iEarth

The use of formative assessment in geoscience courses at UiT, UiB, and UNIS in 2021

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"What and how students learn depends to a major extent on how they think they will be assessed." Biggs & Tang, 2011, p. 191.

SENTER FOR FREMRAGENDE UTDANNING

Aim

This report presents quantitative data on the use of formative assessment in geoscience courses taught in 2021 at UiT, UiB, and UNIS. The data were collected to provide a baseline for monitoring the transition to increased use of formative assessment in courses which is one of the actions stated in the iEarth center plan (Bakke et al., 2020). Data on the use of formative assessment will be collected each year throughout the remaining iEarth center period (until 2025).

The aim of this study is to present a short literature review on formative assessment, the results from the 2021 survey, and recommendations for yearly data collection routines for the remaining center period.

iEarth context

The presented dataset was collected in the context of iEarth Focus Area 2 (FA2, A Learning Environment for Students). A key step for FA2 is to engage students as partners in the educational process. In the iEarth center plan it is stated that "to increase the extent to which students understand and engage with their own educational goals, we will encourage peer instruction and assessment and ensure that feedback to students from instructors more accurately targets the learning process. A key factor in transforming students' approaches to learning is to shift emphasis from traditional final exams towards integrated, formative assessment" (Bakke et al., 2020).

The aim to increase the use of formative assessment in geoscience courses in Norway is stated as a planned action point in the iEarth center plan. The aim is that formative assessment is used in >50% of the courses by the end of the center period (Action No 3, FA2; Appendix 1). Further, formative assessment is probably the most prominent cornerstone needed to establish the necessary trust needed to engage students as partners (Action no 1, FA 2; Appendix 1).

Formative assessment: a brief review

Formative assessment is a continuous evaluation process which serves the purpose to improve and form student learning in the following two ways: 1) by helping students get an understanding of what level of learning is required and how to get there and 2) by allowing teachers to use their evaluations to form and design the teaching to meet the learning needs of the students.

- Summative assessment: assessment *of* learning
  Controlling what students have learned
- Formative assessment: assessment *for* learning
  Assisting students in mentoring their own learning

The concept of formative assessment had a break-through in the late 1990s, when the British assessment researchers Paul Black and Dylan William presented their research on assessment for learning (Black and William, 1998a, 1998b, 2002). They showed that assessment used formatively can serve as a powerful tool

in the learning process of students. At that time the concept of formative assessment in pedagogical contexts was not new as such. In 1967, Michael Scriven introduced the terms formative and summative assessment to clarify how the evaluations of educational programs can be made based on different purposes (Scriven, 1967). In an article from 1969, Benjamin Bloom also used the term formative assessment but referred to the evaluation of individual students (Bloom, 1969). Both Scriven and Bloom believed that evaluations are formative only when the information collected is used to influence subsequent decisions regarding what is being evaluated. Any assessment that provides evidence that has the potential to improve instructional decision-making by teachers, students or their peers can therefore be formative. Taking this into account it is, however, important to understand what kinds of formative assessments are likely to be most effective. William (2010) suggests that to do so, it is necessary to go beyond the functional definition of formative assessment and instead focus on the underlying instructional processes. In the work of Leahy et al. (2005) and William (2007), attention is drawn to the following three instructional processes: 1) to establish where the learners are in their learning, 2) where they are going, and 3) what needs to be done to get them there. As presented in Table 1, they further suggested five practical classroom strategies for formative assessment by crossing the instructional process dimension with that of the agent in the instructional process (the teacher, the peer, the student).

The five classroom strategies for formative assessment are:

1) Clarifying, sharing and understanding learning goals and criteria for success.
2) Engineering effective learning activities that elicit evidence of learning.
3) Provide feedback that moves learners forward.
4) Activating students as instructional resources for each other.
5) Activating students as the owners of their own learning.

<table>
<tr><th></th><th>Where the learner is going</th><th>Where the learner is right now</th><th>How to get there</th></tr>
<tr><td>Teacher</td><td>Clarifying learning intentions and sharing and criteria for success (1)</td><td>Engineering effective classroom discussions, activities and tasks that elicit evidence of learning (2)</td><td>Providing feedback that moves learners forward (3)</td></tr>
<tr><td>Peer</td><td>Understanding and sharing learning intentions and criteria for success (1)</td><td colspan="2">Activating students as instructional resources for one another (4)</td></tr>
<tr><td>Learner</td><td>Understanding learning intentions and criteria for success (1)</td><td colspan="2">Activating students as the owners of their own learning (5)</td></tr>
</table>

Table 1: Five classroom strategies for formative assessment (marked 1-5) in which both the instructional process dimension (where the learner is going, where the learner is now, and how to get there) and three different agents in the instructional process (teacher, peer, student) are considered. Source: Leahy et al. (2005).

Methods

This report presents quantitative data on the use of formative assessment in geoscience courses

taught during the spring and fall semesters of 2021. Data were collected by iEarth education chairs and the network coordinator through informal conversations with course responsible teaching staff at five out of six iEarth departments:

- Department of Earth Science, University of Bergen (UiB_geo)
- Geophysical Institute, University of Bergen (UiB_gfi)
- Department of Geosciences, UiT The Arctic University of Norway (UiT)
- Department of Arctic Geology, The University Centre in Svalbard (UNIS_AG)
- Department of Arctic Geophysics, The University Centre in Svalbard (UNIS_AGF)

Results

The results from the 2021 data collection on formative assessment in geoscience courses (divided in bachelor and master level courses) are shown in Figure 1. The full dataset is presented in Appendix 2-6. The full dataset includes information about course code, course name, assessment form (same as listed in the course descriptions available online), use of formative assessment (yes, no, partly/no information) and comments where information about the type of formative assessment included in the individual courses is presented.

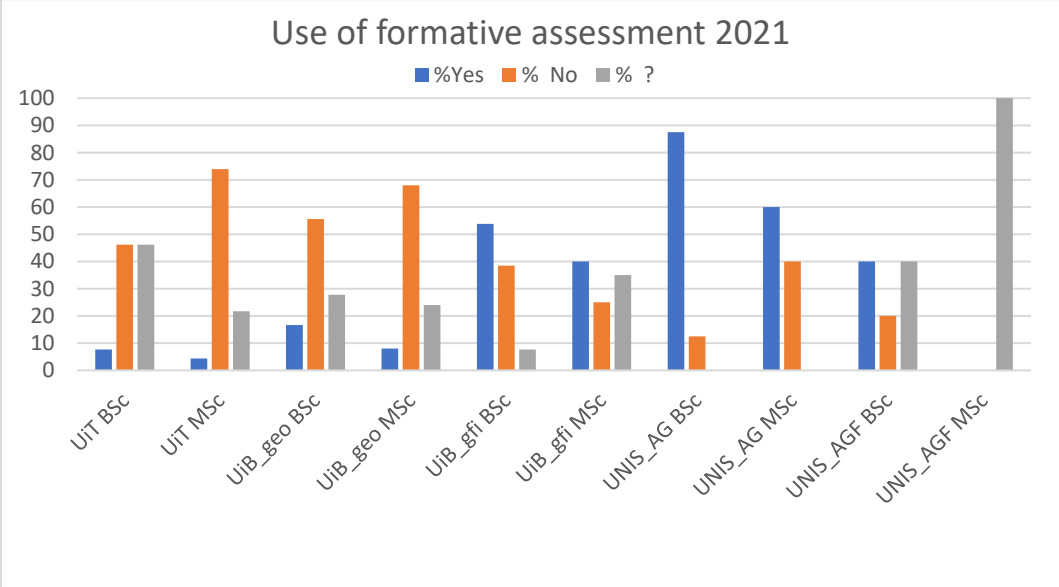

Figure 1. Results from the 2021 survey on the use of formative assessment in geoscience courses, divided into bachelor and master level courses at each department. Blue bars represent the percentage of course using formative assessment, red bars show the percentage of courses with no formative assessment and grey bars represent courses listed as partly including formative assessment or with no information.

UiT

At UiT 13 bachelor courses and 23 master courses were surveyed (Appendix 2). In the BSc courses one includes formative assessment (7.7%), six are listed as partly including it while the remaining six courses do not include formative assessment. In the MSc courses one includes formative assessment (4.3%), five are listed as partly including it, and 17 courses do not include formative assessment. The two courses using formative assessment include feedback from the teacher. The courses listed as partly using formative assessment include feedback on exercises or examples where students failing the exam get feedback on their report before handing it in a second time. Further, courses including continuous examination are listed here too.

UiB geo

A total of 36 BSc courses and 25 MSc courses were surveyed (Appendix 3). On the BSc level, six courses use formative assessment (16%), ten have no information, and a total of 20 do not include formative assessment. In the MSc courses two use formative assessment (8%), six have no information, and 17 courses do not include formative assessment.

In the six courses including formative assessment both feedback from teachers and student peer-review is used. Student peer-review and self-evaluation using rubrics is used in one BSc course.

UiB gfi

At the Geophysical institute at UiB 13 BSc courses and 20 MSc courses were surveyed (Appendix 4). On BSc level, seven courses use formative assessment (53.8 %), one has no information, and five do not include formative assessment. On MSc level, eight courses include formative assessment (40 %), seven have no information, and five do not include formative assessment. No details on the type of formative assessment are listed.

UNIS AG

A total of eight BSc courses and 5 MSc courses were taught in 2021. Ten courses were canceled due to the pandemic, all on MSc level. The full data set is presented in Appendix 5.
Out of the eight BSc courses, six include formative assessment (87.5 %), while one course partly includes it, and another does not. Out of the five MSc courses, two include formative assessment (60 %), and three do not. A closer look into the courses that include formative assessment, reveals that for the bachelor courses formative assessment is equally divided between classroom and field teaching. However, on MSc level, formative assessment is only included in the field component of courses in the format of feedback from the teachers.

UNIS AGF

A total of five BSc courses and three MSc courses were taught in 2021, while three courses were cancelled due to the pandemic. The full dataset is presented in Appendix 6.
For the BSc courses two include formative assessment (40 %), while one does not. For the remaining two courses, we do not have information, which is also the case for the three MSc courses. A closer look into the two BSc courses which include formative assessment, shows that both uses feedback from the teachers and student peer-review.

Synthesis

In 2021, >50% of the courses at bachelor-level at the Geophysical Institute at UiB and at bachelor and master-level at the department of Arctic Geology at UNIS were using formative assessment, thus already reaching the goal stated in the iEarth centre plan. However, for the remaining departments, the percentage of courses including formative assessment is considerably lower (Fig. 1).

In the literature review chapter of this report, we define two broad purposes with formative assessment: 1) to help students get an understanding of what level of learning is required and how to get there and 2) to allow teachers to use their evaluations to form the teaching to meet the learning needs of the students. In the 2021 survey most of the reported activities fall into the former category and only two courses show evidence of that teachers use formative evaluations to guide the teaching (Appendix 3 and 5).

In this report we use the framework of the five classroom strategies for formative assessment (Fig. 1; Leahy et al., 2005; William, 2007) to analyze reported activities in the 2021 survey (Appendix 2-6). We find evidence of all five strategies, even though some are more commonly used than others. Evidence for each strategy is presented below.

"Clarifying, sharing and understanding learning goals and criteria for success."

Rubrics are used to communicate learning goals and criteria for success in one course (Appendix 3).

"Provide feedback that moves learners forward."

This is the most common strategy that we find evidence for (Appendix 2-6). The teachers are most often the ones giving the feedback. However, in some courses there are examples where students are the agents in the instructional process through peer-review (Appendix 3, 5 and 6) and self-evaluation (Appendix 3 and 5).

"Engineering effective learning activities that elicit evidence of learning".

There is evidence for two courses using reflection to bring attention to the learning process of students. during multi-day fieldwork in the format of discussions in the evenings (Appendix 5).

"Activating students as instructional resources for each other."

In the results from the 2021 survey, we find courses where students are activated as instructional resources for each other through peer-review on written projects, oral presentations and fieldwork results. Student peer-review is included in a total of seven courses at all departments (Appendix 3, 5 and 6).

"Activating students as the owners of their own learning."

Examples of where students are activated as owners of their learning are found in courses using reflection (Appendix 5) and self-evaluation (Appendix 3 and 5)

Recommendations for continued data collection

In the 2021 survey we see that the level of detail when it comes to describing the use of formative assessment differs between departments. The data was collected without a formal interview guide or questionnaire which is a factor that might influence the level of detail when it comes to describing course activities related to formative assessment. An additional factor that might influence the level of detail is that the concept of formative assessment as such is still new to many teachers.

In the light of these findings, we recommend:

1) Workshops on formative assessment at all iEarth departments where attention is brought to common misunderstandings of the concept formative assessment and where practical experiences are shared.
2) That data on the use of formative assessment will be collected locally by education chairs guided by a formalized questionnaire (Appendix 7)
3) That the questionnaire is tested out and on a smaller group of teachers at one department and then an evaluated and revised version is used for data collection.

Workshops

To increase the awareness and understanding of formative assessment we recommend that teachers and students at all iEarth departments get the opportunity to join workshops focusing on sharing experiences and getting new ideas on the practical use of formative assessment. The workshops are important actions when it comes to bringing attention to the benefits of formative assessment when it comes to increasing the extent to which students understand and engage with their own learning.

Data collection:

For coming years, we recommend that the data collection remains being carried out locally by education chairs, but that it is guided by a questionnaire.

The recommended questionnaire is presented I Appendix 7. Questions are based on a modified version of the classroom strategies for formative assessment (Leahy et al., 2005; William, 2007).

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Appendix 1. Action points from the iEarth center plan 2020-2025 for the Focus Area 2 (FA2) “a learning environment for students”.

Action	Audience	Assessment criteria
Engage **students as partners** in their education	Instructors, students, administration and leaders	Large # students participate in faculty meetings, boards etc.
Peer instruction and peer feedback	Students	Students have forums for peer instruction and feedback.
Transition to include formative assessment on courses	Instructors	>50% of courses at all institutions use formative assessment.
Course-based undergraduate research experience (CURE)	Instructors/students/industry collaborators	CURE implemented in >3 B.Sc. courses at all institutions.
Optimise instructional technologies and physical learning spaces	Instructors/students	All institutions have access to and use Active Learning Classrooms and webinar facilities as part of the physical learning space.
Arrange national workshops for iEarth students – e.g. on Design Thinking, peer instruction and feedback etc.	Students	>4 workshops arranged with attendance from all institutions.
Students write a Bachelor’s thesis as part of their B.Sc. degree	Students	B.Sc. thesis is offered as a part of the undergraduate degree at all institutions.
Students define their own M.Sc. project	Students	>50% of the M.Sc. students define the topic and research questions for their M.Sc. thesis.
National iEarth course in geohazards	Instructors/industry partners	A national geohazards course offered by UiB, UiO and UiT will be operated and developed.

Appendix 2: Collected data on the use of formative assessment at the department of Geosciences, UiT The Arctic University of Norway (UiT)

Course code	Course name	Assessment (from course description)	Formativ assessment	Comments
GEO-1001	Innføring i geologi	Written exam 100%	Partly	Feedback on excersises, but does not influence the final grade
GEO-2001	Mineralogi	Written exam 100%	Partly	1 hour practical test identifying minerals
GEO-2002	Strukturgeologi - berggrunnskart	Written exam 100%	No	
GEO-2003	Kvartærgeologi	Written exam 100%	Partly	Feedback on excersises, but does not influence the final grade
GEO-2004	Petrologi	Written exam 100%	No	
GEO-2005	Sedimentologi	Written exam 100%	Partly	Feedback on excersises, but does not influence the final grade
GEO-2006	Innføring i anvendt geofysikk	Written exam 100%	No	
GEO-2007	Historisk og regional geologi	Written exam 100%	No	
GEO-2008	Geokjemi	Written exam 100%	Partly	Feedback on excersises, but does not influence the final grade
GEO-2009	Grunnleggende feltkurs i geologi	Field report 100%	No	
GEO-2010	Marine geofag	Written exam 100%	Partly	Feedback on excersises, but does not influence the final grade
GEO-2011	GIS og geostatistikk	Project report 100%	No	

GEO-2012	Geohazards	Portfolio assessment: 10 quizz (20%), poster in groups (25%), risk-comunication project in groups (25%), individual term project (30%)	Yes	Continous examination. Feedback from teacher on each assessment task
GEO-3104	Videregående strukturgeologi	Written exam 100%	No	
GEO-3105	Advanced petrology	Take-home exam 100%	No	
GEO-3106	Tectonics	Written exam 100%	No	
GEO-3107	Ekskursjon i berggrunnsgeologi	Field report 100%	Partly	Upon failing the exam, students get feedback on the report before handing it in a second time
GEO-3111	Marin kvartær strat. Og paleoklima	Written exam 100%	No	
GEO-3112	Sedimentary processes and products	Written exam 60%, Presentation (poster, written or oral) 40%	Partly	Continous examination
GEO-3113	Field course in exogene geology	Field report and presentation 100%	Partly	Upon failing the exam, students get feedback on the report before handing it in a second time
GEO-3115	Petroleum geology	Written exam 100%	No	
GEO-3117	Optical mineralogy	Written exam 100%	No	
GEO-3118	Miljøgeologi	Written exam 100%	No	
GEO-3119	Petroleumsprospektering	Written exam 100%	No	
GEO-3120	Forvaltning av petroleumsressursene	Portfolio assessment: take-home exams 2x20%, 1x60%	Yes	Continous examination
GEO-3122	Micropaleontology	Oral exam 100%	No	
GEO-3127	3-D seismic exploration	?	No	

GEO-3129	Drilling and prod. Of oil and gas	?	No	
GEO-3130	Ore geology	Written exam 100%	No	
GEO-3131	Deformation processes	Take-home exam 100%	No	
GEO-3135	Ustabile fjellsider: geologi, skredfare	Oral presentation 25%, poster presentation 25%, take-home exam 50%	Partly	
GEO-3136	Quaternary geochronology	Poster 25%, report and oral presentation 75%	Yes	Feedback from teacher on report (following oral presentation), before final hand in of the report.
GEO-3137	Seismology	Portfolio assessment 50%, written exam 50%	Partly	Continous examination
GEO-3144	Arctic Marine geo and geophy, cruise	Field report 100%	No	
GEO-3145	Arctic Marine geo and geophy, workshop	Written report 100%	No	
GEO-3151	Geoseminar i geologi og miljø		No	

Appendix 3: Collected data on the use of formative assessment at the department of Earth Science, University of Bergen (UiB_geo)

Emnekode	Emnenavn	Assessment (from course description)	Formativ assessment	Comments
GEOV102	Ekskursjoner og øvelser i geologi	Written exam 100%	?	Feedback from teacher on assignments
GEOV104	Innføring i strukturgeologi og tektonikk	Exercises 20%, written exam 80%	No	
GEOV109	Innføring i geokjemi	Portfolio assessment and written exam	No	
GEOV111	Geofysiske metoder	Portfolio assessment: quizz 20%, exercises 30, written exam 50%	No	Feedback from teacher on excersises to prepare for the exam
GEOV218	Bergartsfysikk	Written exam 100%	Yes	
GEOV225	Feltkurs i kvartærgeologi og paleoklima	Portfolio assessment (report, field report), oral exam	No	
GEOV229	Geomorfologi	Portfolio assessment	Yes	Student peer-review, feedback from teacher before final hand in of portfolio
GEOV231	Maringeologisk/geofysisk felt- og laboratoriekurs	Written report on assigned dataset	Yes	Feedback from teacher on report before final hand in
GEOV242	Magmatisk og metamorf petrologi		?	
GEOV252	Feltkurs i geologisk kartlegging		No	
GEOV255	Seismotektonikk		No	
GEOV260	Petroleumsgeologi		No	
GEOV265	Global and Applied Geophysics		?	
GEOV101	Innføring i geologi		No	
GEOV103	Innføring i mineralogi og petrografi		No	
GEOV107	Innføring i sedimentologi		No	
GEOV110	Innføring marin og terrestrisk kvartærgeologi		No	
GEOV112	Den faste jords fysikk		No	
GEOV113	Refleksjonsseismisk datainnsamling og prosessering		No	

GEOV114	Innføring i geobiologi		Yes	Student self-evaluation and peer-review using rubrics. Teacher uses this information to guide the next step in instruction.
GE25:58OV210	Platetektonikk		No	
GEOV217	Geofarar		Yes	Student peer review
GEOV222	Paleoklimatologi		No	
GEOV223	Kvartære havnivåendringer		No	
GEOV226	Kvartærgeologisk felt og laboratoriekurs		No	
GEOV228	Kvartærgeologiske dateringsmetoder		?	
GEOV230	Glasialgeologi		No	
GEOV241	Mikroskopi		?	
GEOV243	Miljøkjemi		?	
GEOV245	Geomikrobiologi		?	
GEOV251	Videregående strukturgeologi		No	
GEOV254	Geodynamikk og bassengmodellering		?	
GEOV272	Seismisk tolkning		No	
GEOV274	Reservoargeofysikk		?	
GEOV276	Introduksjon til teoretisk seismologi		Yes	Feedback from teacher on excersises to prepare for the exam
GEOV277	Geofysiske inversjonsmetoder		?	
GEOV300	Utvalgte emner i geovitenskap		Yes	Student peer-review on projects before final hand-in and presentation
GEOV324	Paleoklima i polare strøk		No	
GEOV341	Termokronologi og tektonikk		No	
GEOV355	Anvendt seismologi		No	
GEOV361	Sekvensstratigrafi		No	
GEOV364	Videregående petroleumsgeologi		No	
GEOV372	Integrert tolkning av seismikk og borehullsdata		No	
SDG207	Energiomstilling		?	
SDG213	Årsaker og konsekvenser til klimaforandringar		Yes	

GEOV302	Geostatistikk/Praktisk dataanalyse i geovitenskap		?	Feedback from teacher on excersises
GEOV322	Masterekskursjon i kvartærgeologi		No	
GEOV325	Glasiologi		No	
GEOV326	Kvartære miljø, prosessar og utvikling		No	
GEOV328	IceFinse		?	
GEOV331	Utvalgte emner i paleoseanografi		?	
GEOV342	Den geokjemiske verktøykassen		?	
GEOV344	Geobiologi		?	
GEOV345	Regionalgeologisk feltkurs		No	
GEOV352	Petroleumsgeologiske feltmetoder		No	
GEOV359	Instrumentering og dataprosessering i jordskjelvseismologi		No	
GEOV360	Sedimentologi og faciesanalyse		No	
GEOV362	Pyreneene feltkurs i tektonikk og sedimentologi		No	
GEOV366	Andvendt reservoarmodellering		No	
GEOV375	Avansert anvendt seismisk analyse		No	
GEOVDID200-P	Geofagdidaktikk		No	

Appendix 4: Collected data on the use of formative assessment at the Geophysical Institute, University of Bergen (UiB_gfi)

Course code	Course name	Assessment (from course description)	Formative assessment
ENERGI101	Introduksjon til energikilder og forbruk	Written exam 100%	?
ENERGI200	Energiressurser og -forbruk	Written exam 100%	No
ENERGI230	Miljø og energi	Written exam 70%, project work 30%	No
GEOF100	Introduksjon til atmosfære, hav og klima	Written exam 100%	Yes
GEOF105	Atmosfære- og havfysikk	Lab report (individual 15%, lab report and presentation (group) 15%, written exam 70%, 10 quizzes (bonus points)	Yes
GEOF110	Atmosfære-, hav- og klimadynamikk	Midway written eam 20%, final written exam 80%	No
GEOF210	Dataanalyse i meteorologi og oseanografi	Written exam 100%	No
GEOF211	Numerisk modellering	Written exam 100%	Yes
GEOF212	Fysisk klimatologi	Midterm assignment 30%, written exam 70%	Yes
GEOF213	Atmosfære- og havdynamikk	Mandatory assignments and exercise sets 30%, written exam 70%	Yes
GEOF220	Fysisk meteorologi	Oral exam 100%	No
GEOF232	Praktisk meteorologi og oseanografi	Written report and oral presentation 100%	Yes
GEOF236	Kjemisk oseanografi	Oral exam 100%	Yes
GEOF301	Introduksjon til master	Report 100%	Yes
GEOF310	Turbulens i atmosfærens og havets grenselag	Oral exam 100%	No
GEOF311	Turbulens i atmosfærens grenselag	Oral exam 100%	No
GEOF321	Modeller og metoder i numerisk vêrvarsling og klimaprediksjon	Oral exam 100%	Yes
GEOF322	Feltkurs i meteorologi	Report 100%	Yes
GEOF327	Atmosfærens generelle sirkulasjon	?	?
GEOF328	Mesoskala dynamikk	Mid-term exam 20%, presentation of research paper 10%, oral exam 70%	?
GEOF334	Fjernmåling i mikrobølgeområdet	Oral exam 100%	No
GEOF336	Videregående kjemisk oseanografi	Oral exam 100%	Yes
GEOF337	Fysisk oseanografi i fjorder	Oral exam 100%	?
GEOF338	Polar oseanografi	Oral exam 100%	Yes
GEOF339	Avansert dynamisk oseanografi	Oral and written exam	?
GEOF343	Vindgenererte overflatebølger	Oral exam 100%	No

GEOF345	Fjernmålingsteknikker i meteorologi og oseanografi	Oral exam 100%	No
GEOF346	Tidevannsdynamikk og havnivåvariasjoner		Yes
GEOF347	Seminar og jordsystemet og bærekraftig utvikling	Reasarch paper and presentation 100%	Yes
GEOF348	Avansert klimadynamikk	Oral exam 100%	?
GEOF349	Vind og bølgeinduserte laster	?	?
GEOF351	Seminar i atmosfærisk vitenskap	Presentaion or poster 40%, summary paper 20%, written assignment 40%	Yes
GEOF352	Avansert atmosfæredynamikk	Written mid-term exam 20%, oral exam 80%	?

Course code	Course B1:E14	Assessment (from course description)	Formative assessment	Comments
AG-204	The physical geography of Svalbard	Term project 50%, popular science article 50%	Yes	Supervisors on term projects give feedback to their groups during fieldwork, data processing and report writing
AG-221	Arctic Physical Geographical Field Techniques	Oral exam 60%, poster presentation 30%, two geological maps 10%	Yes	Feedback from teacher on geological maps before final hand-in
AG-210	The Quaternary and Glacial Geology of Svalbard	Field notebook 15%, fieldreport 20%, self-guided fieldwork 15%, termproject 30% oral presentation of term project 20%	Yes	Feedback from teacher on field results and reflection, self evaluation and peer-review each evening in the field. Feedback from teacher on written report before final hand-in
AG-211	The marine geology of Svalbard	Field and lab report 20%, term project report 20%, oral presentation of term project 20%, written exam 40%	Partly	Feedback from teacher to each student (oral in plenum) following their oral presentations of individual term projects, before final hand-in.
AG-209	The Tectonic and Sedimentary History of Svalbard	Term project 60%, written exam 40%	Yes	Group discussions with the teacher about what was difficult during the last lecture. The teacher uses this feedback to guide the next step in the teaching
AG-222	Integrate geological methods: from outcrop to geomodel	Exercises 20%, digital field report 30%, presentation of virtual fieldtrip 25%, poster presentation 25%	No	
AG-218	International bachelor permafrost summer school	Oral group presentation of fieldwork 33%, written report 67%	Yes	Feedback from teacher during fieldwork

AG-220	Environmental change in the high arctic landscape of Svalbard	Oral presentation of research proposal 20%, evaluation of field notes 10%, oral presentation of progress report 30%, written report 40%	Yes	Feedback from teacher: in the field, on research proposal and oral presentation of progress report
AG-323	Sequence Stratigraphy – a Tool for Basin Analysis	written report 40%, written exam 60%	No	
AG-326	Arctic Quaternary environments	short written report x 4 20%, participation in seminars 10%, oral exam-key concepts 20%, take home exam 50%	No	Seminars
AG-338	Sedimentology field course	Group report - oral presentation and poster 100%	Yes	Feedback from teacher during fieldwork and data processing
AG-340	Arctic glaciers and meltwater dynamics	Web quizzes 20%, written report 80%	No	
AG-348	Arctic late Quaternary glacial and marine environmental history	Oral presentation 25%, Group report - oral presentation and poster 75%	Yes	ReFeedback from teacher and reflection (self-evaluation) each evening in the field: reflecting on what was difficult and what could be done differently the next day.
Canceled courses 2021				
AG-322				
AG-330				
AG-334				
AG-335				
AG-342				
AG-346				
AG-349				
AG-351				
AG-352				
AG-325				

Course code	Course name	Assessment (from course description)	Formative assessment	Comments
AGF-211	Air-ice-sea interaction	Field report 40%, oral exam 60%	Yes	Student peer-review - feedback on review process of old reports, and feedback on presentation of old reports and their own final report
AGF-212	Snow and ice processes	Field report 50%, written exam 50%	?	
AGF-213	Polar meteorology and climate	Field report 30%, oral exam 70%	?	
AGF-214	Polar ocean climate	Field report 30%, oral exam 70%	Yes	Feedback from teacher on data processing, student peer review on
AGF-216	The stormy sun and the northern lights	Written exam 100%	No	
AGF-301/801	The upper polar atmosphere	Written exam 100%	?	
AGF-304/804	Radar Diagnostics of Space Plasma	Oral exam 100%	?	
AGF-345	Polar Magnetospheric Substorms	Written report 50%, oral exam 50%	?	

Cancelled courses in 2021

AGF-210
AGF-223
AGF-350/850

Appendix 7: Recommended questionnaire for continued data collection. Questions are based on a modified version of the classroom strategies for formative assessment (Leahy et al., 2005; William, 2007).

Does your course include activities that:

1. Are clarifying, sharing and understanding learning goals and criteria for success?

   Yes □ No □

   If yes, describe the activities in your course:……..

2. Provide feedback that moves learners forward?

   Yes □ No □

   If yes, describe the activities in your course:……..

3. Activate students as instructional resources for each other?

   Yes □ No □

   If yes, describe the activities in your course:……..

4. Activate students as the owners of their own learning?

   Yes □ No □

   If yes, describe how you work with this in your course:……...