

Integrating the student and teacher perspective in Course alignment across 3 years: teaching of geological maps in the UiO bachelor

Torabi, Anita, Augland, Lars Eivind and Lundmark, Anders Mattias

¹Institutt for geofag, Pb 1047, Blindern, 0316 Oslo, e-post: anita.torabi@geo.uio.no

ABSTRACT

We report the results from an iEarth funded student-staff collaboration at the Department of Geosciences, Oslo University. The aim of the study was to find out what challenges students experience in geological map teaching across the bachelor program in geology, and to find solutions in discussion with the students. Two Master students conducted interviews and questionnaire surveys among bachelor students, and wrote up the results along with their analysis (Appendix 1). This formed the basis for discussions with the course responsible teachers of the three courses in the bachelor where most of the teaching of geological maps takes place: GEO1110 (1st year), GEO2130 (2nd year) and GEO3010 (3rd year). The challenges and solutions identified in that discussion are presented in this report.

INTRODUCTION AND AIMS

A commonly used model for curriculum design is the “spiral curriculum” where students revisit themes at different stages of their education, each time adding complexity and depth to their understanding (cf. Bruner, 1960). E.g., geological maps may be introduced early in a geoscience programme, but quite superficially. In following courses, new layers of skills and understanding are added, as students use the maps to solve problems that are more complex. However, university programmes consist of a great many courses. In our experience of teaching geoscience bachelor courses at Oslo University, it is rare that individual teachers can stay abreast of what and to what degree students master knowledge, skills, and build understanding in courses other than the one’s they personally teach. In practice, this makes it difficult for teachers to ensure that they build on what students already know. Starting to teach at a too basic or too advanced level leads to frustration and a waste of valuable teaching time. In this project, students in the geology bachelor programme at Oslo University experienced some of that frustration with regards to work on geological maps, particularly as they took the capstone Field and Mapping course GEO3010.

Using and interpreting, and sometimes making, geological maps are important for nearly all geoscience work, both professionally and in academia. Geological maps are therefore used in a great many geoscience university courses, but in the geology bachelor at Oslo University, traditional geological map interpretation is primarily taught as part of the bachelor courses GEO1110 (1st year), GEO2130 (2nd year) and GEO3010 (3rd year; UiO, 2022). Over the years, geological maps have been taught in various ways and to different degrees in the different courses, and teachers have come and gone. All the three courses above have recently had new teachers taking over course responsibility (i.e., the authors of this report). Therefore, and in response to student frustration, we decided to try to find out more about the student experience, and potentially implement changes to the three course. One obvious source of intimate knowledge of the content of the courses are the students themselves, and we therefore applied for iEarth funding to employ two students to gather experiences from their peers, and help us understand the results from the students perspective (cf. Harrington et al. 2014).

The aim of this project is to evaluate coherence and progression in map teaching across the courses, and use the results to eliminate unnecessary repetition, ensuring beneficial repetition, and identify and address potential gaps in the teaching and learning.

METHODS AND RESULTS

To find students interested in running the study, information about the project was sent to Master students taking Structural geology at the masters level (the course GEO4850). Two students who had taken the three courses of interest in previous years were employed part-time to design and do the study, Helene Reykdal and Victoria Kjeldstad. Helene and Victoria decided on a mix of quantitative and qualitative questions, combining questionnaires and interviews. They also decided on what questions to ask based on the project description, and expanded the study by including questions regarding more generally to fieldwork. Since all three courses had undergone considerable change over the years, it was decided to limit the study to students from the last 3 years, which include students who took the courses during corona restrictions. For practical reasons, only students still enrolled at the university were included (potentially lending some bias to the results). Students who participated in the study were offered beverage and food during the interview as compensation for participation. The data were gathered and interpreted in a written report (Reykdal and Kjeldstad, 2022), and presented to and discussed with the teachers. The report, including details on the methods, the questions and the results, are found in Appendix 1.

DISCUSSION AND CONCLUSIONS

As teachers, we were aware that students wished for more coherence in the map teaching. Through the study we received detailed feedback and recommendations from both the interviewed students, and from Helena and Victoria, both in the form of their report and in the ensuing discussions. The most important themes raised in the discussions were:

1. Most of the geology students were unaware of the learning goals related to fieldwork and geological maps in the courses. Not knowing the goals makes it difficult for the students to evaluate if they are making progress, and to see how the different courses fit together.

Suggestion: Repeat both formally and casually the learning outcomes of the courses and show the relevance of it to the future jobs of students. Make sure that the learning goals are coherent across the courses.

Suggestion: Start each course with an anonymous quiz; ask the students to rate their understanding of themes from previous courses that the new course is building on, and point the students to material from previous courses for repetition where necessary. This will support students in seeing the relation between different courses, as well as giving them the opportunity to prepare for new courses. It will also give teachers the opportunity to get to know what level the students are starting from, and to adapt their course accordingly.

2. The students learn different field skills during their bachelor. These need to be maintained over time. E.g., the students in the geology programme report a large time gap between introductions to GIS programs for making and using digital maps in the first year of the bachelor studies, and the use of these skills in the third year capstone course (by this time they had forgotten how to use them).

Suggestion: Most geology bachelor course have, or could include, field and map components. Add elements to the courses that allow the students to use their knowledge from previous courses. E.g. use the GIS skills developed in the 1st year to prepare for fieldwork in the 2nd and 3rd year courses. This does not necessarily include adding new skills, the main purpose is to maintain the skills and demonstrate their usefulness to the students.

3. To maintain already learnt skills, the students need access to teaching material from previous years. In theory, such material is available on Canvas, in practice some students may need to be able to access this material in the course they are currently taking.

iEarth projects database 2022

Suggestion: Put essential material related to skills in Canvas folders that can be added to all the relevant courses in the bachelor. Alternatively, or additionally, develop new platforms, like a handbook for bachelor students, where they can go back and be reminded of what they have learnt whenever it is needed.

4. The students report learning most from practical work, including fieldwork.

Suggestion: The students suggest more frequent and smaller field exercises in the courses. Also, they remind us to be mindful of the fact that they need more scaffolding in the early courses to know “what to do” in the field, whereas being allowed time and freedom to explore field locations in the later part of the bachelor is very valuable.

We conclude that the student voice brought to the discussions was extremely valuable for our understanding of the problems the students face. It resulted in several concrete suggestions (above) that we will now work to implement for the next iteration of the courses.

ACKNOWLEDGMENTS

We’d like to thank Helene Reykdal and Victoria Kjeldstad for an excellent job and valuable discussions, and all the students who participated in the study (and remain anonymous to us teachers). iEarth is acknowledged for funding the work.

REFERENCES

Biggs, J., & Tang, C. (2011) Teaching for quality learning at university. McGraw-Hill education (UK).

Bruner, J.S. (1960) The process of education. Harvard university press.

Harrington, K., Flint, A. & Healey, M. (2014) Engagement through partnership: Students as partners in learning and teaching in higher education.

UiO (2022) Geologi og geografi bachelor programme. Available from:
www.uio.no/studier/program/geologi/studieretninger/geologi/index.html (Retrieved 1-6 2022)

APPENDIX 1

Reykdal, H. & Kjeldstad, V. (2022) iEarth Education Research report. Course alignment across 3 years with students as partners: geological maps in the UiO bachelor

Course alignment across 3 years with students as partners: geological maps in the UiO bachelor

iEarth Education Research report

Helene Reykdal, Victoria Kjeldstad

Aims of the study

The main purpose of this study was to map out feedback from geology students on the coherency of Bachelor courses GEO1110, GEO2130 and GEO3010 with a special focus on fieldwork and mapping topics.

Methods

To map out the different aspects of the courses, both quantitative and qualitative interviewing methods were used to include as many students as possible in the study. It was important to ensure complete anonymity, and the students were only categorized by the year they started their degree.

At first, a web form with multiple-choice questions was sent out, where the candidates could answer on a scale from totally agree to totally disagree. This was done to make the students reflect on the three different courses before the actual interview, and to get a general feeling for their attitude towards the different courses. This was also done to ask what year they started their degree and what year they had the different courses, which affects their answers due to the inconsistency of the courses.

Secondly, two different group interviews were planned in person. A PowerPoint presentation was used to guide the discussion through the questions, while leaving room for the students to express their thoughts as they occurred. All persons agreed to having their voices and answers recorded, which was disposed of after transcription.

Finally, after the interviews were done, the same questions were sent to all the students in a different web form which required text-based answers.

The questions for the group interviews and written text-forms were divided into four categories within: (1) Classroom-based teaching, (2) Field-based teaching, (3) Group-based teaching and (4) Independent work.

The candidates of this study were chosen based on the following criteria: (1) The students completed the courses GEO1110 between 2018 and 2020, GEO2030 between 2019 and 2021, and GEO3030 in 2020 or after. (2) The students are still enrolled at the University of Oslo and available by e-mail.

Results

The response from the first web form is presented in Table 1. In general the participants experienced that the three studied courses are all relatively coherent, while a couple of the students didn't experience this at all. By doing the courses GEO1110 and GEO2130, half of the students felt prepared for the course GEO3010, while the rest felt very unprepared. The mapping exercises of the different courses have a trend where the participants felt that exercises in GEO1110 had some relevance to their degree, GEO2130 was more relevant, while most felt the exercises in GEO3010 were very relevant. In general, all the students are somewhat pleased with the amount of field work they were able to do. This is excluding the students that had GEO2130 in 2020, which didn't attend any field excursions due to the pandemic, and the students that haven't finished the course GEO3010 yet. The results in this form also display a negative trend in the student's motivation during the years of their degree. The first year, all participants were somewhat-very motivated for their degree, while this motivation started to drop during their second year in GEO2130, with several students experiencing little motivation after the course GEO3010, mostly due to the pandemic, but also due to some feelings of unpreparedness.

Table 1. Results from the first web form with multiple choice answers. Total number of participants: 14.

<i>Answer</i>	<i>Number of answers</i>	<i>Answer</i>	<i>Number of answers</i>	<i>Answer</i>	<i>Number of answers</i>
What year did you do the course:					
GEO1110 – Earth Processes?		GEO2130 - Structural geology?		GEO3010 – Field and Mapping Course?	
2018	6	2019	4	2020	4
2019	5	2020	6	2021	7
2020	3	2021	4	2022	3
How prepared were you for the course GEO3010?			How coherent do you think these three courses are?		
Very	1	Very	1		
Somewhat	6	Somewhat	11		
Neutral	2	Neutral	0		
Very little	5	Very little	2		
Not at all	0	Not at all	0		
How relevant were the exercises in the group seminars in:					
GEO1110?		GEO2130?		GEO3010?	
Very	2	Very	4	Very	8
Somewhat	8	Somewhat	7	Somewhat	4
Neutral	3	Neutral	1	Neutral	1
Very little	1	Very little	0	Very little	1
Not at all	0	Not at all	2	Not at all	0

How pleased were you with the field excursions in:					
GEO1110?		GEO2130?		GEO3010?	
Very	1	Very	2	Very	3
Somewhat	6	Somewhat	4	Somewhat	6
Neutral	5	Neutral	1	Neutral	2
Very little	1	Very little	1	Very little	0
Not at all	0	Not at all	0	Not at all	0
Didn't attend	1	Didn't attend	6	Didn't attend	3
How motivated were you for the geological field of study after doing the course:					
GEO1110?		2130?		3010?	
Very	8	Very	3	Very	2
Somewhat	4	Somewhat	10	Somewhat	5
Neutral	1	Neutral	1	Neutral	3
Very little	1	Very little	0	Very little	4
Not at all	0	Not at all	0	Not at all	0

The second set of questions were asked during two different interviews over two different days, as well as a web-form. The questions asked, and summaries of the student's answers are the following:

(1) Were you aware of the learning outcomes in GEO1110, GEO2130 and GEO3010? None of the students were aware of the learning outcomes in any of the courses, and GEO3010 was pointed out as the course they had no awareness of what to expect. Some read the list of learning goals (læringsmål) before taking the courses, and then never looked at them again.

(2) How did you experience the map- and GIS-teaching in GEO1110?

The students were taught how to use QGIS in a single 2-4 hours lecture in GEO1110. Some thought this was fine, and the rest felt that the gap in GIS-knowledge this creates is far too big. The students that didn't take additional geography courses, or courses from other institutes, don't know how to use GIS. Most ended up drawing their final map by hand in GEO3010. The students suggested sticking to one single version of GIS throughout the degree, and to use the version both lectures and students can be comfortable with. None of the students wanted to use QGIS in GEO1110. The students were also missing a proper introduction to GIS, where the basic concepts and terms are explained, before tackling practical problems. All students agreed that the lecturer showing how to use GIS in class, and working alongside them works great, they were just missing more of it.

(3) How did you experience using theoretical knowledge in the field? (E.g. recognizing rocks, fossils, formations.)

The 2017 and 2018 students learned a lot when doing practical exercises such as recognizing rocks and minerals, where they were given a set of actual rocks and minerals. However, there is a big difference between looking at perfect rock specimens in group exercises and recognizing rocks out in the field. The 2019 students learnt a lot less by only studying minerals in GEO1110 and didn't get to put their knowledge to use in the field due to restrictions. The 2019 students learned a lot by having a

whole day in the field in GEO1110, where they learned to properly measure strike and dip. Some of the 2017 and 2018 students experienced too much pressure in the practical group sessions with little room for mistakes, which made them forget what they learned. In general, the students learn the most by being in the field, and the students wished for more of it, and especially casual days outside without any requirements of reports afterwards.

(4) How much did you gain from the lectures in GEO3010 before starting with the independent field work? Was the education sufficient enough? How much did you remember from previous courses?

None of the students thought the lectures were useful or relevant before doing their own mapping. They didn't think the lectures had any coherence with the group seminars either. The students are also frustrated by the lack of information provided in the lecture notes and PowerPoints, which mainly consisted of pictures with no written explanations. This made it hard for the students if they wanted to go back and look at the material again. The students often felt very overwhelmed and underprepared because they felt that concepts were mentioned in a hurry with no time to process the information.

The students had forgotten everything about mapping and drawing profiles from GEO1110 before doing GEO3010, and the gap in time between these two courses is too great. The students wish for more maintenance of their mapping skills. They didn't think they learned anything relevant about mapping in GEO2130, with exercises at a too low difficulty level compared to GEO1110.

Field-teaching

(5) How did you experience the field-teaching in GEO1110?

Most of the 2017 and 2018 students had good experience out in the field in GEO1110. Some students were fine with the amount of field days, while others wanted more casual trips. Some of the students felt the environment in the field was very safe, with room for questions and curious exploration. The students would sometimes get to look at outcrops without the teacher's guidance. However, in such an early stage of geology education, the students did not have enough knowledge to know what to look for. Instead, the students should have been given a task sheet beforehand to get clues on what to look for. The students also wanted to have a more structured plan instead of orally given instructions and briefings on concepts the students didn't fully understand yet.

(6) How did you experience the field-teaching in GEO2130?

The 2018 students only had digital field-teaching where they couldn't cooperate with the other students, which they found very frustrating, and they didn't learn as much as the 2017 and 2019 students. The other students were very pleased with the teaching plan, and they had a very positive experience. They felt the preparations, material provided, exercises in the field were all good. One 2017 student wished they would focus a bit more on using the structural data to create actual maps and profiles.

(7) How did you experience the field-teaching in GEO3010?

Most of the students thought field-teaching was the best part of the education in GEO3030. They had a proper introduction of the area they were going to, and they got to know what to expect. Overall, the students liked doing independent work, where they could study the area at their own pace and ask the teacher questions.

(8) How did you experience the independent field work in GEO3010?

All students had a very positive experience of independent field work, where everyone could try the different tasks, but ended up with what they were most comfortable with. They tried to make sure everyone was aware of what was being done at all times, and the teamwork they did is something they greatly appreciated.

(9) How prepared were you to create an independent map in GEO3010 after taking the courses GEO1110 and GEO2130?

The geological map learning in GEO1110 was good; they got a decent introduction to map interpretation. The students learnt little about geological maps in GEO2130 and forgot almost everything before GEO3010. In general, the students got a proper repetition of what they learned in previous courses in GEO3010 (group exercises), which was crucial because of the one-year gap of no map learning.

(10) How cohesive did you think the courses GEO1110, GEO2130 and GEO3010 were?

The students felt that the courses GEO1110 and GEO3010 were very cohesive, but none of them understood why we also asked about GEO2130 as well. Some of them constantly mentioned that they thought GEO2120 - Sedimentology was more relevant. They didn't experience a natural transition between the three courses, which left a huge gap in their mapping abilities between the first and last year. One student pointed out that they would like more focus on structures in GEO2130, which would be useful in GEO3010. They felt like they had to learn the basics from GEO2130 anew when starting GEO3010. The 2018 students don't remember if they had any mapping teaching in GEO2130, but they desperately wanted more of it, and to be able to maintain their skills from previous courses.

(11) How confident were you in your independence in the field after taking GEO3010?

The students from the different years felt they were more prepared after doing GEO3010, but didn't feel like "real geologists" yet. None of them felt confident in their abilities after this course, but felt this was consolidated better during master's courses. A student that doesn't do master's courses that involve mapping feel like they lack this very important skill set beyond an understanding of the basics.

Group-teaching

(12) How did you experience the group seminars?

In GEO1110, the students didn't think they would be able to solve any GIS- or mapping exercises on their own or only based on the lectures. They were dependent on getting help from the teachers in the group seminars. They were lacking proper course material where they could look for examples of what they were doing. A couple of students were able to solve the exercises on their own, based on their own knowledge and the introduction done by the lecturer. In general, the students were very pleased, despite having lectures on zoom. They were the least pleased with the GIS-part of the seminar.

In GEO2130, The 2017 students were generally pleased, and thought they could solve the problems on their own by reading the book and by asking for help when needed. They thought the group seminars were exceptionally good, and most of what they learned in the course they figured out there. The 2018 students felt the group seminars were more important than the lectures when learning about mapping. A 2019 student thought the seminars were okay and were happy with the help from the teachers, but didn't think all exercises were relevant.

All students from the different years felt that there was way too much to do in the group seminars in GEO3010, and they didn't understand how to solve any of the exercises without asking the seminar teacher for help. They didn't have any course material to look to, and were very dependent on the teachers. They are generally happy with the seminars as a whole, they think they are very useful, but they wish they could be able to solve some things on their own. The students were strongly requesting better examples, and even suggestions for solutions to be able to see if they are working correctly.

(13) To what degree were the group exercises on the three courses helpful for your understanding of maps?

The students experienced that the group exercises were beneficial in all the courses, even though the exercises from GEO3010 were extremely tedious and the students believe they can learn just as much from the exercises even if the workload reduces. The most tedious part of the exercises in GEO3010 was the multiple re-evaluations instead of one complete correction, which the students found unnecessary.

(15) What was your experience with using illustrations to understand geological concepts in 3D?

All the students liked 3D illustrations; they helped a lot (e.g., V-rule, paper cube). They would like to see much more of it, as it's difficult to imagine objects in the field in 3D.

(16) To what degree did the written mapping exercises help you prepare for real field work?

How did you experience the transition from solving problems on paper to problems in the field?

Most of the students thought the written exercises helped quite a bit, but they felt the most prepared after having field days in GEO3030 with the teacher. Some of the students thought it was weird that all the written exercises in GEO3030 were on paper and only used FieldMove on an iPad in the field. One student said that the preparation in GEO1110 was good but did not feel prepared after GEO2130.

(17) Do you have any thoughts on how the group-teaching could be improved?

All the students want to look at solutions when they are finished with the exercises, to get reassurance of whether they did the exercises correctly or not. The students want the teacher to go through and explain the method in a similar exercise before receiving the actual exercises. It would be better if a 4-hour group session were separated into two 2-hour sessions on different days, where the students get to reflect on the material and come up with questions.

(18) Was it clear to you why you were solving the different exercises?

Most of the students did not always know why they were solving the exercises in the beginning, but later on and when they finished the task saw the learning outcomes. Some students didn't mind solving the exercises without any explanation beforehand.

Independent work

(19) Did you read the course material for GEO1110, GEO2130 AND GEO3010? If yes, how useful was this, and if no - why?

One 2018 student enjoyed the course book in GEO1110, the rest never touched it, since it wasn't relevant to the actual course. The students thought the lecture material on its own was sufficient. In GEO2130, the thoughts were more mixed. The 2017 students thought the lecture material and book were coherent, while the 2018-2019 students didn't think the lecture material matched the book too much. Not all, but most students read the book in GEO2130. Some students wished they would be told the specific chapters they had to read before each lecture and group seminar.

In GEO3010, none of the students were really aware of what was considered relevant course material. Some students read material provided by the teacher on Canvas and found their own material online. They weren't too happy with the presentations. When going through the powerpoints at a later stage, they wished there were more explanations to different pictures, with summaries and important concepts highlighted. A few students pointed out that they would rather have "Landet blir til" as a course book.

All students agreed that they don't like buying course material that ends up unread. They wanted the lectures to provide specific pages/chapters that are relevant, and if they can't do that, explicitly tell the students that the book is good reading material, but is optional to buy.

Important points raised during the interviews

- Awareness of the learning goals/learning outcomes should be important, and the students should be reminded of them during the course.
- The students want to stick to one QIS-programme throughout the degree. They don't like QGIS and would like to be taught ArcMap and/or ArcGIS Pro from the start.
- All students were frustrated over the lack of examples in the teaching.
- Neither GEO1110 nor GEO3010 have a book that is connected to the syllabus.
- The students felt they were often served new problems with no means to understand how to solve them, which always led to more frustration than actual learning. They would like more interactive examples of the mapping exercises in the form of thorough explanations combined with drawing on a blackboard or give them examples of similar problems with different results.
- The mysteries surrounding the mapping exercises reflect real life where you don't know the answer to the geological problem, but the students agreed that this doesn't work when you're just starting to learn the methods for producing an actual map. A quote from one of the students is that they feel like they're trying to "invent the wheel", which they find very frustrating.
- The other courses in Mathematics and Natural Sciences at the UiO all provide examples of solutions to the problems the students are presented with, and this is something the students at the faculty of Geosciences are strongly requesting.
- The students were also missing a clearer syllabus for the three different courses, but especially in GEO3010.
- The students miss the coherence between the courses, where their mapping skills are maintained throughout the degree. One solution to this could be to introduce different modules the students have access to at all times, where each module contains videos, explanations and examples of different concepts. An example could be a module named "Stereonet", where everything you need to know about stereonets is condensed.
- Geology is a practical field, and they wish the teachers would bring them on spontaneous excursions nearby, and generally spend more time outdoors.