Perspective

Working to overcome the fear of student discomfort and peer judgment while teaching for sustainability

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Abstract English: How we teach is strongly influenced by the culture we teach in, especially what (we believe) our colleagues think is good and acceptable. Understanding the reluctance to changes in teaching practice, including fear of disapproval from colleagues and students, investigating and reappraising those fears, and starting to talk about alternative interpretations is a first step towards overcoming the inertia with inhibits changes in teaching practices that are urgently needed for a sustainable future.

To start these conversations and work towards change, we here present a teaching situation. A teacher, author 1, stepped out of the culturally accepted role according to feedback from a colleague. Triggered by this feedback, the teacher questioned herself on whether this part of the lecture was appropriate and on how the students perceived the situation, and talked to another colleague, author 2, about the situation. To inform the reflection, we asked students for feedback. We speculate on and discuss the implications of their responses, and invite you to join the conversation.

Abstract Swedish: Hur vi undervisar påverkas starkt av den kultur vi undervisar inom, särskilt av vad (vi tror att) våra kollegor anser vara bra och acceptabelt. Att förstå motviljan mot förändringar i undervisningspraxis – inklusive rädsla för ogillande från kollegor och studenter – att undersöka och omvärdera dessa rädslor, samt att börja prata om alternativa tolkningar, är ett första steg mot att övervinna den tröghet som hämmar de förändringar i undervisningen som är akut nödvändiga för en hållbar framtid.

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För att inleda dessa samtal och arbeta mot förändring presenterar vi här en undervisningssituation. En lärare (författare 1) avvek, enligt återkoppling från en kollega, från den kulturellt accepterade lärarrollen. Triggad av denna återkoppling började läraren ifrågasätta om denna del av föreläsningen var lämplig och hur studenterna uppfattade situationen, och diskuterade detta med en annan kollega (författare 2). För att ha mer underlag till diskussionerna, bad vi studenterna om återkoppling. Vi spånar kring, och diskuterar innebörden av, deras svar, och bjuder in dig att delta i samtalet.

Keywords:
Teaching for Sustainability, peers, students, reflection-on-action, techno-scepticism

1 Setting the scene

Léa was discussing a large variety of groundwater contamination from anthropogenic origin, in lecture 4 of 6 that she was scheduled to give in the groundwater chemistry module of the groundwater engineering course. She felt that she had built a good relationship with the students who were engaged and curious, and this gave Léa the confidence to step outside of how the course had previously been taught, purely focussed on facts. She decided to add some personal thoughts on the topic she was teaching, and after explaining the different types of existing remediation techniques and their intrinsic limits, she shared her professional opinion that all these technical "solutions" are overall powerless to clean contaminated groundwater. She talked about her experience working with consultants on groundwater remediation, quoting for example this statement by an expert "the law says you have to clean, nature says you cannot, but you know, people like the placebo effect". She emphasized a series of issues arising, according to her, from the fact that companies in charge of remediation are driven by profit and not by the need to actually clean up. After the lecture, Léa's colleague who was sitting in the room to prepare for taking over the class next year approached her and shared her discomfort with Léa challenging the work of environmental consulting companies and thus stepping out of the traditional role. This made Léa wonder: How did students take my "rant"? Did I make them uncomfortable? Did I overstep any boundaries? And this is where our conversation starts.

2 Teaching for Sustainability: wicked problems and values

Teaching for Sustainability is urgent and critical to prepare students for the end of the world as we know it (Stein et al., 2022). It is also a big challenge for teachers (McCune et al., 2024), since sustainable development is a wicked problem (Lönngren et al., 2017). Wicked problems are extremely complex problems that do not have a clear cause or formulation, that will never be "solved", only dealt with better (or worse), where there is no way to test any of the infinite possible solutions before implementing them, and where the many representations and approaches are all valid depending on underlying norms, values or perspectives (e.g. Hamshire at al., 2024).

The wicked problem of groundwater contamination is at the centre of our paper. Groundwater contamination is ubiquitous, uncontrollable and posing serious threats to drinking water and ecosystems. Technical "solutions" to this problem, developed and deployed by the "groundwater remediation" private sector, are largely ineffective, use-up a significant amount of resources and public money, and may lead to additional contamination (Søndergaard et al., 2018; Lévy, 2024). These techniques include e.g. excavation followed by moving contaminated sediments to a different place (see e.g US Department of Energy Moab UMTRA project), pumping contaminated water from an aquifer where back-diffusion from the solid matrix may eventually re-contaminate the water (Kulkarni et al., 2022; Carroll et al., 2024) or injecting chemicals and microbes into the subsurface to chemically and biologically degrade the contaminants, with debatable effects (Grieger et al., 2010; Lévy et al., 2022). How we should deal collectively with this

problem is an open, largely political, question and thus arises the central question of this paper: "h*ow to teach Engineers about groundwater contamination and remediation*?"

Understanding that different values might lead to different evaluations of the same situation, as well as to different approaches, is an important aspect of the key competencies for sustainability that the literature has converged on (Redman & Wiek, 2021; Brundiers et al., 2021). However, this is very far from the lived reality of students and teachers, especially in STEM, where the overwhelming experience is that there is one correct solution, or at least one that is better than others, based on measures that are usually not contested. Traditionally, STEM teachers are expected to teach the "pure content", that many would claim is value-free (Cech, 2014), but every choice to (not) include something in the curricula is based on values, even though they are usually not made explicit (Ottemo et al., 2020). Techno-scepticism, or indeed any critique of the status quo, is thus extremely difficult to teach to students that are being socialized into a culture of disengagement by the whole environment within their engineering schools (Pleasants, 2024; Cech, 2014). While being "neutral" for many STEM teachers seems important, we challenge the idea that this is a tangible or even desirable aim: For us, teaching is not only about *qualification* for future employment and *socialization* into being a good employee, but also about *subjectification*, i.e. becoming autonomous and independent in thinking and acting (Biesta, 2009). For this, it is important that we teach key competencies for sustainability, like values thinking (Redman & Wiek, 2021; Brundiers et al., 2021). But since it is still unusual that STEM teachers take a personal stand on a topic, and when it happens, it can be perceived as them breaking the implicit contract of what it means to be a STEM teacher. But is it really? Or are they, on the contrary, attempting to teach an important lesson?

3 Taking a personal stand in an Engineering course: teaching groundwater chemistry

The Groundwater Engineering course is taught to master students at the Faculty of Engineering at Lund University, for a total of 7.5 ECTS. Within this course, two weeks are dedicated to groundwater chemistry, with four lectures and two exercise sessions. The curriculum covers chemistry basics, introduction to fluid-rock interaction and biogeochemical reactions – i.e. natural processes – as well as anthropogenic influence on groundwater, including contamination and remediation attempts.

In December 2024, Léa was teaching this groundwater chemistry module for the fourth time and had adjusted the course content and teaching method to make it (i) as relevant as possible to current challenges and possible future jobs and (ii) as understandable, interactive and exciting as possible to catch the interest and attention of an audience with diverse background (civil engineers with very limited chemistry background, environmental engineers with strong chemistry background, international program on waste water engineering with multiple backgrounds).

This fourth edition seemed to have generated general enthusiasm and interest for the course, based on initial feedback. The positive interaction with the students during the first three lectures, and confidence built over the previous course editions, as well as through student supervision, on the fact that students want to learn more about groundwater contamination and remediation, led Léa to approach this topic in a more

authentic and personal manner, i.e. sharing personal experience and personal opinion, at the same time as presenting the different contaminants, their sources and the (unsatisfactory) remediation strategies. She wrapped-up her presentation of contamination sources and remediation strategies with the following statement: “I hope you have understood that PFAS are everywhere and there is no good method for cleaning the contaminated groundwater. The only way to eventually stop this would be to ban PFAS production, but the EU has been unable to take such a decision, let alone the US”. Similarly, after describing the hypocrisy she perceived around clean-up projects, she stated that “groundwater remediation is a juicy business financed partly by public money, and so far they are not solving anything, but they are making a lot of money”. Driven by the need to explain why she considered it relevant to address this during the course, she added: “one day you might work for an environmental consulting company and deploy clean-up strategies, or you might work for a real estate promoter who needs to obtain a risk analysis of the land in terms of pollution, before being allowed to build anything. I want you to enter these jobs with a critical spirit and be able to question the practices there”.

Léa felt that students were especially attentive and captivated by this part of the lecture. However, a fellow teacher, who attended the lectures in order to take over the teacher role at a later stage, approached Léa afterwards with the following feedback: “you are very negative towards remediation companies, maybe what they do does not work to the extent we hope but at least they are trying, and we still need them”. Léa started questioning herself on whether she had overstepped her teacher role in sharing her judgement on the activities of these companies.

4 Teacher reflection on action

When Léa told her colleague Mirjam about the experience described above on the day it happened, they decided to investigate the situation a little more. Léa already knew, from her own perception and from feedback by colleagues who attended the first three lectures that students appreciated her teaching, so by the time she let herself go off script, she felt that there was a good relationship with students to build on.

4.1 The survey

How could we find out how the students perceived the rant? We decided not to ask directly about feelings of discomfort (which Léa was especially worried about) in order to not bias responses by the question itself. Instead, we decided that if that situation had made an equally big impression on the students as it did on Léa’s colleague, they would mention it in response to more general questions. Two days later, at the end of session #6, Léa asked students to respond anonymously, pen-on-paper, to the questions “What are your main takeaway from the groundwater chemistry lectures?” and “Was there anything you appreciated or felt uncomfortable with?”

4.2 Student responses

Léa received 21 student responses (of approximately 30 students who attended the session #6). Surprisingly, none of them mentioned “the rant”, neither as a take-away (which were all about chemistry concepts like pH values or processes like reduction and

oxidation) nor as something that they appreciated or made them feel uncomfortable. In fact, the only two mentions of anything resembling discomfort are in relation to not having the required prior knowledge for the course and thus feeling unfamiliar with the content. The overwhelming majority of responses were positive feedback on engaging and interactive teaching.

5 Discussion

If none of the 21 students responded anything related to "the rant", did we ask students the wrong questions? Or did we, possibly, ask *ourselves* the wrong question? "The rant" had a big impact on Léa because she felt, prompted by her colleague's feedback, that she might have overstepped what is acceptable behaviour from a teacher in an engineering context, by sharing experiences from the reality of working with the topic she was teaching on and by sharing value judgements on other players. But if none of the students found it worth mentioning when given the opportunity two days later, maybe it did not make an equally big impression on the students. We can only speculate about why that is. The students might not have been paying attention at that moment (unlikely considering how engaged Léa speaks in general and on this topic in particular, and unlikely also on the background of the very positive feedback where students pointed out that they liked the engagement with frequent questions). The students might have thought it was just unimportant side information but (i) Léa felt that they were particularly attentive at that moment and (ii) there was no comment about anything related to Léa going off track or rambling, on the contrary, the clear structure was appreciated. Alternatively, "the rant" might have been more of a passing comment than an actual rant, and Léa's perception might have changed afterwards as she started thinking about the situation when it was being pointed out by her colleague. Or maybe students did pay attention, Léa was as clear as she thought she was, and students took it as a normal part of teaching and learning in that context. It might not have been a main takeaway as important as the role of, for example, pH values, since it was a short episode and pH values were talked about throughout the 4 lectures. But, maybe, students do expect critical reflection on the role of their future profession in the world. Or they are so unused to critical reflection on the role of their future profession in the world that they did not even recognize it as it was being modelled for them. What exactly happened from a student perspective, and what they think about it, is subject to future conversations.

How did a comment by a colleague create all this doubt in Léa? Teachers are strongly influenced by what their colleagues think and the professional culture around them, (Roxå & Mårtensson, 2009). Teaching is often considered private and talked about only with very few, trusted colleagues (Roxå & Mårtensson, 2009); in this case, Léa spoke about the situation described here only with the disapproving colleague, who is an influential one, and with Mirjam, her co-author on this article. Teaching for sustainability currently requires a lot of cognitive and emotional work from teachers since they need to embrace the identity of someone who does this work, who bridges between disciplines, who also works on their own discipline to change teaching culture there (McCune et al., 2024). Key competencies for sustainability, which we want to help our students acquire, include being aware of one's own and other's values and being able to articulate and discuss them even when there is no universal agreement (Redman & Wiek, 2021; Brundiers et al., 2021). The example of Léa's "rant" shows how difficult this is, even for

teachers. Ultimately, if policy makers and educational leaders are serious about shifting priorities when it comes to teaching for sustainability in higher education, they need to acknowledge that teaching for sustainability through emotions and values sharing does not mean imposing a political opinion on students (Annelin & Boström, 2024) and they need to support teachers in that direction by giving them "permission and space to challenge traditional academic roles" (McCune et al., 2024). Failing to do so may reinforce the idea, developed e.g. by Jickling and Sterling, (2017), that higher education still serves neo-liberal economic purposes.

6 Conclusion

We have presented a case of teacher reflection-on-action, supported by student feedback and collegial discussions to shed light on a situation that was, in retrospective, perceived as potentially problematic. Our conclusion is that the teacher did not overstep the boundaries of her role, rather stretched these boundaries to include important aspects of teaching for sustainability, that is authentically sharing her experiences and values and opening up traditional approaches for criticism, modelling the role of a professional in her discipline, and her students' potential future job.

We are sharing this experience because it illustrates on the one hand that engineering students do not by default react negatively to hearing that engineering solutions may create profit without solving the problems they are supposed to solve. (We don't, however, know whether the experience had any impact on them at all – this will need more investigation in the future.) On the other hand, we wanted to illustrate the very real risk of self-censorship teachers face in the context of teaching for sustainability, which may result in not saying things that we feel really matter, out of fear of either peer judgment or student discomfort. Certain types of discomfort may even be considered important parts of learning, and we need to be prepared to feel discomfort ourselves – and start sharing our emotions, and discussing why we choose to put ourselves in positions that are likely to create discomfort – in order to prepare students for the end of the world as we know it.

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