Gard L. Andersen, UNIVERSITY OF OSLO, g.l.andersen@geo.uio.no
Kristian B. Bakken, UNIVERSITY OF OSLO, k.b.bakken@geo.uio.no
Adriana A. Dauvi, UNIVERSITY OF OSLO, adriana.amun@hotmail.com
K. Dunnett, UNIVERSITY OF OSLO, k.dunnett@geo.uio.no
Torjus Haakens, UNIVERSITY OF OSLO, torjuh@math.uio.no
Ida H. M. Hansen, UNIVERSITY OF OSLO, ihhanse@student.geo.uio.no
Karianne S. Lilleøren, UNIVERSITY OF OSLO, k.s.lilleoren@geo.uio.no
A. Mattias Lundmark, UNIVERSITY OF OSLO, mattias@geo.uio.no
Pia Alette B. Pedersen, UNIVERSITY OF OSLO, papeders@uio.no

Co-Creation in Practice: Redesigning a Geoscience Bachelor Course

ABSTRACT

Co-creation has the potential to enhance the quality of university education through its impact on course delivery and the participants' learning experiences, but it is often not straightforward to realise. We present a case study of a student-initiated co-creation project where students, course teachers, and student administration worked together to improve an introductory geoscience course at a Norwegian university. A thematic analysis of participants' reflections and interviews shows positive meta-cognitive, affective, and social effects similar to the results of other studies of co-creation. Students and staff brought complementary expertise to course development, and establishing a common pedagogical framework provided a shared language and basis for informed argumentation and negotiation. The process of co-creation also required an expertise of its own. For example, students initially struggled to recognise how they could contribute to the project, and while examples of other co-creation projects were helpful, students found local (culturally, geographically, subject-specific) examples of student involvement most relatable. We discuss how equity and power concerns were addressed in the working group, and how course representatives and discussion-based midterm evaluations partly addressed diversity and inclusivity challenges. The alignment of student initiative, access to funding for student salaries, and teachers primed to try a co-creation approach all contributed to this co-creation project. This suggests that even in an educational system known for its flat hierarchy and promotion of democracy and equality, catalysts and explicit support are important to promote co-creation.

KEYWORDS

students as partners, student-staff partnership, co-creation, course design, geoscience education

INTRODUCTION

Traditionally, university teachers develop new courses and revise old ones. They are subject experts and have variable amounts of experience with teaching and formal pedagogical knowledge. However, with every passing year, it tends to become more difficult for teachers to remember the learning challenges of a novice. Meanwhile, the social, technological, and economic contexts of

students pursuing university education are changing, and with them, student experiences and expectations. If courses are to be well-adapted to students, their perspectives need to influence course design.

An emphasis on involving students in course development has gained ground in recent years, recognising the expertise that students can contribute (Bovill and Bulley 2011; Goff and Knorr 2018; Healey, Flint, and Harrington 2014). For example, it is students, not staff, who best know what prior knowledge and skills students bring to a course, what they find engaging, interesting, or challenging, and what constraints are imposed by parallel courses and other commitments (such as family and paid work).

Collaborations between students and staff are discussed using a range of terms like "students as partners," "student-staff partnership," "active student participation," and, more generally, "co-creation" (Bovill 2020b). The majority of such examples are from anglophone contexts, and there are few examples from the natural sciences, even fewer from the geosciences (St. John 2018). However, co-creation may not be easily transferable between cultural settings (Green 2019; Zhang, Matthews, and Liu 2023). For example, Kaur (2020) discusses the tension between a hierarchical teaching tradition in China and the aim to reduce power imbalances inherent in co-creation, suggesting that co-creation needs to be explored in a variety of settings.

An opportunity to explore co-creation in the development of a geoscience course at the University of Oslo, Norway, arose in 2020 when students approached staff to discuss shortcomings in the second-semester introductory geoscience course they had just taken. In this case study, we provide an account of and explore this example of co-creation in the context of a higher education geoscience course in Norway, thereby adding an example from a non-Anglophone natural science context.

The concept of co-creation

There are many ways to think about the relationships between students and staff and their roles in teaching and learning (Biggs and Tang 2011; Bovill, Jarvis, and Mpamhanga 2020a; De Ketele 2014; Prosser and Trigwell 1999). Our inspiration came from scholarship on co-creation and partnership by Barrineau, Engström, and Schnaas (2019) and Bovill, Jarvis, and Mpamhanga (2020a). Co-creation and Students as Partners are both part of a framework in which students and staff work together to reach shared educational goals, while sharing influence over the process and outcomes (Bovill 2020b). Bovill et al. (2016) defined co-creation as: "when staff and students work collaboratively with one another to create components of curricula and/or pedagogical approaches." Meanwhile, Cook-Sather, Bovill, and Felten (2014) defined Students as Partners as: "a collaborative, reciprocal process through which all participants have the opportunity to contribute equally, although not necessarily in the same ways, to curricular or pedagogical conceptualization, decision-making, implementation, investigation, or analysis." Comparing the two definitions highlight the more egalitarian focus of partnership compared to co-creation.

We conceived, initiated, and implemented the project in this case study as a students as partners effort involving collaboration between a small number of students and staff. However, there are also elements of whole-class co-creation (the involvement of all students taking the course). We therefore follow Bovill (2020b) in using co-creation as the general descriptive term for our work.

The potential positive effects of co-creation on participating students and staff are well-documented. A literature review by Matthews et al. (2018) lists benefits such as improved relations, academic learning and meta-cognition, increased engagement, confidence, employability, sense of belonging to a community and identity development, and material gains (e.g., being part of

publications). However, they also note that success is not guaranteed, and failed partnerships can result in negative outcomes, such as worse relationships and decreased confidence.

Co-creation commonly takes place in small groups of staff and students (Bovill et al. 2016; Bovill 2020b), and studies indicate that students already in an advantageous position are more likely to volunteer or be selected for participation, reinforcing existing inequalities (Bovill 2020b; Marquis et al. 2018; Mercer-Mapstone, Islam, and Reid 2021). Power dynamics reflecting the hierarchies of higher education may also interfere with co-creation: students may feel pressured to support a staff agenda, feel as if staff ignore their input (Cook-Sather, Bovill, and Felten 2014), or feel used as cheap labour (Barrineau, Engström, and Schnaas 2019).

THE CASE STUDY: CO-CREATION IN PRACTICE

Setting

The co-creation project explored in this case study took place in the department of geosciences at the research-intensive University of Oslo, Norway. It is centred on development of the second semester introductory geoscience course Earth Processes (10 ECTS, nominally 266 hours work over 17 weeks, with five days of field work), which builds on the first semester introductory course Earth History. Course teaching is shared by three teachers, each responsible for a separate part of the course, and two PhD fellows who run practical classes. In 2020, the course was taken by 22 students, and by 25 students in 2021. Most students are in their first year of a bachelor's degree in geology or physical geography and take parallel courses in physics and mathematics; a few students take it as an optional course.

The department is part of the Centre for Excellence in Education "iEarth" formed in 2019 and funded by the Norwegian Ministry for Higher Education. iEarth aims to develop geoscience education and champions the involvement of students in all aspects of teaching and learning, providing a strong motivation for co-creation.

Purpose

The co-creation project aimed to address known (i.e. from previous course evaluations; Gasser and Linge 2019; Thomassen 2019), and emergent (during discussions and development) problems with and opportunities available in the course, as described in more detail below. The goal of this case study, meanwhile, is to explore an example of co-creation in the context of a higher education geoscience course in Norway. Our research questions focus on the process and experiences of the co-creation:

1. How did the co-creation project unfold?
2. How was the co-creation project experienced by students and staff?
3. What lessons can be learnt from the co-creation experience?

The first research question is answered through the case study narrative; the second through analysis of reflections from students and staff involved in the course development; and the last in the discussion that combines all our data.

Participants

The co-creation working group consisted of one member of the student administration, KBB, two of the three course teachers, AML and KSL, both of whom were active in iEarth; we interviewed the third course teacher after the project about their perceptions of its impact. The teaching team did not change between 2020 and 2021, but course responsibility rotated to AML. Five geoscience bachelor students made up the majority of the working group: GLA, AAD, TH, HMH, and PABP. One

student had taken the course in 2019, two had taken it in 2020, and two students were enrolled to take the course in 2021. We also invited two PhD fellows to one working group meeting in order to discuss the practical work they oversaw.

Methods

All authors took part in the co-creation project except KD who joined after its completion and provided an external analysis of the experience and impact. We use a qualitative case study approach (Robson and McCartan 2016) to describe the co-creation experience, drawing on materials collected during (e.g., meeting notes) and after the work (e.g., student and staff reflection notes and staff interviews). This allows us to explore the co-creation from several perspectives and through multiple sources (Pearson, Albon, and Hubball 2015), and triangulate (Robson and McCartan 2016) data reported both within the project and in relation to published co-creation efforts.

As background to our exploration of co-creation, the impact of the course development is examined through the midterm and end-of-course evaluations in spring 2021. Nine students answered the end-of-course evaluation. The responses were summarised by KD to identify recurrent themes, which were compared to issues raised by students in the 2020 course cohort and two external course evaluations (Gasser and Linge 2019; Thomassen 2019).

Student participants provided written reflection notes at the end of the co-creation project guided by questions suggested by AML. These related to: the main outcomes of the project; their satisfaction with their involvement; what worked well and what didn't in the project; the impact their involvement had on how they approached their studies; whether they would consider or recommend becoming involved in a similar project; and how they thought more students could be involved. Two students provided feedback as a pair. The responses were summarised by KD to identify recurrent themes.

The course leader, student administrator, and one of the two PhD fellows also provided reflection notes guided by questions suggested by AML related to: their role in the project; their perception of the project; what they observed in the meetings they attended; the impact on their thinking about teaching and learning; and the clarity of project objectives and organisation. KD interviewed the two course teachers who did not provide reflection notes, referred to as Staff 4 and 5 in this paper, in spring 2022; these semi-structured interviews explored their perceptions of the co-creation project.

The impact of the co-creation project on the participants is explored through the reflection notes and the semi-structured interviews. The thematic analysis of staff reflections and interviews (Vaismoradi, Turunen, and Bondas 2013) started from two categories of known interest: course coherence (the main challenge that the co-creation project aimed to address) and diversity and inclusivity (from co-creation literature, e.g., Bovill 2020b). We identified other categories through repeated reading of the material until no further categories were found. We then grouped the categories into four main themes, with some categories belonging to more than one.

FINDINGS

We recount the activities of the co-creation working group and examine the course development through the midterm and end-of-term course feedback. We then summarise the analysis of the written reflections and interviews from staff and students and describe the impact of the co-creation project on staff and students.

Unfolding of the co-creation project

An opportunity for change

In 2020, the Covid-19 pandemic disrupted the second semester introductory geoscience course, moving the course to remote teaching. After this disruption, there were five weeks of online classes and, in the end, two field days. Only five of the 22 students on the course completed the anonymous end-of-course evaluation and gave a seemingly positive evaluation of the course. Likert scale-questions on how much students felt they had learnt from different course activities, ranging from one (poor) to five (excellent) gave averages from 3.6 to 4.4. The free text comments asked for better communication of deadlines and learning goals and less remote teaching. Given the challenges of emergency remote teaching, the teachers expected such comments and felt reasonably satisfied with the course.

Unexpectedly, five students handed in a written course report of their own design and asked for a meeting with the course teachers. They felt that the end-of-course evaluation did not address their main concerns. They argued that the course did not build properly on the first semester geoscience course, lacked internal coherence across its different themes, and did not communicate clearly what the students were supposed to learn. The meeting that followed initiated an enthusiastic discussion about the course, and about teaching and learning. To address students' concerns, we needed both student and staff perspectives, sparking the idea of collaboratively developing the course.
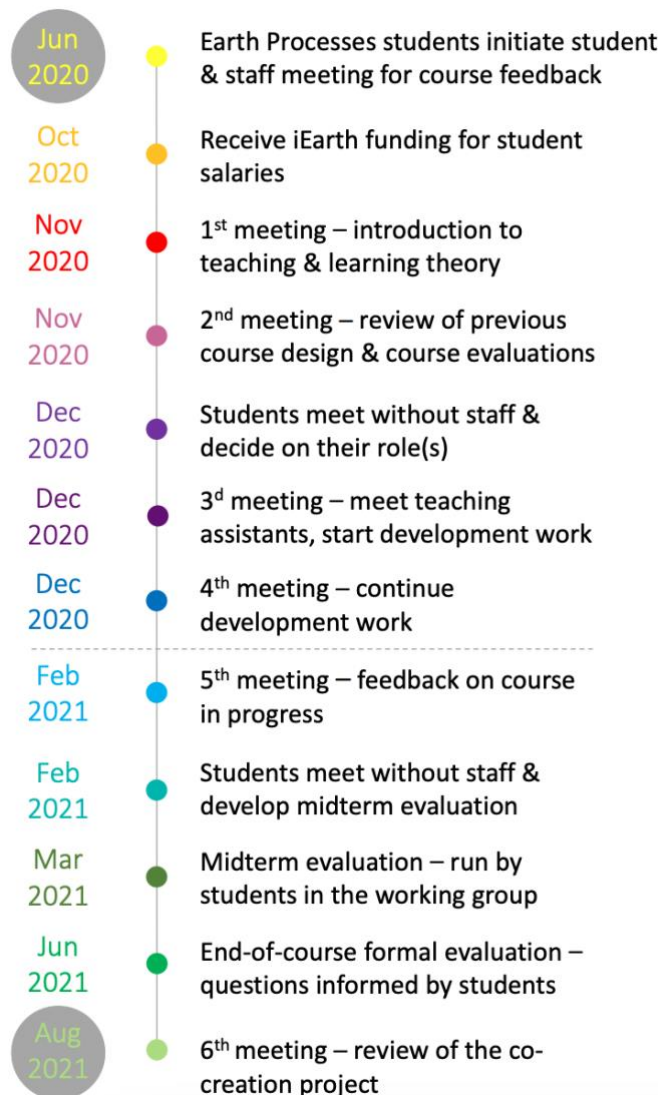
The co-creation process

Two of the five students who initially approached staff declared that they wanted to take part in a working group to develop the course, which was formed in autumn 2020 and continued to meet until the end of the course in spring 2021. When we discussed the idea with the newly formed iEarth student organisation at the department, two students from the previous course iteration (2019) volunteered, although one subsequently could not participate. The idea to include two enrolled students came from the students already in the working group. We presented the project to first semester students during one of their teaching sessions, and the first two students to volunteer joined the working group. To ensure course development conformed to local regulations and administrative procedures, we included this expertise by bringing administrative staff into the project. The timeline of the project and the working group meetings is presented in Figure 1 (below).

Six working group meetings took place in advance of, during the course, and after the course had finished. In the first meeting, we looked at excerpts from the first two chapters of an introduction to university teaching by Biggs and Tang (2011) and discussed how we learn and course design (constructive alignment).

The second meeting focused on the design of the existing course, student feedback from previous years, and two external course evaluations (Gasser and Linge 2019; Thomassen 2019). An important early step was to agree on specific tasks and responsibilities. Students can take on many different roles and responsibilities (e.g., Barrineau, Engström, and Schnaas 2019; Bovill 2017; Healey, Flint, and Harrington 2014), and we discussed some of these in the second working group meeting. The students then met separately to decide what role(s) they wished to take on. They suspected that developing new course material or mentoring enrolled students would be very time-consuming and decided to focus on offering ideas for and giving advice on course changes, facilitating information flow between staff and students, and monitoring the impact of changes made. Figure 2 summarises the main activities the students ended up doing.

Figure 1. Timeline of the course development work

Jun 2020 — Earth Processes students initiate student & staff meeting for course feedback

Oct 2020 — Receive iEarth funding for student salaries

Nov 2020 — 1st meeting – introduction to teaching & learning theory

Nov 2020 — 2nd meeting – review of previous course design & course evaluations

Dec 2020 — Students meet without staff & decide on their role(s)

Dec 2020 — 3d meeting – meet teaching assistants, start development work

Dec 2020 — 4th meeting – continue development work

Feb 2021 — 5th meeting – feedback on course in progress

Feb 2021 — Students meet without staff & develop midterm evaluation

Mar 2021 — Midterm evaluation – run by students in the working group

Jun 2021 — End-of-course formal evaluation – questions informed by students

Aug 2021 — 6th meeting – review of the co-creation project

Timeline of the development of the course and working group meetings. Dashed line marks the start of the Earth Processes course in January 2021.

The following three meetings focused on practical changes to the course. We devoted much of the time to idea generation and refinement: what changes should be made, and how? In between meetings, staff and students worked separately on reviewing ideas and materials. At the time of the fifth meeting, the course had started, and we used the meeting to follow-up and review ongoing developments. As the time for a midterm evaluation drew near, the students designed a new evaluation. The midterm evaluation indicated that the changes to the course worked well, and we spent the final working group meeting in August 2021 discussing staff and student experiences of the co-creation project.

Figure 2. Student activities during the co-creation project

Student activities during the co-creation project in this case study (figure adapted from Barrineau, Engström, and Schnaas 2019). Most co-creation work took place in the planning phase of the course, except for the course representatives' work.

Including the student perspective in both the planning phase and during the course led to many changes. The students in the working group helped redesign teaching activities in response to digital teaching requirements during Covid-19 (e.g., expanded the use of pre-session assignments and breakout rooms during Zoom sessions), and initiated the development of and revision of supporting materials (e.g., an introductory chemistry video for those with little chemistry from high school, and a compendium for geological maps). The students addressed issues from earlier course evaluations by reviewing overlap with the preceding geoscience course, checked for deadline collisions with parallel courses, and gave advice on how to streamline communication.

The students in the working group also suggested changes to the course assessment in order to better reflect the course workload. As a result, the teachers transferred 15% of the final grade from a multiple-choice exam to a field report. Students still felt this poorly reflected the effort required to write the field report, but administrative regulations prevented further changes in the timeframe of the development work. This was one of several cases where administrative restrictions could be identified immediately by having a member of the administration in the working group. (The field report has subsequently been increased to 35% of the final grade.)

The students in the working group also proposed the introduction of course representatives, whose task would be to engage fellow students in discussions about teaching and learning throughout the course and provide continuous feedback to the course teachers and working group during the course. The two course representatives in spring 2021 were also members of the working group. Having course representatives led to many small adjustments while the course was running in spring 2021, such as better organisation of course materials on the learning management system and adjusting assignment deadlines. When the course representatives reported that students felt unsure about how to write a field report (now part of the course grade), the students in the working group organized an extracurricular seminar on report writing (subsequently incorporated in the regular

course). When the course representatives reported that students found the geographical information system difficult to use, the students in the working group promptly set up a help desk.

The working group students also designed and ran the midterm evaluation. Midterm evaluations are commonly used in the department, typically taking the form of Likert scale or "do more of, do less of, continue with" questions answered by students individually. The working group students, on the other hand, wanted the evaluation to stimulate discussion and reflection. Students completed their midterm evaluation in small groups (five groups of three to five students, visited by a student in the working group) in a 45-minute course session, which consisted of open questions about different aspects of the course, e.g., how it built on the previous course. Designing and running the midterm evaluation has since become an optional part of the duties of course representatives. In addition, students suggested changes to the end-of-course evaluation, which now focuses on formative feedback on the course through open questions rather than rating student learning experiences.

Student feedback on the co-created course

The co-creation project sought to address three main concerns. Both the 2020 students and the external course evaluations identified the connection between the Earth Processes course and the preceding Earth History course as areas of concern. The disconnect clearly went beyond the Covid-19 related issues in 2020. However, in the 2021 midterm evaluation, all groups (with the exception of one group who hadn't taken the preceding course) said that they felt there was: "Good coherence, it's obvious that [this course] builds on the previous one." Answers from the end-of-course evaluation also suggested cross course coherence, and eight respondents said that the transition between the two courses was good or great (one student did not respond).

The 2020 students and the external course evaluations also raised the issue of poor coherence within the course. A course can easily become fragmented when teaching is distributed between many lecturers (in this case, three lecturers and two PhD fellows). In the 2021 end-of-course evaluation, five students reported seeing the connections between the different topics, one student provided no response, whereas three students reported that the connections were still not clear enough. Two of them highlighted the challenges of shared teaching responsibilities, in the words of one of them: "with different teachers for different topics, it can be difficult to see the connections because each focuses on separate topics."

The third major area of student criticism in 2020 related to the course organisation and communication. In the 2021 midterm evaluation, students reported that the course information was clear and consistent. Overall, the feedback indicates that the co-creation project was successful in attaining its main aims, although there is a need for further improvement in integrating different themes within the course.

The co-creation experience

Staff perspective

From the thematic analysis of staff reflections and interviews, we identified 11 categories and grouped them into four overarching themes: course, involvement, communication, and satisfaction (Table 1). The course theme includes comments related to the course being revised. The involvement theme gathers comments that highlight diverse aspects of the people involved and their contributions to the efforts. The communication theme covers how students and staff interact. The final theme, satisfaction, consists of reflections that the efforts were felt to have been worthwhile and to have had a positive effect on the course. The individual reflections and interviews emphasised different

categories and themes. For example, communication was emphasized in one interview, while course coherence was a dominant theme in the other. Some categories occurred in all the staff contributions: course—structure and delivery; involvement—student activity, people involved, inclusivity, and staff-student relationships (also communication theme); and satisfaction—the only category under the corresponding theme. The communication theme was not present in all staff contributions.

Table 1. Themes and categories from thematic analysis of staff reflections

Theme	Categories	Category description
Course	Coherence*	The coherence of the course and the transitions between courses.
	Structure	The internal structure of the particular course.
	Delivery	How the course is taught.
	Student activity	Student engagement and participation in course activities.
Involvement	Student activity*	Student engagement and participation in co-creation activities.
	Student community*	That students form a distinct group or community.
	Inclusivity*	Whether all relevant people are able to contribute.
	People involved*	The dependence of activities and involvement on individuals.
	Staff-student relationships*	Relationships between students and staff when working together.
Communication	Staff-student relationships*	How students and staff view and interact with each other.
	Listen*	Staff need to listen to students.
	Explain*	Staff need to explain pedagogical decisions to students.
Satisfaction	Satisfaction*	Satisfaction with the co-creation project.

Themes and categories from thematic analysis of staff reflections. Two of the categories fell into two themes, depending on their context. The categories that also appeared in student reflection notes are marked with [*].

Student perspective

At the end of the project, the student members of the working group shared insights about their experiences. All students thought that they had done a good job developing the course; one recognised that there was still more to do. This corresponds to the "satisfaction" category of the thematic analysis above. They all also said that they would consider taking part in a similar project again or would recommend that a friend do so. One qualified their statement with the condition that they would need to know that "the rest of the student team is actively participating" (Student 3), a caveat associated with the "people involved" category.

The students also shared how they thought more students could be involved. All students identified establishing a dialogue between students and teachers and ensuring teachers receive on-going feedback while the course is in progress as important. Making the contributions of previous students clear was thought to be a key element to demonstrate that student opinions matter and can have an impact. Here we see the "listen" and "explain" categories of the communication theme from the student perspective.

Students' reflections on their experience fell into three themes: changes in their own learning habits (e.g., taking more reflective approaches to learning, increased motivation for studies, and curiosity about learning); changes to their interactions with lecturers; and an appreciation of teaching

work. All students reported that in the future, they would be more inclined to speak up if there was something they felt was not working, and moreover, bring ideas and suggestions. Two students also reported an increased appreciation of the (usually unseen) effort that goes into teaching. The experience affected how students viewed their relationships with staff and belonged to the "staff-student relationships" category.

Impacts of the co-creation experience on students and staff

We see positive meta-cognitive, affective, and social effects on the (student) working group members consistent with the co-creation literature (Cook-Sather, Bovill, and Felten 2014; Healey, Flint, and Harrington 2014; Matthews et al. 2018). Meta-cognitive effects were apparent in the student reflections where several students mentioned changes in their approach to their own learning, for example, two students reported being "able to reflect more about if my current study habits support higher order thinking" (Student 2) and trying "to focus more on deep learning when I study" (Student 3).

The enthusiasm for the co-creation manifested in the affective domain: "If the students continue to help with improving [the course], it could one day become one of the best geology introductory courses in the world." (Student 3), and the course was "the topic I was most eager to work on this term" (Students 4 and 5). One student reflected that they now "ask more questions or answer more questions than I did before" (Student 2), showing that the increase in engagement carried over to other courses. There was also an increased feeling of agency, as the co-creation project was "a[n] experience going from reviewing/criticising a course to actively take part and 'solve' the problems" (Student 2). One student also addressed the importance of agency and self-efficacy by remarking that sharing how students changed the course: ". . . can potentially be motivating for other students who want to contribute and who are wondering about the influence they can have" (Student 1).

In the social domain, the students felt that they could "be more open to the lecturer about what is working, and what is not" (Student 1). The willingness to speak up was accompanied by a change in perspective about the relationship between students and staff. The students who provided feedback as a pair commented on their relationship with staff: "it [was] good to see that the distance between us [students and lecturers] isn't actually that big." In addition, students had also gained a "better understanding of how many considerations go into course design" (Student 2).

Staff reflections focused mostly on the value and viability of co-creation as a way of working. As one teacher reflected: "Many of the observations and suggestions from the students were things we [the teachers] hadn't thought of, or simply couldn't know without student input." (Staff 1). For the teachers, the project confirmed that working closely with students was something they wished to continue: "I was already convinced from reading . . . I now see much clearer that this is the way I want to move forwards." (Staff 1), "it's just much clearer to me every time that you have to talk to the students" (Staff 4). In addition, while getting student feedback after a course is normal, the experience of including students in course planning was new but valuable, since "some of the suggestions [from students] were implemented immediately in the course" (Staff 2).

The co-creation may also have affected students in the Earth Processes course who were not members of the working group. The students taking the course in 2021 organised an extracurricular field day and invited students in the geophysics programme to join them. The three course teachers cannot recall this happening before. Although this coincides with Covid-19, an unusually small number of students taking the course, and the co-creation project, we suspect that the examples of

student-led extracurricular initiatives from earlier in the semester triggered this initiative. Curran (2017) also described such "ripple effects" from co-creation and students as partners work.

DISCUSSION

Drawing together the narrative and themes from the project reflections, we examine three aspects of the co-creation experiences: sharing and developing expertise in the working group; diversity and inclusivity; and the context of the project.

Different kinds of expertise

The co-creation project aimed to bring complementary student, teacher, and administrative expertise to course development. In our discussions, the value of these different kinds of expertise quickly became apparent (the "people involved" in the thematic analysis). Students could draw on much more recent and diverse experiences with teaching and learning from school and university than staff whose recent experiences with education were primarily from teaching their own courses. As discussions turned to online delivery, the students provided examples from other university courses and thoughts about how different approaches might be implemented in the geoscience course.

The students who were further along in the bachelor program had both gained perspective on potential uses of the material taught in the Earth Processes course and had more experiences of university teaching to draw from when suggesting improvements. The students following the course, on the other hand, knew exactly what their fellow course participants had already been working on in previous and parallel courses, and how the teaching and learning was progressing in this course. Having administrative expertise at hand meant the group was "able to quickly address any practical issues raised [which] ensured that we didn't spend any time in our meetings discussing meaningless stuff" (Staff 3).

However, from the beginning the teachers felt that it made little sense to embark on course development without a common understanding of how learning occurs in the first place. A different kind of expertise was needed. Barrineau, Engström, and Schnaas (2019) describe introducing a pedagogical framework through a two-day conference for students and staff; we condensed this framework into reading material and the first working group meeting (Figure 1). Even so, the pedagogical theory provided direction and guidance when we discussed changes to the course as well as a shared language for discussing teaching and learning. As the meetings went on, talk of "deep and surface learning" and "higher order thinking" became commonplace.

Nevertheless, for the working group to make full use of the complementary expertise of students and staff, we found ourselves in need of a third kind of expertise: an understanding of the process of co-creation (cf. Mercer-Mapstone and Marie 2019). One student reflected that: "When we tell students that they are completely free [in choosing how to contribute], it can be difficult for them to know where to start" (Student 2). This was echoed in staff reflections where the initial agenda was: "let's improve the course, and you contribute where you can. [However,] it was very unclear to all of us I think what exactly the students would be doing" (Staff 1). One teacher remarked that they "took up too much space in the beginning. . . . Then things started to change . . . The students got/took more and more space" (Staff 1).

Student and staff co-creation–who gets a say?

Academic power dynamics typically favour teachers. In contrast, co-creation is rooted in reciprocity, negotiation, and shared decision-making (Bovill, Jarvis, and Mpamhanga 2020a; Cook-

Sather, Bovill, and Felten 2014). Our co-creation project originated from a student initiative, and students and staff set the agenda for the project together. Within the working group, students outnumbered staff, and three of the five participating students had already completed the course (and hence were not graded in the course). Introducing the pedagogical scaffolding early on helped both teachers and students make sense of their experiences in a structured way and make evidence-based arguments for their views (Figure 1). Additionally, a students-only meeting provided space for students to decide among themselves on their role(s) in the project. Matthews et al. (2018) suggest that a successful co-creation project is one where students feel included and listened to. The sense of co-ownership expressed in the students' reflection notes suggests this goal was achieved:

> The best part about this project has been that we have done it together. We [the students] have not just been asked to say something because it is important to include the students, but we have collaborated the whole way. (Student 3)

A different challenge is that the main beneficiaries of co-creation may be students already in an advantageous position, who on the strength of already high academic achievements, social capital, or financial means may be more likely to volunteer or be selected for participation (Bovill 2020b; Marquis et al. 2018; Mercer-Mapstone, Islam, and Reid 2021). Our case study is quite typical in that it involves a small number of students in the co-creation working group (Bovill 2020b), which raises the issue of diversity and inclusivity ("involvement" in thematic analysis). The first students to join the working group brought up the matter of financial means and made it clear that a pre-requisite for the co-creation project was that the work would be paid. Together, we applied for and received funding for student salaries from iEarth (38 hours each for five students).

Looking back, we missed an opportunity to address diversity in the working group by not extending an invitation to all former Earth Processes students, even if the number of students we could pay was limited. Also, springing the co-creation project on the first semester students and selecting two volunteers on the spot allowed the students little time to reflect on the offer. This could disadvantage students with other commitments or with limited prior exposure to academia, who may need more time to consider the implications of participating in such projects. It is tempting to opt for the convenient choice, in our case, using a selection process that allowed us to start the co-creation project quickly.

On the positive side, we explicitly conceived of and presented the role of course representatives to students in the course as a way for them to discuss among themselves and provide continuous, anonymous feedback to lecturers. Students contributed lots of feedback, and many suggestions led to immediate changes in the course. Even so, in the midterm evaluation, three of the five student groups commented that they hadn't had much need of the course representatives. This may reflect that course representatives gathered much of the feedback informally, and students taking the course didn't perceive this as "real" feedback. It also suggests that teachers could have done more to close the feedback loop and highlight how the course representatives' work impacted the course. In later iterations of the course, students have opted to have course representatives, and randomly select two students with the possibility to opt out ahead of the selection. This model includes a co-creation approach and may assist in addressing issues of equity by reducing student self-selection.

In the reflections from both staff and students, the importance of involving as many students as possible in co-creation was a recurrent theme. We asked students about this directly and the students suggested various workarounds, including an in-course workshop for course evaluation,

creating several co-creation teams addressing different topics, rotating course representatives in a single course, and having course representatives in more courses (in response, course representatives are gradually being introduced in the department, with half of the compulsory bachelor courses using them in 2022). The staff also expressed concerns about the small number of students directly involved in the co-creation: "it's not good enough to just involve a few students, all who want to join must be included!" (Staff 1). And though course representatives were considered a step in the right direction, "you have some middle man in a way . . . and how representative is that?" (Staff 5).

Co-creation can also be challenging for staff. The teachers have responsibility for the course and may feel uncertain about sharing control with students (Cook-Sather, Bovill, and Felten 2014). Staff may "have a tendency to want to pick the students" to feel "that [they] could control [the project] a bit more" (Staff 4). Also, not every teacher would be comfortable with inviting students to critique an entire course. It requires that one isn't "scared of these situations" (Staff 4). This exemplifies some of the potential tensions in co-creation and the power staff have to direct projects (cf. Kehler, Verwoord, and Smith 2017; Mihans, Long, and Felten 2008).

Co-creation in a local context: university geoscience in Norway

Most publications on co-creation and related work originate in English speaking countries and Scandinavia (Bovill 2020b; Green 2019; Kaur 2020;). In the Nordic countries, higher education is characterized by relatively flat (non-hierarchical) organizations, and the promotion of democracy and equality has a longstanding tradition (Gunnulfsen, Ärlestig, and Storgaard 2023; Rinne and Antikainen 2022, 294–308). We expected this setting to lower the threshold for student-staff co-creation. The students in the 2020 cohort expecting to be taken seriously by their teachers when they asked for a meeting to discuss the Earth Processes course and their trust in teachers to accept criticism in a face-to-face meeting support this expectation about the case study's context. Similarly, all the teaching staff reacted positively to the idea of co-creation. One teacher regarded developing the course with students as largely a continuation of an ongoing development of the course: "2020 to 2021 there was maybe a little bit more happening than in the past" (Staff 5), and that gathering "the different sorts of stakeholders in a room and make them . . . mean something or add something" was simply a very good approach (Staff 4). Even if the idea of co-creation was uncontentious, it was acknowledged that the co-creation approach depends on personalities. Both staff interviewed indicated that the scope of and approach to the development "has a lot to do with people involved" (Staff 5), and that not all may be able to "just dive into that and take . . . whatever comes" (Staff 4).

When co-creation affects an existing course, the aim of empowering students can conflict with institutional and national regulations. At the University of Oslo, the programme and teaching committee, comprising staff and student representatives, must approve significant changes to courses. This ensures quality control, student representation, and confirmation that students know what the courses they sign up for entail. However, in the context of co-creation, the same regulations can prevent students and staff from adapting a course to the needs of the students taking it (cf. Cook-Sather, Bovill, and Felten 2014). One such instance was the students' wish to increase the weight of the field report in the final course grade. We implemented this change a year later, but one can easily imagine a situation where the next student cohort has other needs and preferences.

In looking for examples for our co-creation project, we mainly used Barrineau, Engström, and Schnaas (2019) who discuss co-creation at Uppsala University in Sweden. Despite the cultural and geographic closeness of Sweden and Norway, a need for an even more local context was felt: "We feel most familiar/connected to examples [of co-creation] from our own previous students on the same course, then other courses and faculties and lastly universities abroad" (Student 2). The same student

went on to suggest that "I think it is important to collect some highlights from this year and show as examples to next year's students (if [the co-creation approach] is repeated)." This resonates with the suggestion by Green (2019) that the complex cultural construct that is partnership (and co-creation) needs to be translated into each cultural setting in order to make an impact, highlighting the importance of examples and case studies from multiple countries, cultures, and disciplines.

Our co-creation project resulted from the confluence of a student initiative, availability of funding, and teachers primed to try out new approaches by their participation in iEarth. This suggests to us that even in an educational system known for its flat hierarchy and promotion of democracy and equality, some form of catalyst and explicit support is important to introduce and develop co-creation approaches more widely.

Limitations

Beyond the specific context of our work, a limitation of this study is that the participants are also authors of this paper, which may introduce biases (e.g., wanting the project to be successful or emphasising positive experiences). However, several types of data were collected through different means, from different persons, and at different times, allowing us to explore the co-creation from several perspectives and providing internal triangulation. There is good thematic consistency and high convergence within the material and with existing literature, which provides confidence in the analysis and interpretation of the data. In addition, KD, who had not been involved in the project, conducted the thematic analysis. For similar projects, a methodological improvement would be to collaborate with an external observer experienced in educational investigations from the outset of the project.

CONCLUSIONS

We have described a successful collaborative development of an introductory geoscience course by students, course teachers, and student administration in a Norwegian context. The participants' experiences have much in common with examples of co-creation (e.g., Healey, Flint, and Harrington 2014; Matthews et al. 2018), such as positive meta-cognitive, affective, and social effects, but also challenges related to diversity and inclusivity. From our experience, co-creation, like any project that involves discrepancies in knowledge, expertise, and power among its participants, benefits from scaffolding in order to ensure that all participants can engage in a meaningful way.

The following are key elements for the success of the co-creation project:
- Establish a common pedagogical framework to provide a shared language for discussions and to give all participants a basis for informed argumentation and negotiation. When student involvement goes beyond sharing their perspectives to designing and evaluating teaching and learning, basic pedagogical understanding sets students (and staff) up for success. Pedagogical scaffolding can also ensure that the metacognitive benefits commonly reported in the literature (Matthews et al. 2018) are a result of design rather than accidental by-products of co-creation.
- Acknowledge that the process and pedagogy of co-creation requires its own expertise (e.g., students must recognise what and how they can contribute, and may need help to articulate their expertise). Literature on co-creation in its various forms helped us, but facilitation may have proved even more effective.
- Address diversity and inclusivity challenges (e.g., paying students decreases the chances that financial resources dictate who can participate). Co-creation involving selected members can be made more inclusive by inviting all students to contribute to and

influence their learning experience through course representatives and discussion-based midterm evaluations, as two examples.

- The presence of catalysts and explicit support for co-creation. This suggests to us that widespread adoption of co-creation requires institutional support.

On a final note, all the students and staff who participated reported that they would like to participate in more co-creation. The project triggered more enthusiasm and engagement than we previously imagined and has sparked several new projects. We strongly encourage any reader who is considering a co-creation project to give it a try!

ACKNOWLEDGMENTS

FUNDING

DISCLOSURE

The authors report that they have no competing interests to declare.

ETHICS

The Norwegian Centre for Research Data (NSD) approved interviews with lectures (no. 860957). All the written statements were anonymous and exempt from requiring ethical approval in line with NSD regulations.

AUTHOR BIOGRAPHIES

At the time of the project, the authors were:

Gard L. Andersen (NOR), student at the Department of Geoscience, University of Oslo, Norway.

Kristian B. Bakken (NOR), student advisor at the Department of Geoscience, University of Oslo, Norway.

Adriana A. Dauvi (NOR), student at the Department of Geoscience, University of Oslo, Norway.

K. Dunnett (GBR), geoscience education post-doc at the Department of Geosciences, Oslo University, Norway

Torjus Haakens (NOR), student at the Department of Geoscience, University of Oslo, Norway.

Ida H. M. Hansen (NOR), student at the Department of Geoscience, University of Oslo, Norway.

Karianne S. Lilleøren (NOR), senior lecturer at the Department of Geoscience, University of Oslo, Norway.

A. Mattias Lundmark (SWE), associate professor at the Department of Geoscience, University of Oslo, Norway.

Pia A. B. Pedersen (NOR), student at the Department of Geoscience, University of Oslo, Norway.

REFERENCES

Barrineau, Sanna, Alexis Engström, and Ulrike Schnaas. 2019. *An Active Student Participation Companion*. Avdelningen för kvalitetsutveckling—Enheten för universitetspedagogik.

Biggs, John, and Catherine Tang. 2011. *Teaching for Quality Learning at University*, 4th ed. McGraw-Hill Education (UK).

Bovill, Catherine. 2017. "A Framework to Explore Roles Within Student-Staff Partnerships in Higher Education: Which Students Are Partners, When, and in What Ways?" *International Journal for Students as Partners* 1 (1): 10–14. https://doi.org/10.15173/ijsap.v1i1.3062.

Bovill, Catherine. 2020b. "Co-Creation in Learning and Teaching: The Case for a Whole-Class Approach in Higher Education." *Higher Education* 79 (6): 1023–37. https://doi.org/10.1007/s10734-019-00453-w.

Bovill, Catherine, and Cathy J. Bulley. 2011. "A Model of Active Student Participation in Curriculum Design: Exploring Desirability and Possibility." In *Improving Student Learning Global Theories and Local Practices: Institutional, Disciplinary and Cultural Variations*. The Oxford Centre for Staff and Educational Development.

Bovill, Catherine, Alison Cook-Sather, Peter Felten, Luke Millard, and Niamh Moore-Cherry. 2016. "Addressing Potential Challenges in Co-Creating Learning and Teaching: Overcoming Resistance, Navigating Institutional Norms and Ensuring Inclusivity in Student-Staff Partnerships." *Higher Education* 71 (2): 195–208. https://doi.org/10.1007/s10734-015-9896-4.

Bovill, Catherine, Joy Jarvis, and Karen Mpamhanga. 2020a. *Co-Creating Learning and Teaching; Towards Relational Pedagogy in Higher Education*. Critical Publishing.

Cook-Sather, Alison, Catherine Bovill, and Peter Felten. 2014. *Engaging Students as Partners in Teaching and Learning: A Guide for Faculty*. John Wiley & Sons.

Curran, Roisín. 2017. "Students as Partners—Good for Students, Good for Staff: A Study on the Impact of Partnership Working and How This Translates to Improved Student-Staff Engagement." *International Journal for Students as Partners* 1 (2): 1–16. https://doi.org/10.15173/ijsap.v1i2.3089.

De Ketele, Jean-Marie. 2014. "L'Accompagnement des Etudiants dans l'Enseignement Supérieur: Une Tentative de Modélisation." *Recherche et Formation [En Ligne]* 77: 73–85. https://doi.org/10.4000/rechercheformation.2321.

Gasser, Deta, and Henriette Linge. 2019. *Ekstern Evaluering av UiO-Emnene GEO1100 og GEO1110.* Internal Report, University of Oslo.

Goff, Lori, and Kris Knorr. 2018. "Three Heads Are Better than One: Students, Faculty, and Educational Developers as Co-Developers of Science Curriculum." *International Journal for Students as Partners* 2 (1): 112–20. https://doi.org/10.15173/ijsap.v2i1.3333.

Green, Wendy J. 2019. "Stretching the Cultural-Linguistic Boundaries of 'Students as Partners.'" *International Journal for Students as Partners* 3 (1): 84–8. https://doi.org/10.15173/ijsap.v3i1.3791.

Gunnulfsen, Ann E., Helene Ärlestig, and Merete Storgaard, editors. 2023. *Education and Democracy in the Nordic Countries: Making Sense of School Leadership, Policy, and Practice*. Springer Nature.

Healey, Mick, Abbi Flint, and Kathy Harrington. 2014. *Engagement through Partnership: Students as Partners in Learning and Teaching in Higher Education*. Higher Education Academy.

Kaur, Amrita. 2020. "Students as Partners: Challenges and Opportunities in the Asian Context." *International Journal for Students as Partners* 4 (2): 145–9. https://doi.org/10.15173/ijsap.v4i2.4366.

Kehler, Angela, Roselynn Verwoord, and Heather Smith. 2017. "We Are the Process: Reflections on the Underestimation of Power in Students as Partners." *International Journal for Students as Partners* 1 (1): 38–52. https://doi.org/10.15173/ijsap.v1i1.3176.

Marquis, Elizabeth, Ajitha Jayaratnam, Anamika Mishra, and Ksenia Rybkina. 2018. "'I Feel Like Some Students Are Better Connected': Students' Perspectives on Applying for Extracurricular Partnership Opportunities." *International Journal for Students as Partners* 2 (1): 64–81. https://doi.org/10.15173/ijsap.v2i1.3300.

Matthews, Kelly E., Lucy Mercer-Mapstone, Sam L. Dvorakova, Anita Acai, Alison Cook-Sather, Peter Felten, Mick Healey, Ruth L. Healey, and Elizabeth Marquis. 2018. "Enhancing Outcomes and Reducing Inhibitors to the Engagement of Students and Staff in Learning and Teaching Partnerships: Implications for Academic Development." *International Journal for Academic Development* 24 (3): 246–59. https://doi.org/10.1080/1360144X.2018.1545233.

Mercer-Mapstone, Lucy, Maisha Islam, and Tamara Reid. 2021. "Are We Just Engaging 'The Usual Suspects'? Challenges in and Practical Strategies for Supporting Equity and Diversity in Student-Staff Partnership Initiatives." *Teaching in Higher Education* 26 (2): 227–45. https://doi.org/10.1080/13562517.2019.1655396.

Mercer-Mapstone, Lucy, and Jennifer Marie. 2019. *Practical Guide: Scaling Up Student-Staff Partnerships in Higher Education*. Institute for Academic Development: University of Edinburgh.

Mihans II, Richard J., Deborah T. Long, and Peter Felten. 2008. "Power and Expertise: Student-Faculty Collaboration in Course Design and the Scholarship of Teaching and Learning." *International Journal Scholarship of Teaching and Learning* 2 (2): 16. https://doi.org/10.20429/ijsotl.2008.020216.

Pearson, Marion L., Simon P. Albon, and Harry Hubball. 2015. "Case Study Methodology: Flexibility, Rigour, and Ethical Considerations for the Scholarship of Teaching and Learning." *Canadian Journal for the Scholarship of Teaching and Learning* 6 (3). https://doi.org/10.5206/cjsotl-rcacea.2015.3.12.

Prosser, Michael, and Keith Trigwell. 1999. *Understanding Learning and Teaching; the Experience in Higher Education*. Open University Press.

Rinne, Risto, and Ari Antikainen. 2022. "The Nordic Model of Higher Education from a Comparative and Historical Perspective." In *Routledge Handbook of the Sociology of Higher Education*. Routledge. https://doi.org/10.4324/9781003262497.

Robson, Colin, and Kieran McCartan. 2016. *Real World Research,* 4th ed. Wiley.

St. John, Kristen. 2018. "A Community Framework for Geoscience Education Research: Summary and Recommendations for Future Research Priorities." *Journal of Geoscience Education* 69 (1): 2–13. http://commons.lib.jmu.edu/ger_framework/15.

Thomassen, Elise B. H. 2019. *Å Forbedre et Emne i Høyere Utdanning. Hvordan Studenter og Lærere Opplever Emnet GEO1110 og hva kan Gjøres for å Utarbeide det Ytterligere*. Internal Report, University of Oslo.

Vaismoradi, Mojtaba, Hannele Turunen, and Terese Bondas. 2013. "Content Analysis and Thematic Analysis: Implications for Conducting a Qualitative Descriptive Study." *Nursing and Health Sciences* 15 (3): 398–405. https://doi.org/10.1111/nhs.12048.

Zhang, Meng, Kelly E. Matthews, and Shuang Liu. 2023. "Engaging Students as Partners in Intercultural Partnership Practices: A Scoping Review." *Higher Education Research and Development* 42 (7): 1792–1807. https://doi.org/10.1080/07294360.2022.2157800.