an embodied and phenomenological framework, through which we explore entanglements of body, material, and space (Braidotti, 2013).
- Nine S1 students (age 12-13; 8 female, one male) and their teacher in a Scottish secondary school in an **elective gardening group, based in the Home Economics classroom**; 16 researcher visits over school year.





Research Questions

1. What are the key features of a transdisciplinary STEAM approach to science education as experienced in the school gardens?
2. In what ways might sensorial-aesthetic and embodied experiences in and across the educational spaces foster transdisciplinary learning and teaching?
3. To what extent can STEAM Gardens engage with curriculum tensions, surface knowledges in the local community, and highlight matters of concern to young people and their families?

Analytical Approach

- Data from observation notes, images, student pre-questionnaires are **layered** (Lambert, 2019; MacLure, 2013) to surface discourses, tensions, and opportunities of transdisciplinary STEAM practices: **a speculative inquiry** (Rousell, 2021).
- Relational materialist lens (Hultman & Lenz Taguchi, 2010), with entanglements of material, data, researchers, human and more-than-human; foregrounding sensorial-aesthetic and embodied **encounters**:

“our reality cannot be thought upon as socially constructed involving humans only, as is so often the case in educational research. Non-human forces are always involved in this construction” (p. 529)

- Material artefacts also acting upon the human – constant and complex dialogue.

Findings: Relational and Affective Knowing

- Intensity of sensorial encounters with material artefacts of the garden (plants, soil, roots).
- Combined with activities of the home economics classroom (cooking, baking, painting) grounded the role of the sensing body in science education (Colombetti, 2014).



"it smells, like, sharp"

a. Which sense do you use the most in Science?

hearing :3



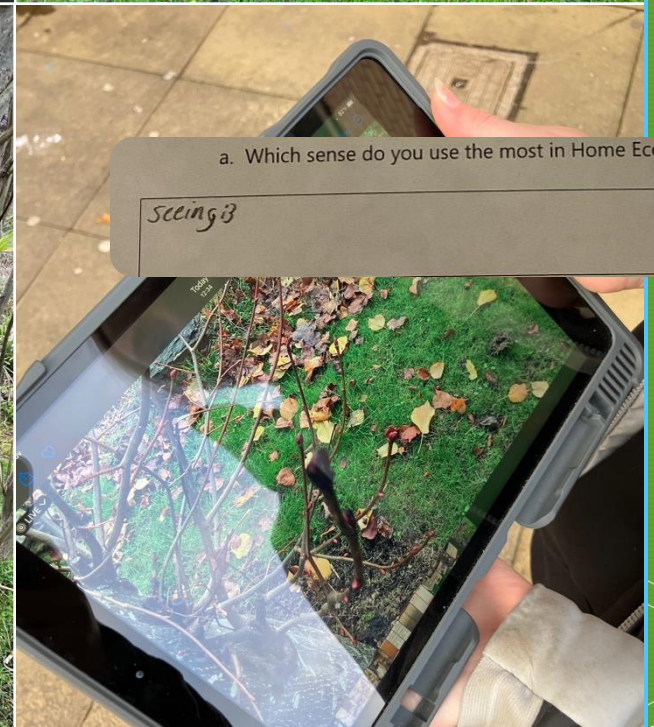
"The soil was following me, now I'm following the soil"



"we can just use our hands"

a. Which sense do you use the most in Home Economics?

seeing :3



Movement, transition, transformative spaces

Relaxing



I like eating my lunch there sometimes



a. What does the space make you feel like?

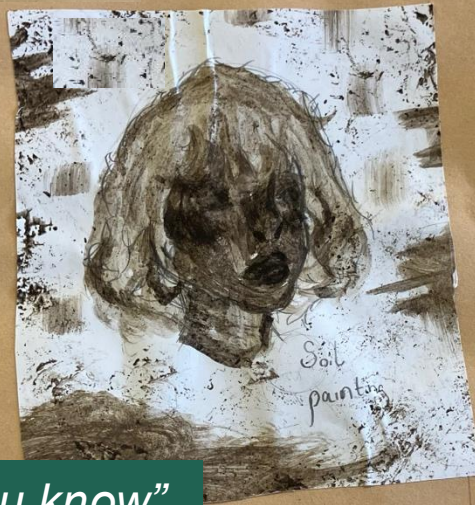
silly

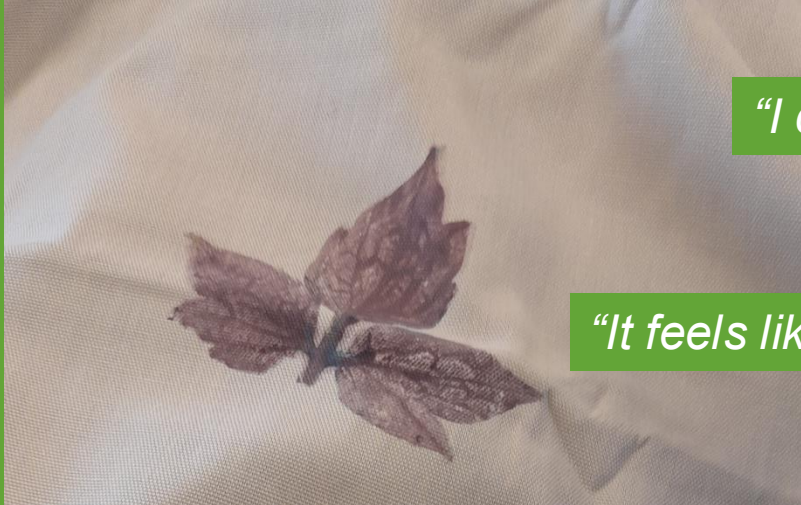
*"what happens when you mix
two soils together?"*

*"I can't wait to tell
my Art teacher"*

"soil has a life of its own, you know"

*Working / Touching
the soil*

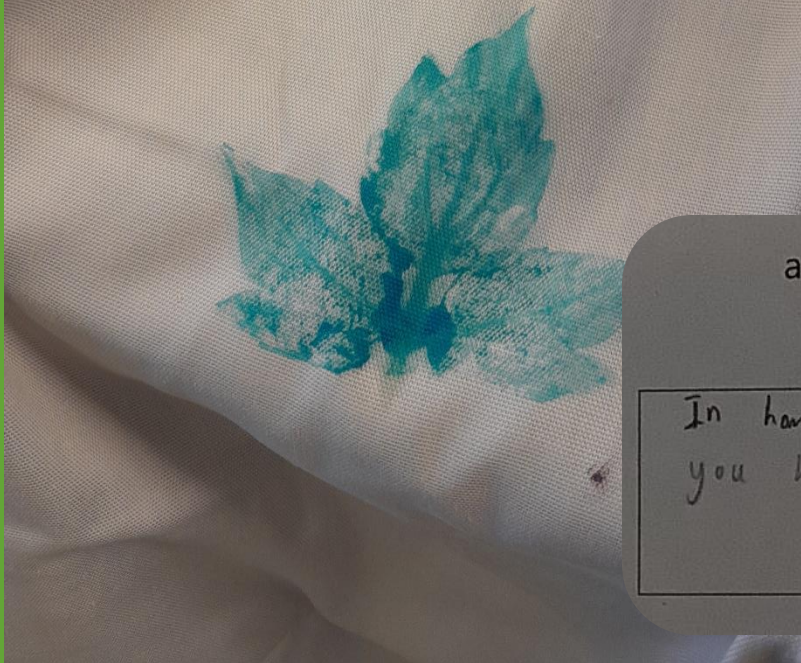




"I can show my parents that I made this"

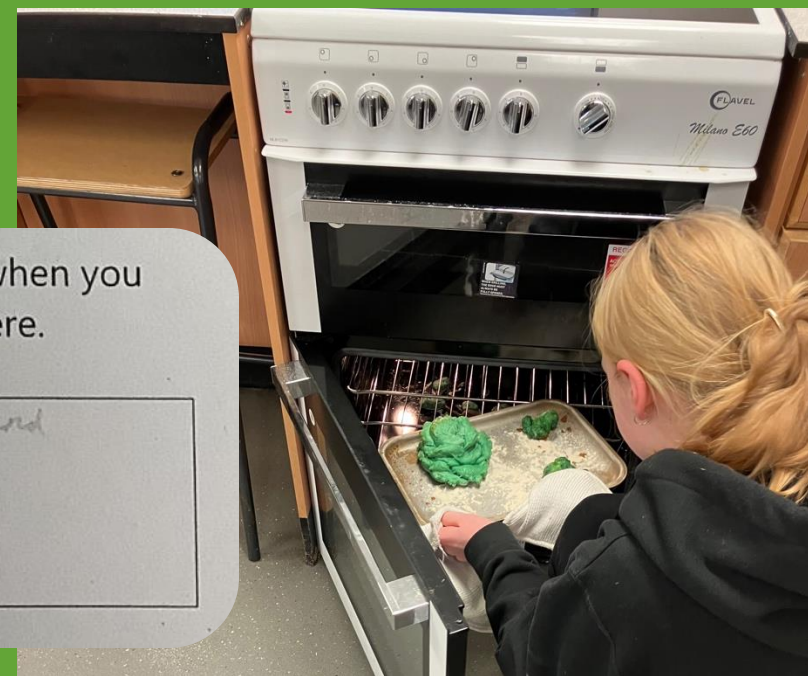
"It feels like touching the soil"

"it can be like an assembly line, imagine you're in a factory"



- 
- a. If you have an example from your time in school when you enjoy using your senses the most, please add it here.

In home eco when we are being told what to do and you have to follow the orders to perfection.





“We need to think about who is going to look after the garden next year... and the summer. It needs to be protected.” [pupil]



“we don’t know what’s happening, now we know” [parent]



Emerging Activism

- Weeding highlighted issues of litter, vandalism, lack of resources: growing understanding of how different educational spaces are valued.
- Students taking action to raise awareness: holding a plant and bake sale and organising a visit for parents.
- Such actions demonstrate a developing activism in advocating for issues that matter to them in the school and community (Calabrese-Barton & Tan, 2020).

▶ Concluding thoughts

- Widened students' perceptions not only of what science education is but *what it could be*.
- Direct embodied and sensorial-aesthetic encounters disrupt established disciplinary divides and hierarchies (Colombetti, 2014), acknowledging the value of different ways of seeing, being, and doing in education (Calabrese-Barton & Tan, 2020).
- Inviting the community disclosed opportunities for transdisciplinary practices which engaged with issues that *matter* to students, teachers, parents – developing a 'transformative political imagination' (MacIntyre, 2013).
- There are continuing tensions in how such spaces of emerging activism are seen and valued by schools, curriculum, policy and politics.

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