

Students' perceptions of active learning: Experiences from a course on urban ecological research

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Abstract

Preparing the next generation to address current and future ecological challenges requires creative and collaborative ways of problem framing and solving. Active learning formats have the potential to support the development of skills needed to address these challenges. For future development of active learning formats, it is important to understand students' perceptions of different aspects of their learning experience and outcomes. This article is based on students' feedback from a practical course on urban ecological research. In small groups, students develop a hypothesis and research design, conduct fieldwork, and then analyse and present the results. After completion of the course, I collected qualitative feedback from students and then coded it to assess students' perception of their active learning experiences, separated by course framing, group work and supervision. The results show that students appreciate the independence to explore real-world problems in a supportive group atmosphere. Within group work, the division of tasks is perceived to lead to more efficiency, but at the same time hinders learning new skills if roles are distributed based on existing experience. Further challenges stem from the trade-offs between students who prefer closer supervision with pre-provided contents and those who perceive close supervision as disruptive or a lack of trust. I discuss how, according to self-determination theory, the learning climate provided by course framing, group work and supervision can strike a balance between needs for autonomy, competence, and relatedness. To improve, I suggest a predictable supervisory structure and full transparency to students about the active learning goals and challenges.

Introduction

Educating the "next generation", as the theme of this issue, means preparing students for increasingly complex challenges posed by current and upcoming global crises, ranging from pandemic response through biodiversity loss to climate change. These crises are often interlinked, have inherent trade-offs and high uncertainty, posing wicked problems that do not allow identifying clear-cut problem-framings or even unidimensional solutions (Balint et al., 2011). To allow students develop critical thinking, creative science approaches and collaborative maturity, new, transformational ways of learning are required (Baxter Magolda, 2009; DeHaan, 2011; Schneider et al., 2021). As part of that, ETH Zurich aims to foster a competence framework that supports besides subject-specific competences also method-specific, social and personal competences (ETH Zürich, 2023). Active learning is an important

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format to increase the range of acquired competences. Here, students steer their own learning process by defining a question or a problem and then independently develop a research approach to resolve the question or problem. Such self-defined learning processes have been shown to be a better preparation for complex challenges than more knowledge-based learning approaches (Freeman et al., 2014; J. I. Smith & Tanner, 2010; Wieman, 2014). Active engagement of students in the classroom has been proven to be highly effective for overall learning outcomes, yet students often perceive their own learning experience higher with passive teaching formats, especially if they are more familiar with such traditional learning environments (Deslauriers et al., 2019). To find out if this cognitive discrepancy also exists in the environmental sciences and how different aspects of the active learning process are perceived individually, I asked students for detailed feedback after running an active learning course.

In a practical course centred around basic ecological processes in urban ecosystems, we apply a “radical” active learning approach, which means that we intentionally leave the definition of research questions and hypotheses for the students to define. The aim of the course is to enable students to develop their own ways of creative science thinking. We assume that scientific endeavour starts with questioning the small things in environments that are assumed to be familiar places. Here, we invite students to explore patterns and processes of ecological interactions right in front of their doorsteps in and around the city of Zurich (Fig. 1). Apart from the general framing that the methods should include fieldwork on the ground and the overall time framing, we do not restrict the scientific questions, research design and analysis methods that the students apply in small groups. Yet, we do provide guidance by mentors with experience in applied ecological research. Throughout the course and especially in the final debriefing session, we foster co-learning within groups and peer-feedback across groups. With this setup, we attempt to create a student-centered learning environment (Baeten et al., 2010), inspired by flipped classroom techniques (Cho et al., 2021; Zappe et al., 2009).



Figure 1: Example project from the course, where students decided to probe a stream in the forests of Zurich to compare macroinvertebrate communities upstream and downstream of artificial structures (picture: Noah Bachmann).

While the general benefits of active learning are widely accepted, it remains unclear if certain elements of active learning processes are more appreciated by students than others. To improve my own teaching and to share those experiences with others, I asked students after the course to provide their written qualitative feedback on the course experience. I wanted to find out how students perceive their own active learning process in terms of provided structure for the creative process, and what could be improved from their points of view regarding supervision and group work. I discuss the results in the theoretical framework of self-determined learning. The key question of this qualitative research is how different aspects of the active learning process are perceived and valued by students. This information will be valuable for lecturers and teachers in multiple disciplines especially in the natural sciences.

Methods

The integrated practical field ecology is a Bachelor course in the Environmental Sciences curriculum designed to let students develop, run, and present their own ecological research project within a three-week timeframe, involving fieldwork around the city of Zurich. The course is roughly divided into a brainstorming, ideation, and design phase (first week), a fieldwork phase (second week) and an analysis and presentation phase (third week). Students run their projects in groups of three to four, each group supervised by a mentor. The course took place twice in April and May 2022, with 14 participants in the first round and 16 in the second round.

After the course, I carried out 30 voluntary, qualitative written surveys with course participants. The questions were grouped into three blocks, including general feedback, groupwork and course contents (see survey questions in Appendix). Self-reported students' perceptions are considered a useful indicator of learning processes, as they have been shown to influence learning outcomes (Lizzio et al., 2002). I intentionally omitted general identity-related questions such as gender, age and background as they were not relevant for the study questions, however, we included one question (no. 12) to allow free expression of identity-related issues that influenced the learning process from student's points of view. Responses were allowed in German and English; replies translated from German are labelled in the results. To ensure anonymity, participants were asked to upload their reply-sheets under a random name to a joint folder. While the purpose of the questionnaire was initially stated as for an assignment in the ETH course Foundations of Teaching and Learning, I later obtained written consent from all participants to allow the publication of this article.

To analyse the qualitative replies, I largely followed an inductive approach following a modern interpretation of grounded theory (Deterding & Waters, 2021), where responses to open-ended questions are coded into thematic aspects of perceived key elements of active learning and key challenges. Further, the question framing included deductive elements such as the assumption that self-determined learning is influenced by the learning climate provided by social interactions between students and the supervisory structure (Levesque-Bristol et al., 2022). Key focus of the analysis was therefore on self-confidence and preferred learning, and the enabling conditions provided by supervisors and within working groups. Given the focus of this paper on student's perception of active learning as a pedagogical method, I omitted responses that solely concerned the contents of the course.

Following a more quantitative approach, I further coded each survey if it was generally positive, neutral, or negative on a) the overall course, b) the course framing and approach, c) the groupwork and d) the supervision. These replies are reported in percentages of all participants.

Results

The students overall appreciated the active learning process. Out of the 30 replies, 71% were generally positive towards the approach, 16% neutral and 13% negative. This positive experience is mentioned in conjunction with personal motivation and creative processes that happened within the groups, especially while designing the experiment and during fieldwork. Yet, students also identified challenges that they faced related to the learning climate, the framing and creative process, supervision, and group work experiences. In context of the ETH Zurich competence framework, many of these challenges are linked to high expectations for subject- and method-specific competences but are instead part of the process to develop social and personal competences (Fig. 2). In the following sections we provide example quotes from student's responses to illustrate the specific perceptions and challenges faced by students, grouped into course framing and creative process, groupwork and supervision.

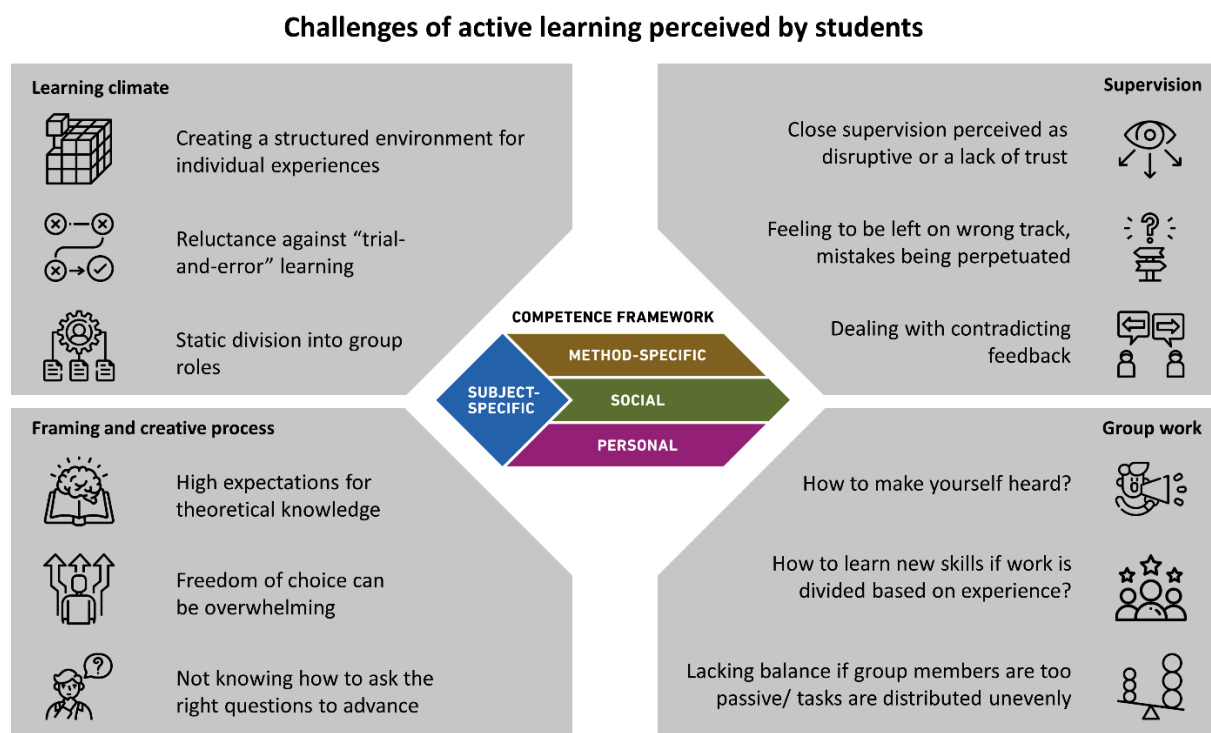


Figure 2: Overview of the coded active learning challenges based on students' replies grouped around the ETH Zurich Competence Framework².

Course framing and creative process

The students' replies were generally favorable about the course framing and teaching approach taken, with 80% positive, 10% neutral and 10% negative replies. A key driver of

² Source: www.ethz.ch/comp-teachingstaff, Images: www.flaticon.com

motivation appeared to be the independence in the work process, where students are free to decide what to do and how. This was highlighted in comments such as the following:

“I learn much more if I can invest time based on my own interests rather than just handling the provided contents”

“In the end, I believe I learned more from this course, putting less hours of work into it. It felt less like an obligation and more like something fun to do”.

What further drove student’s motivation was the overall change to do something different than in other lectures:

“It is different to our normal day when we are sitting in lectures and only have to listen to the professor. Here we could do something on our own.”

“In the past the scientific method has always been delivered to me in a very dry way («this is how it’s done.»)”

Another set of replies concerned the benefits of applying theoretical knowledge to practice and through this start a process of reflection to find out about own abilities and gaps:

“I was really happy to be able to apply what I already knew and find out what I did not know yet.”

“This challenged you to think of solutions yourself but if you can’t figure it out there is always someone there to help you so you don’t waste too much time on one small problem.”

Yet, students also described challenges that they faced throughout the process. Some were challenged by the (perceived) lack of structure and theoretical knowledge and felt overwhelmed by the freedom. They perceived a need for “full picture” of theoretical knowledge and a set of available methods before being able to try things out by themselves:

“I personally prefer more theoretical knowledge.”

“Active learning is ineffective if foundational methodological knowledge is missing.” [translated from German by the author]

Some students also shared a feeling of being overwhelmed by the full freedom of choice and expressed the wish for more structured ways of teaching:

“The freedom of research topic choices we had overwhelmed and then frustrated me, instead I would have liked to have a focus or more of a guiding question to hold on to.”

“Maybe there could’ve been a bit more structure. It felt like it was a bit missing but maybe it’s just that we’re not really used to this kind of work (yet)”

Finally, there was some expression of general reluctance against what was perceived as “trial-and-error” learning:

“I am wondering the whole time, how I can make sense of the chaos around me and do not want this also at university. I need concrete methods and tools rather than being thrown into cold water. I am sick of more trial-and-error-learning.” [translated from German by the author]

Group work

Students' replies about their groupwork experience, showed 71% positive, 26% neutral and 3% negative replies (i.e. one out of 30). In the group work, students appreciated being able to support each other and learn from each other. The process of spending time together in the field also had an important social function of getting to know people:

"Everybody helped everybody."

"I felt very comfortable in my group and in the whole course. I was encouraged to say something but never forced to. So sometimes I get out of my comfort zone but it was nice to do this and say my opinion."

"I had the feeling to be able to say anything if I wanted to. My opinion was never judged in a negative way"

"The structure of the course made it really easy to get to know the people."

Yet, this group process also included perceived challenges, especially regarding the division of tasks, communication and decision-making. Negotiation processes within groups were perceived as a process of self-assertion and feedback to others, making sure to have the own opinion heard while giving space to others:

"Some people didn't bother to say what their opinion was after they were told that something they mentioned isn't important and I think that that was sad."

"When I have to give feedback, I have to understand the process, see possible mistakes but also give my feedback in a precise and understandable way."

"Someone took the role of the "leader" who tried to manage the group and finalize decisions. Others were focused on the more creative, inventive part."

"The quality would be better if we were more motivated. Then the team would work better together."

Another recurring theme was the equal division and distribution of tasks. While some students perceived their form of division as positive and effective, others expressed a perception of lacking balance if group members were too passive, or tasks were distributed unevenly:

"That's not specific to this course, but I find it super hard if the students don't engage in the course. Here it was not as bad as usual. Students asked more questions and gave more critical feedback. They were also activated to do so. Cool!"

"I think that the group put me in a position I don't usually like to take. But it was really good to get out of my comfort zone and take on a role that I normally wouldn't."

"One person controlled everything and had the overview of what should be done."

"I feel the roles were distributed unevenly. One or maybe two people did the bulk of the work (partially also because of language barriers with English). So, if that person or those two people were on the wrong track about something, there was virtually no counterbalance."

Some students further mentioned that too much division of tasks can limit the learning of other group members who might become marginalized in the group process or lack confidence to take on certain tasks. An overly static division into stereotypical roles led to two contrasting perceptions: a) If someone had to take a role that they felt unsuited for, this could be perceived as inefficient. b) If work is divided exactly based on existing skills and experience, there are less perceived opportunities for students to learn new skills:

“There was a coordinating and reminding role, a technical role (maps, data collection) and a statistical role (R)”

“Statistician, organizer, no-show-person, pressure-maker, decision-maker” [translated from German by the author]

“I think I also had to take on some roles that were not necessarily my strong suit and I feel like it impacted our results negatively.”

“Everybody did what they already were good at, which is nice for the efficiency but maybe not great for learning new skills.”

“Data analysis was overtaken by one person, which is sad so the others struggled improving their own stats skills”

Supervision

The supervision that we provided as lecturers was rated positive by 52%, neutral by 19% and negative by 29% of students. Across the range of student responses, there was a trade-off regarding the role of the supervisors or mentors: some students expected more direct feedback and guidance, others appreciated that they were not under constant supervision, while others perceived that too close supervision was disruptive or implied a lack of trust or confidence in their work:

“We could get help when we needed it, but also had enough space when we just wanted to discuss inside our group (aka no pressure).”

“Maybe a bit more input through the course from the mentors, maybe we didn’t reach out enough from our side”

“Sometimes the Teaching Assistants (TA) were interrupting us right in the middle of an important design discussion.”

“I knew that support was there but sometimes I didn’t really feel comfortable with the support given as it felt like a lack of trust in our effort was present. I know that this was probably not the case at all but it was just the mood I caught from it at some moments. Due to that I sometimes felt more comfortable trying to find solutions to a problem myself than consulting an assistant.”

The way we initiated and interacted throughout the active learning process led to some uncertainties which the students had to resolve for themselves first:

“When you told us at the beginning what we would have to do, I thought that it would be way harder to find ideas.”

“The feedback from the assistants and lecturer was very much appreciated and that I think is important also in future courses maybe just a short meetup over Zoom about the progress, but the exchange between groups not so much.”

Further responses allow to identify potential reasons for the discrepancies between student's perceptions of the supervisory structure. These could have to do with certain contradictions between feedback given by different mentors or a general feeling of being left on a wrong track, leading to a perceived perpetuation of mistakes. Another perceived reason for limited benefit from supervisors was the feeling of not knowing how to ask the “right” questions to advance:

“The tips of the assessors were sometimes distracting; when we decided to do one thing, they advised us to do it differently.”

“The comments of our tutor mostly made sense, but often I did not understand where they should lead us to. Once we had decided what exactly we wanted to investigate, we were told to consider other things, without exactly telling us how to do it”

“I feel like we did not manage to get the help we needed or desired from our mentor (not because of lack of engagement or competence but rather unclear communication or not knowing how to ask the right questions on our part)”

Outcomes perceived from lecturer perspective

While this is generally a pleasant course to teach due to the high level of students' engagement and motivation there are also challenges from a lecturer perspective. Given the very open framing of the research questions, it happens quite frequently that the approach and methodology chosen by students are more or less outside our own research experience. This can lead to disappointment on the side of the students and an uncomfortable feeling on our side as lecturers, who are expected to be experts. We react to this by framing the course as a joint learning experience, but it is not always possible to overcome this discrepancy.

This is an ungraded course, but we generally found the final presentations by students of high quality. So far, every group has managed to identify their own hypothesis, collect data and analyse it. Naturally, the quality of the sampling designs and data produced is variable. Yet, we make it clear to students from the outset that it is not the aim to be complete in the results, but rather in the process (from start to end). We always highlight the importance of the trial-and-error approach and explicitly ask students to reflect on their own learning process during the project. They do this for example with pictures or other ways to describe and document which things did not go so well and what they think could be done better:

“I think all of the presentations were very engaging and interesting to listen to. They also felt very informative, so I think the delivery of the results was done very well. However, I do think that the results themselves don't have a lot of scientific value or are kind of random because they were all generated within days not months or years. Also I think everyone made a lot of mistakes during data collection (at least our group did).”

Experiencing the learning curve together with students, and hearing about the general enjoyment of the field activities is the most rewarding part of the teaching experience. As a student framed it in the survey:

“I thought all the presentations were very good and was surprised by how much was achieved in the past three weeks. I think almost everyone was able to profit from this course in some way.”

Discussion

Contrary to results reported from other fields (Deslauriers et al., 2019), I find that students in our course generally showed high appreciation for the active learning approach that we chose. Complementing existing research, our qualitative approach allowed us to break down perceptions of different aspects of active learning. It shows that the course framing and structure, as well as the support within working groups was of high importance to students and generally valued higher than supervision by mentors and lecturers. A key success factor for active learning is the “buy-in” from students (Cavanagh et al., 2016). That means, the willingness of students to fully embrace the methodology strongly affects the individual learning outcomes. The willingness of all students to provide constructive feedback through the questionnaire indicates good buy-in from students. The replies illustrate a general feeling of excitement about the approach and the creative process that it triggered. Yet, individual replies showed some general reluctance and feeling of insecurity resulting from the supervisory structure that may have limited their individual buy-in and reflected on their perceived learning outcome.

The results can be interpreted in context of self-determination theory (Deci & Ryan, 2008). Self-determined learning happens in a tension field of three psychological needs that support personal wellbeing: *autonomy*, the ability to contribute to decision-making reflecting own motives; *competence*, the ability to master skills or achieve goals and *relatedness*, the feeling of connection and sense of belonging. The learning climate provided by a course determines the perceived satisfaction of these needs (Levesque-Bristol et al., 2022). Hence, active learning is most successful when all basic needs for self-determination are met. I suggest that the overall framing of the creative process (the course setup), the supervisory structure, and the groupwork are the essential levers for a course leader to control the learning climate that enables self-determined learning (Fig. 3). If *autonomy*, *competence* and *relatedness* are met within each of these factors, then the learning climate should generate good active learning outcomes.

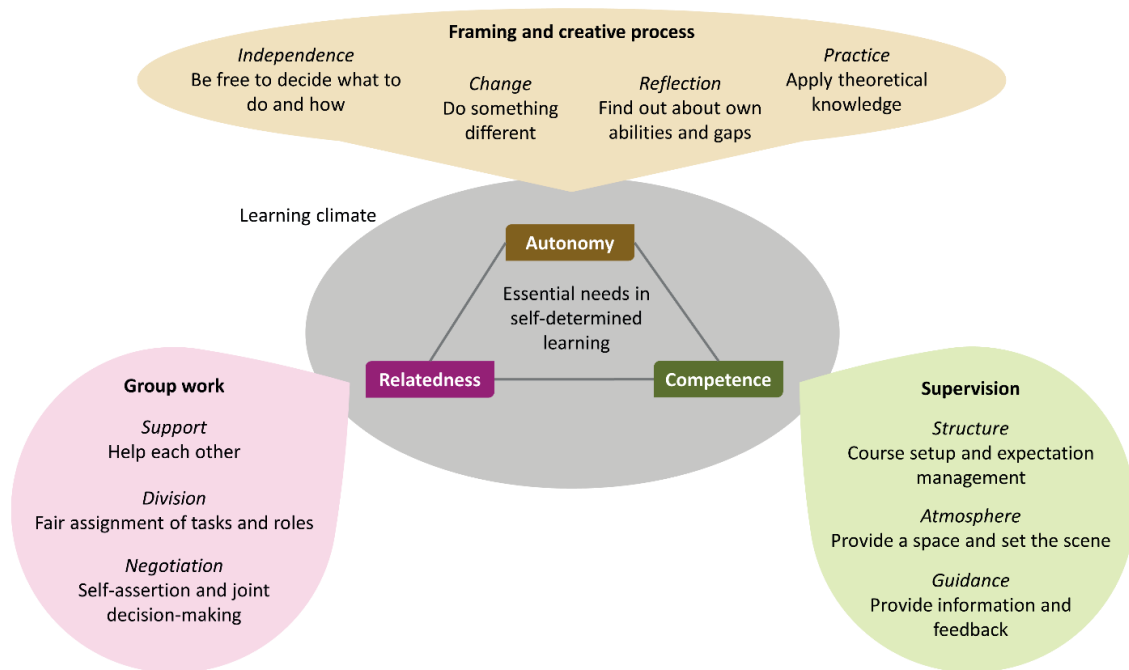


Figure 3: Foundations for active learning based on student feedback. These can be seen as the main “ingredients” for active learning, following the theoretical framework of self-determined learning (adapted from Levesque-Bristol et al., 2022) to generate a beneficial learning climate in active learning courses.

Our results show that the overall framing of the course supported the feeling of *autonomy*, the groupwork supported the feeling of *relatedness* and the supervision supported the feeling of *competence*. This led to overall positive perceptions of the active learning format and outcomes. On the *autonomy* side, independence, freedom and change from the ordinary, were frequently mentioned as highlights of the overall course. Yet, the students’ perceptions of the process also reflect challenges resulting from tensions between contrasting autonomy needs that can be associated with individual preferences and experiences, but also limitations in the supervisory structure and group-dynamics.

Group work

Clearly, students can benefit from exchanging with each other through peer-instruction (Giuliodori et al., 2006). Our results show that the group work provided a strong base for the feeling of *relatedness* as an essential need in self-determined learning. This was expressed through an appreciation of the social processes and the attitude of helping each other. On the ladder of cognitive engagement from passive through active and constructive to interactive (Chi & Wylie, 2014), many of the students seem to have climbed quite high. Yet, in the tension field between *autonomy* and *competence*, students perceived several pitfalls inherent to groupwork. A well-documented issue with student’s group work is related to free-riders, i.e. students who try to minimise their own effort and maximise the benefit from the overall group outcomes (Maiden & Perry, 2011). While some students perceived free-riding as a limitation for constructive discussions, others noted that this was less the case than in other courses. A more frequently mentioned (both positively and negatively) issue was the distribution of roles within the group process. It seems that most groups decided on some kind of division of tasks with the purpose to be more time efficient. This was not perceived problematic during fieldwork, but rather in the analysis phase. Here, some students reported that the statistical analysis was carried out by one person that was most familiar with the software and methods, leaving others

behind with the feeling of a missed opportunity to advance their own skills. Structurally, this situation could be countered by a requirement that roles in the group must be actively rotated (Chi & Wylie, 2014), even if that may impact on the overall perceived group performance. Finally, while it has been shown that active learning settings can favour male dominance in group interactions (Aguillon et al., 2020), none of the students reported this as an issue, although the questionnaire explicitly included the possibility to report on gender or identity-related issues within group work or supervision.

Supervision

The results indicate that students clearly differ in their preferences for supervisory structures, and there is a constant tension between thriving on the independent, self-guided and peer-group working, as opposed to directed, structured, and teacher-led approaches. Related to the *competence* dimension of self-determined learning, some students expressed the wish for expert-curated content that should be provided to them in oral or written form. It has been shown that content review is often favoured over experiential learning, independent of the fact if the student has the capacity to process all the provided information or not (C. V Smith & Cardaciotto, 2011). Related to this wish for expert-led learning, we identified that some students were relatively sensitive for the coherence in guidance and instructions provided to them from different mentors. Further, there was an expectation from students that supervisors were able to give expert advice on any of the freely chosen topics and methodologies, which was not the case and - in the given format - also not realistic. Here, students expected the role of the supervisors to be simply providers of information, rather than the more complex roles of “facilitator” or “coach” which are required for problem-solving processes such as the group work in the course (Stauffacher et al., 2006). Finally, a key factor for the perception of supervision seemed to be the timing in which feedback was provided. If groups were visited on a regular base without being called up, this could be perceived as disruptive or as a lack of trust. If on the other hand consultations were provided only upon request from the students, this could lead to a feeling of getting lost in a situation where the group did not feel to be able to formulate a meaningful question. Here, a clearer supervisory structure, with co-agreed scheduled regular meetings may provide a more transparent and predictable framework.

Conclusions

Active learning is now relatively well-established in the field of environmental sciences. Feedback from students in our course showed that they are generally open for this approach and perceive benefits from it. The main challenge lies in making the process equally accessible and beneficial for everyone, involving people with contrasting expectations and learning preferences. One idea to reconcile experienced and actual learning could be to show existing research at the beginning of the course indicating that active learning generates better learning outcomes than passive learning (e.g. Deslauriers et al., 2019). Yet, we also see potential for improvement in how our course is structured and organised. We suggest that the key to successful active learning processes in groups lies in the flexibility how roles are distributed and shifted within groups during the work process, which could be steered by improved preparation and self-reflection beforehand. We further emphasize on the importance of making the supervisory structure predictable before the course which includes clear communication about what kind of mentorship and facilitation is offered and what is expected from groups. While the students feedback overall supported our “radical” active learning approach, we

suggest that reliable supervision and dynamic group processes are key for improved learning outcomes. Providing guidance on group work, facilitation, and debriefing processes from the outset may help improving the supervision and group work related limitations of active learning and thrive on the benefits that many students perceive from active learning.

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Appendix: Original questions

Part I: General feedback

1. What were your expectations before the course? Think about learning goals but also personal and professional experiences that you wanted to make.

Was waren deine Erwartungen an den Kurs, bezüglich Lernzielen, aber auch persönlichen und fachlichen Entwicklungszielen?

2. What surprised you? *Was hat dich überrascht?*

3. What did you enjoy (most)? *Was hat dir (am Besten) gefallen?*

4. What was missing? *Was hat gefehlt?*

5. What should be improved? *Was könnte verbessert werden?*

6. What will you remember? *Was ist hängen geblieben?*

7. If you could restructure the overall course, how would you re-allocate the time between: a) input from lecturers, b) brainstorming, c) study design phase, d) field work, e) analysis phase, f) preparing and g) giving the presentation, f) debriefing, h) other elements?

Wenn du den Kurs selbst strukturieren könntest, wie würdest du die Zeit neu aufteilen zwischen den verschiedenen Kurselementen; was sollte länger, was kürzer dauern?

Part II: Groupwork

8. Was the group size too big, too small or just right?

Wie hast du die Gruppengröße empfunden?

9. In your group, did you notice that people took different roles? Elaborate which ones.

Wie war die Rollenverteilung in deiner Gruppe, gab es unterschiedliche Zuständigkeiten auf inhaltlicher und emotionaler Ebene?

10. Did you feel you could take on a role that suited your abilities and expectations?

Konntest du eine Rolle übernehmen, die deinen Begabungen und Erwartungen entsprach?

11. Within your group, did you encounter any communication issues, and did you develop mechanisms to improve communication?

Gab es Kommunikationsprobleme und wie seid ihr mit ihnen umgegangen?

12. How comfortable did you feel personally with the support from your group, your mentor and the course leaders? Note that in this survey you do not have to give any personal information such as gender, ethnicity, sexual orientation, or personal background. Yet if you feel that any of such factors played a role in the process, feel free to state it here.

Wie sicher und unterstützt hast du dich auf persönlicher und emotionaler Ebene durch deine Gruppenmitglieder:innen, Mentor:in und Kursleiter gefühlt? Falls es einen Zusammenhang mit deiner Identität z.B. bzgl. Geschlecht, Ethnizität, sexueller Orientierung oder persönlichem Hintergrund gibt, kannst du ihn hier darlegen, musst aber keinesfalls.

13. How valuable for your overall learning process was it to work with your classmates as compared to the lecturers/mentors?

Wenn du an den gesamten Lernprozess denkst, wie hoch ist der Stellenwert des Einflusses deiner Gruppenmitglieder:innen, verglichen mit den Mentor:innen und Kursleitern?

14. If you are honest, did you effectively work more, less or exactly the amount of time that was scheduled for the course? Why do you think that was the case?

Wenn du ganz ehrlich bist, hast du effektiv mehr, weniger oder genau so viel Zeit in den Kurs investiert wie im Stundenplan vorgesehen und warum denkst du war das so?

Part III: The scientific process and urban ecological research

15. What is your opinion about the active learning approach of the course in terms of understanding a research process and applying existing ecological knowledge to a real case?

Als wie effektiv empfindest du den aktiven Lernansatz des Kurses in Hinsicht auf die Beherrschung des wissenschaftlichen Arbeitens und der Anwendung ökologischer Grundkenntnisse auf einen konkreten Fall?

16. Which part of the overall scientific process (hypothesis building, research design, field work, data analysis, presentation, etc.) do you understand better through the course?

Welcher Teil des Wissenschaftlichen Arbeitens ist klarer geworden?

17. Which part of the overall scientific process is still unclear to you?

Welcher Teil des Wiss. Arbeitens ist weiterhin unklar oder weniger klar als zuvor?

18. How would you judge the quality of the final presentations (regarding form and content) in their scientific quality and their goal to excite the listeners about the chosen scientific question?

Wie beurteilst du die Qualität der Abschlusspräsentationen im Hinblick auf wissenschaftliche Güte und das Ziel die Inhalte möglichst anschaulich und ansprechend aufzubereiten?

19. Do you feel you received sufficient feedback from classmates, mentors and course leaders that allows you to assess if you reached your own learning goals?

Hast du ausreichend Rückmeldungen auf deine Arbeit erhalten, aufgrund dessen du einschätzen kannst, ob du deine Lernziele erreicht hast?