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Spectator or Actors? Students in the field during research-based education at UNIS

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Adventure is just bad planning

Roald Amundsen

Introduction

After many years of fieldwork research experience in the Arctic, I can state the quote differently: "*No data is just bad planning*." My research in the Arctic lasts from 2007. Two years later, I started to supervise groups of students during UNIS fieldwork expeditions. Later I began to co-lead one of the field courses at the Arctic Technology department. In 2017, after another repetition of the course, I got a little gift and a card from the students: "*Dear Aleksey, Many thanks for the field trip in Svea and solving all of our problems. You made our lives a bit easier, so here is a gift that will make your life a bit easier as well.*" That card reminded me that after years, you keep not noticing the amount of work spent on planning and preparation for the expedition, leading to a safe trip, successful experiments, and happy students. One can think that it happens by itself and it is not difficult. Still, once you join into the field and live those days through, you will realize how many components are in place together to run the campaign successfully: safety, people, organization, equipment, and workflow, and data collection. One little piece of equipment can be crucial for successful data collection, and, I bet, you could give a lot for one in the field if you did not plan a spare one in your toolbox.

Though that season went smooth and students were thankful, already for a couple of seasons up to that time, I was asking myself whether combining research and education works well. I could very well see that on some occasions, it was not possible to compromise research data collection and education process, and then the priority had to be set. In spring 2018, I asked students of the course to voluntarily evaluate the learning process using daily reflections involving answering pre-formulated questions. Based on the feedback collected during the fieldwork, I was hoping to underline student concerns and approach the question raised above whether we manage to combine well research and education and deliver high-quality research-based education. I addressed the results during my talk on Learning Forum at UNIS in autumn 2018 and chosen to discuss it here in the project work for the pedagogical course in university teaching and learning.

Research-Based Education

What is a research-based education? It is a complex process encouraging teachers and students to find new ways to work together. Such that students are involved actively and carry out research independently during the course. Stensaker (2019) calls for the need to re-think research-based education and re-consider whether the established indicators ("library, academic staff with doctoral degrees, and research being published by the same staff") can be used as "proof" of research-based education. So, it is not simple and not trivial to achieve in the concept's depth and real sense. In the end, research-based education is education and has to have the most benefit for student learning.

Healey (2005) developed a matrix linking curriculum design, research, and teaching, where the education process is considered in a 3-D space (Figure 1):

- emphasis on research content vs. research processes
- teaching student- vs. teacher-focused
- students treated as participants vs. as audience.

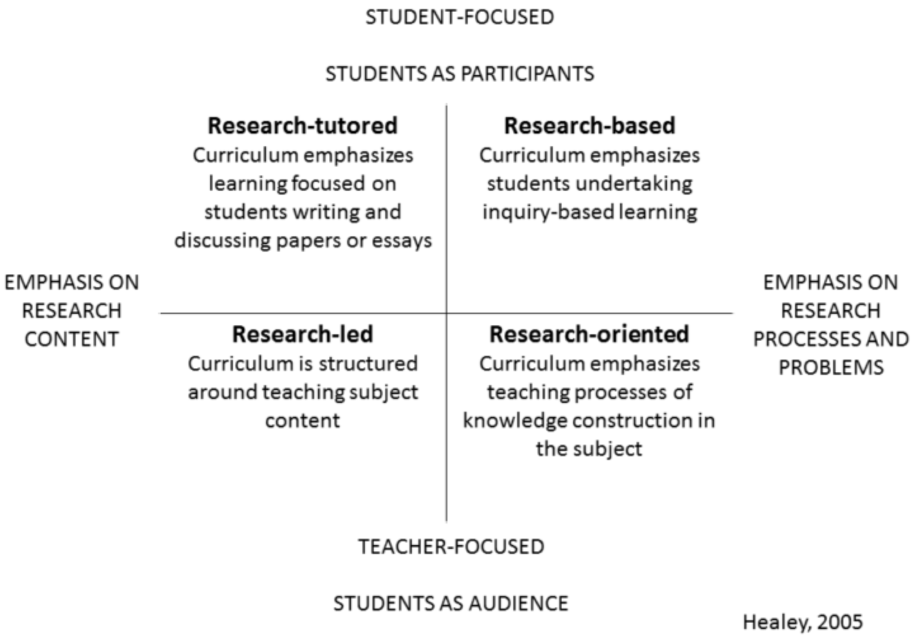

Figure 1. Classification of linkage between curriculum design, research, and teaching (after Healey (2005)).

According to Healey's opinion and many others, higher education should focus more on the research-tutored and research-based approaches with student-focused teaching. That could be the answer to the question raised in the title of this project work – spectators or actors? And here I could stop my investigations? Though this answer is on the surface, its complexity is how to organize the process in the way that we manage to move away from the bottom left quadrant - traditional in many universities, research-led teaching. In the Arctic, and especially in the field, we naturally tend to move to the right side of the matrix (Figure 1) since we teach about relevant phenomena in nature. We use surroundings as a lab and focus on the processes and problems related to infrastructure or materials in the Arctic. But we are still left with the challenge to balance the teaching during the fieldwork so that students are being treated either as participants or as the audience.

Field Work Course

The field course I'm involved as a co-teacher, and I used as a ground for project investigations, extends over one week in April, including compulsory safety training and about four hours lecturing. The course requires previous participation in one of the ice mechanics courses at the Arctic Technology department during the prior fall semester. During the course week, four days are spent in the field where the students take an active part in the logistics. Students as a group are required to prepare a joint field report containing the significant findings from the fieldwork.

The location of fieldwork is on sea ice in Van Mijen Fiord. Facilities of coal mine Svea of Store Norske Spitsbergen Kulkompani mining company are used for sleeping, eating and evening sessions of lectures. Transportation of students and equipment from Longyearbyen, where the University Centre is located, to Svea, about 60 km, is carried utilizing snowmobiles (Figure 2). Usual daily workflow is as follows: early breakfast, driving snowmobiles to the site, fieldwork, lunch on ice, fieldwork, dinner, and debriefing of the day. Learning outcomes of the course as stated on the course description page:

<u>Knowledge</u>
Upon completing the course, the students will:
Have a basic understanding of how to behave and work in an Arctic climate on land and sea ice.

<u>Skills</u>
Upon completing the course, the students will:
Have gained experience in conducting the most common standard techniques for characterizing an ice cover by sampling sea ice.

<u>General competences</u>
Upon completing the course, the students will:
Be able to explain and discuss how ice samples can be used to characterize both physical and mechanical properties of ice by physical testing. This competence applies to engineering aspects in the design of offshore structures.

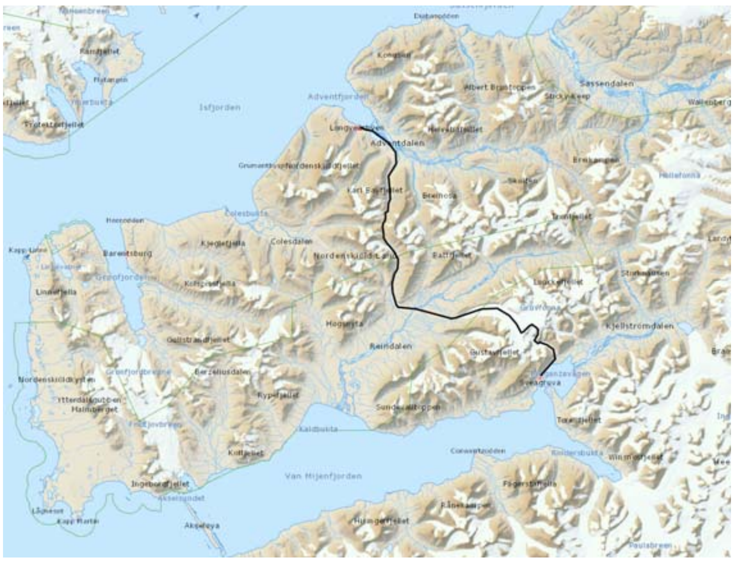

Figure 2. Transportation track (~ 60 km) from Longyearbyen, where the University Centre is located, to Svea mine in Van Mijen Fiord, where fieldwork is carried out on sea ice.

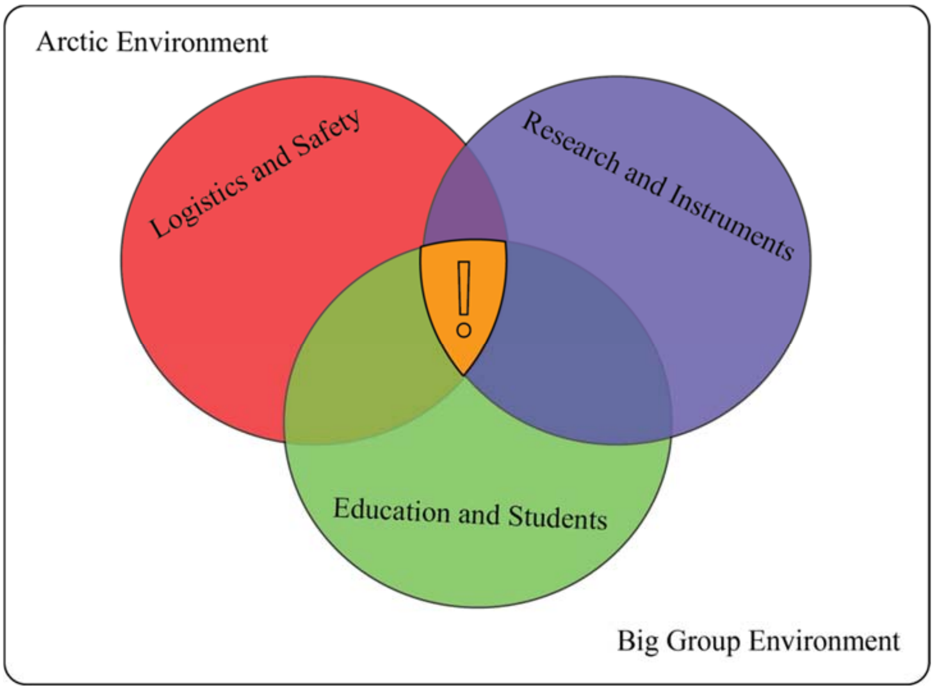

Figure 3. Multicomponent presentation of UNIS fieldwork courses.

It is evident that in the Arctic conditions, the task of conducting fieldwork itself is becoming somewhat not trivial (Figure 3). There are many factors we have to take into account during the preparation and conduction of the fieldwork:

- Safety and Logistics – arctic environment (weather, cold, moving in terrain), polar bear threat, amount of fuel, rescue equipment, weapons
- Duration of Field Work – budget available, weather window available, capability to work long days, time limit stress
- Research Process – many different instruments, short-season stress, expensive data points
- Education and Students – right psychological environment, different experience, different practicality level, various tasks

If in addition, we aim to organize the teaching to the best benefit of the students with student-oriented pedagogy, the task can become very hard or nearly impossible to accomplish. We have to admit that there can be objective reasons shifting us, as teachers, from students being actors towards the spectators. Other than those occasions, we have to aim to perform ideally in the orange overlap area of success in Figure 3. A successful fieldwork course criteria could be formulated as follows, in priority sequence: *safe, tired but happy, learning outcomes achieved and distributed evenly over the student group, a fair amount of high-quality data collected, and minimum equipment losses.* You cannot compromise the first two – safety and a big group environment. But it is often hard to balance education and research. I believe it is so beneficial to the students to have a real experiment on the current research in the discipline present in the field campaign. And this is how we try running our courses. But this requires enormous preparation effort and focus on the site, which can destruct the process from the education, especially if something goes wrong. On the one hand, there are expensive data points, which you can obtain only once a season, but on the other hand, there are students whom you promised a research-based/student-oriented teaching.

On site, the fieldwork process is organized by implementing different student groups assigned to various activities (Figure 4). Activities include the main experiment, which usually is the research of the most current interest in the discipline, and supporting experiments, which are standard from year to year and provide physical and mechanical properties description of the ice cover required for the main experiment. One of the students in each group is appointed as responsible for organizing the group work and reporting. Teachers are distributed the way that each of them is guiding one or two of the supporting research experiments, while a lot of teachers' attention is focused on the main experiment as soon as all groups are into routines. Depending on the conditions and progression, we try to rotate groups such that every group experience all activities. There is a variety of tasks over the activities: tasks which are not involving students much, routine (heavy) worker tasks, technical tasks (data acquisition system, loading equipment), and simple measurement tasks. One can understand that in such various tasks and priorities of the activities, some groups can act heavily supervised, while others as a possible independent. Usually, heavy supervision is implemented in activities where it is most crucial to obtain high-quality research data. Students in such groups are often involved in fascinating experiments while allowed to do only routine workers tasks and mostly acting as spectators.

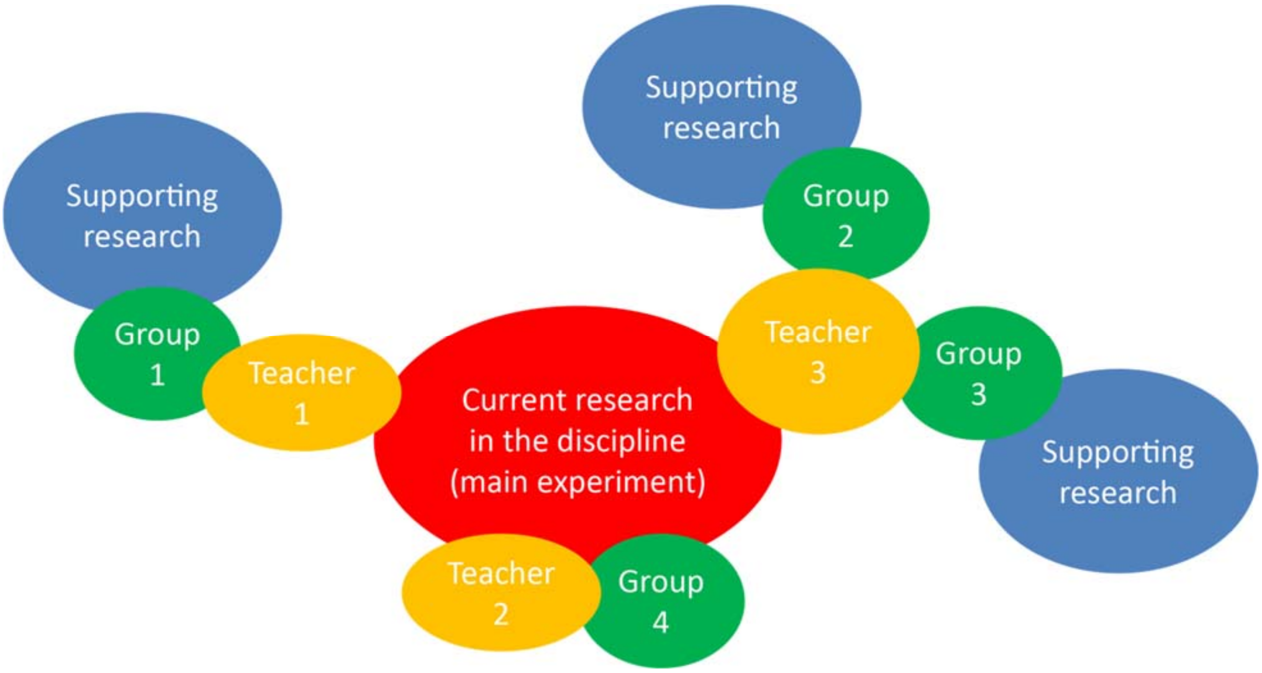

Figure 4. Scheme of research-based education as it is usually realized during the field course.

In such a setup balance between a student being an actor or spectator can differ considerably from group to group (Figure 5). On suggested diagram Research Outcome vs. Learning Outcome possible placement of the groups is arguing that Groups 1-3 were subjected to student-oriented teaching to a higher degree and probably achieved more learning outcome. At the same time, Group 4 helped obtain very relevant data but was involved only in simple tasks and mainly observed during the process. As a result, Group 4 perhaps did not achieve as much learning outcomes as other groups. Rotation of the groups helps eliminate the unevenness in learning outcomes among groups but simultaneously reduces efficiency and data quality. Different approaches, both in the field and during preparation, addressing this possible issue and finding the best possible balance, are discussed within the department and university centre. Students were also involved in giving daily feedback and reflections during the fieldwork. Voluntarily each group was asked to write a field diary with pre-formulated questions.

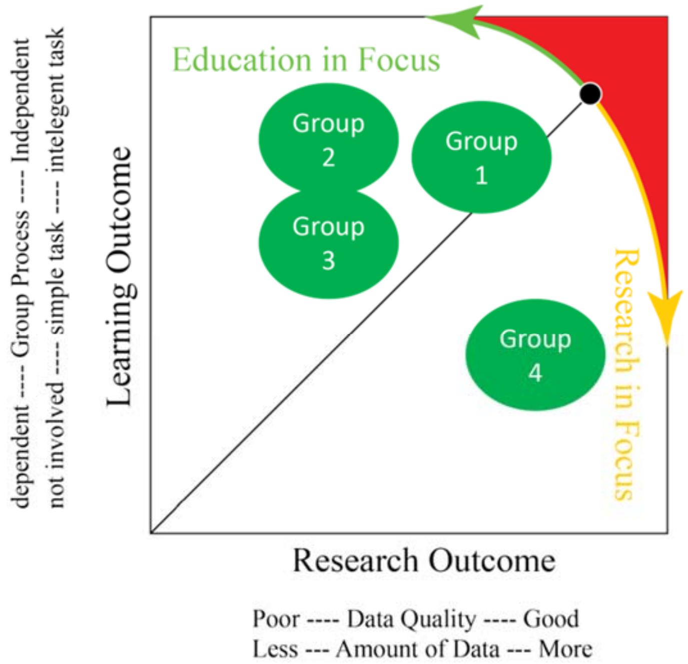

Figure 5. Balance between education and research

Method "Field Diary"

According to the field course flow, as described above, all students were divided into four groups. One volunteer from each group was asked to write a field diary every day, where the progress of the group development, learning outcomes, and practical skills would be addressed. The idea of the field diary was taken from Partamies (2016), who, within the project of the pedagogical course, experimented with her field course and replaced the fieldwork report with a field diary for some of the students. The project got a lot of attention from colleagues and exciting feedback. Here, the idea was implemented to estimate how the course flow is seen from a student point of view and try to conclude if we succeed enough in delivering student-oriented research-based education during the fieldwork course.

Four groups were allocated for the course activities on the ice. In each group, one volunteer was picked to fill a daily diary. Four questions were introduced to be answered:

1. What did we learn today?
    - What was good with the learning process?
    - What did we miss in the learning process?
2. How does our group teamwork develop?
    - What works good?
    - What problems we have in the group?
3. How good does October / March learning process support each other?
    - What is good?
    - What do you miss?
4. Other comments.

Three students submitted word files, while one student delivered a handwritten review. The results were combined in Table 1 below, organized by days, groups, and questions. The green font marked positive, comfortable, convenient events, actions, or outcomes from a student's perspective. While negative, uncomfortable, and missing things were marked by the red font. Black font – general answer.

The daily plan of the course was the following:

- Day 1: safety training, scooter training, packing, transportation to Svea, unpacking, debriefing

- Day 2: morning routines, setting up ice camp, work on ice, lunch, work on ice, dinner, reporting, debriefing

- Day 3: morning routines, work on ice, lunch, work on ice, dinner, reporting, debriefing

- Day 4: morning routines, work on ice, putting down ice camp, lunch, packing, transportation back, unpacking

Results

Table 1. Combined answers from student diaries by days, groups, and questions (font colors: black – general facts, green – positive aspects, and red – negative aspects)

		What did we learn today?	How did our group work develop?	October/March learning process support each other?	Other comments
Day 1, Monday, Transportation to Svea	Group 1	Practical information. Clear and informative Planning	No groups yet Know each other from October Nice to see familiar faces Getting along happily		Perfect weather Efficient course group driving Better preparations
	Group 2	Safety rules, emergency communication, avalanche search, snowmobile driving. Combining theory and practice Better schedule			List of things to bring Better communication 30 min from out to driving
	Group 3	Safety training informative Avalanche training slow			What to bring Schedule 30 minutes (out-driving)
	Group 4	Avalanche safety, snowmobile driving, packing Necessary thorough instructions What clothes to bring Did not get to know that snowmobile gear will be provided	Group is disciplined, **people are not afraid to ask for help** Morale, spirit, giving instructions The group is as fast as its slowest member		Amazing weather

		What did we learn today?	How did our group work develop?	October/March learning process support each other?	Other comments
Day 2, Tuesday, Work on ice	Group 1	Compressive tests, measurements of ice properties Many tests Accurate tests Procedure explanation is quick&theoretical One test as an example? Once procedure is known, all went smoothly	Gets along well Supports each other	Tested theory from October in the field (layers, temperature variations, spatial variability, directionality). Seeing&feeling is another dimension See what problems can be in the field	Decision to move lunch inside Great production, efficient work Learning examples: No 2-stroke fuel into generator! Laptop (battery, updates) to be fixed in advanced.
	Group 2	Fracture test setup and performing procedures Once completed the first sample, much faster prepared next samples Short explanation of steps prior the work, could save us time for the first sample	You have to get used to each other, then it works quite okay Divide tasks and switch between exhausting and easier tasks sometimes felt useless because did not always know what to do	In theoretical course we've learned about splitting mechanism, but it was hard to understand how you could really calculate it. Now we got the idea and got it tested. Combine theory and real tests Enthusiastic explanation about the test the evening before we started. Explanation in advance what results are good/promising and what are not	Quite cold day, but interesting to experience that Decision to move lunch inside More clear explanations in the morning – more achievements
	Group 3	Setting the grid on the ice and operating drilling/coring equipment More communication on what to do Different compasses Distance measurements in cross wind conditions Operating drilling machine in gloves Lost time/samples before we got to learn that less pressure and slower speed of drilling give best samples. Once we got it everything went smooth and quicker Could not we get this as instruction beforehand?	Teamwork was good from the start Even better once we got more experienced **Stuck with the same role for better efficiency**	October was useful for the debrief and analysing the results	sunny with some cloudy banks Temperatures of around -17 to -20 hard winds of about 10m/s people getting cold sometimes waiting in the cold get mood down overall spirits were high everybody is tired at the end of day, thus long (!) debrief was exhausting
	Group 4	Which projects we are going to do. How perform field tasks. PhD students are helpful and including **Important to have someone to ask**	cooperate and functions well as a whole Group size / distribution Willingness to help Eager to learn Lack of information – less efficient	Learnt in theory experienced in practice PhDs are good in letting us guess what will happen and then show/explain	OK weather, windy. People are a bit cold, but not a problem. Long lunch inside set a positive mood People were prepared for weather

		What did we learn today?	How did our group work develop?	October/March learning process support each other?	Other comments
Day 3, Wednesday, Work on ice	Group 1	Drilling/coring samples Previous group explained very clear how to Communication towards group(s)	Good	---	---
	Group 2	Processing samples, temperature measurements, compression test Explanation from previous group => fast start and correct way Lack of data processing and understanding that the results achieved are good	Explanation from previous mate made us start smoothly and no one felt useless in the beginning	Nice to experience practice but hard to evaluate it at once, since we did not process the result yet	Whole day doing measurements – a bit cold and boring, but understand that it is part of the fieldwork
	Group 3	how to set up a large-scale experiment in the Arctic (morning), how to do measurements on the samples (afternoon) more explanations on techniques relevant to the measurement station	Group work was really efficient Switching effectively between stations Good teamwork on reporting in the afternoon too	Not noticeable today	Weather is similar to last day with less wind
	Group 4	repetition of yesterday; plus get to saw out horizontal layers, look at layer orientation, and see how weak the skeleton layer was Learning builds on previous theory	good mood		all dressed for the wind and cold temperature.

		What did we learn today?	How did our group work develop?	October/March learning process support each other?	Other comments
Day 4, Thursday, Work on ice, Packing, Transportation back to Longyearbyen	Group 1	Preparing and performing the fracture test Clear explanation and motivation on site Involved in the experiment	---	---	---
	Group 2	Drilling/coring samples	Explanation from the previous group student Optimising tasks within the group to organize nonstop process	From just taking samples your knowledge about the theory does not really increase	Slow packing when leaving ice We got the feeling we would have packed everything in 10 minutes if someone took the lead and divided tasks
	Group 3	Fracture experiment; plus lifting big block of ice for bringing into laboratory Transportation back to LYR Snowmobiles with heavy sledges stuck While recovering those, many went off the scooters and step around on the glacier Poor fixing of boxes, jerrycans on the sledges	Teamwork is good Long waiting Some angry moods due to glacier behaviour	theory came in handy to see the grains and platelets of the ice, and the direction of growth in the probe test we could see the different snow/flooded/ice layers	Weather super good, (-14°C), almost no wind
	Group 4	sideways crack propagation on the kink test much higher force to crack the ice than what is necessary in the "normal" tests very clear explanations on theories and predictions fun to see how close the theory matched reality	Critical information given to only group of people => interpreted differently=> Information should be given to the entire group at the same time to avoid confusions	---	---

Discussion

A lot of red comments came in on the organization and the flow of the course. And very few (related to each other) indeed on the learning outcome: students find it as incomplete experience if they do not get to process data immediately (same day) to understand whether the data they collected is useful, right. From my teacher's point of view, this comment is the main finding of this work. I can see that natural need to see your achievement by the end of the day. And it throughs us back to the discussion above around Figure 4. We – researchers back up the data collected through the day and, where possible, certainly quick-processing it to see today's results due to scientific curiosity and logistical matters that all work as it supposes. In the current setup students rarely process data from compression test datalogger in the field, and rather translate data from notebooks (salinity profiles, temperature profiles, technical correspondence data) into digital form. While after the fieldwork, we gather all data files together at the final debriefing at Longyearbyen. Then they leave for their home universities and start actual processing and writing reports.

I also picked this point because I feel there is room for improvement in this matter during the course. Though students "complain" about the lengthy evening debriefings, and it is clear that there is a hard balance between logistics, time, weather, etc., it could be considered to focus on some preliminary processing utilizing preprogrammed scripts in the field at once. Also, by more thorough explanations on what results we expect, as students hinted in the diary themselves. The rest of the comments can be divided into three categories: *planning and communication, hints and efficiency, and waiting and safety*.

Planning and communication. I must accept the comment on critical information circulation towards all groups and ensure proper information flow. Though another half of "better planning" comments regarding the logistical organization, I suggest students bring home as a learning outcome, as a problematic aspect of Big Group Environment (Figure 3). "The group is as fast as its slowest member" (Table 1: Day1, Group 4).

Hints and efficiency. There are many comments that we did not supply students with a full sequence of sample preparation steps and small hints operating drilling and coring equipment. They see it as a downside and that efficiency of the performance drops. On the other side, I see it indeed as a factor keeping the process on the student-focused side (Figure 1). "Students as participants" are not supplied with ready solutions, but they need to find out themselves the tips both related to practical issues ("Distance measurements in cross wind conditions; Operating drilling machine in gloves" (Table 1: Day 2, Group 3)) and sample quality issues ("Lost time/samples before we got to learn that less pressure and slower speed of drilling give best samples" (Table 1: Day 2, Group 3)). Such a situation, when they "lose" some time and samples, is observed in supporting research activities (blue ovals, Figure 4), and from our, researchers, point of view, that is fine as we want to assure quality for the main experiment (red oval, Figure 4). From our, teachers, point of view, they are not "losing" but learning indeed and passing this knowledge among groups: "Explanation from previous group => fast start and correct way" (Table 1: Day 3 and Day 4, Group 2 and Group 1).

In the main experiment, the situation shifts towards the "teacher-focused" process (Figure 1). "Students as audience" do not have in mind full sequence of practical steps as they are many, and we are usually in the harry starting preparing sample at once from the morning, to achieve 2-3 samples completed per day, instead of going through the long sequence of small practical steps of preparation. Preparation of one sample plus the testing itself takes up to 2-3 hours. In such a situation, when we are rushing to prepare the first sample of the day or the group, they might "sometimes felt useless because did not always know what to do" (Table 1: Day 2, Group 2), but afterward, they admit that "once completed the first sample, much faster prepared next samples." From our point of view this we cannot compromise concerning the main experiment. And such a situation occurs partly due to lack of time (both objective and in the head) and partly due to the need to ensure that students know how to properly prepare the experiment before they can be allowed to hold some tasks. Some tasks of the main experiment remain blocked for the students throughout the whole campaign, and only the responsible Ph.D. is running them.

Waiting and safety. There are three types of waiting: not smooth planning, unexpected deviation, and forced one. All those cause frustrations to the students, perhaps mostly because they do not realize their origin and do not fully understand the complexity of all components (Figure 3) teachers have to manage during such a field course. Not smooth planning like ones we can improve and will make sure take action on in the future. "Information should be given to the entire group at the same time to avoid confusions" (Table 1: Day 4, Group 4), though it is not always possible, and we, teachers, expect some degree of self-structure inside the group. Unexpected deviations (equipment malfunction, cold issues to the person or equipment, toilet needs, low fuel in snowmobile or generator) can cause large brakes and waiting times on ice or inside. Partly some of them can be addressed by better planning, but they are often part of our work which has to be counted on and be included in understanding of Big Group Environment component (Figure 3). Finally, there is forced waiting; I like to distinguish. Those are when we find it isn't easy to compromise and trust the students (especially during such a short-term course, when students are less experienced with the field equipment) to do specific tasks. Some of such tasks can also be a matter of safety: "Poor fixing of boxes, jerrycans on the sledges". "While recovering those, many went off the scooters and step around on the glacier" (Table 1: Day 4, Group 3). This is one example of a safety matter when things are packed not properly. Luckily, we had all days clear weather that year. The same example (poor sledge packing) in lousy visibility and heavy snow conditions can cause harmful consequences if the group splits or miss someone in the worst case scenario. Again, all frustrations, origins of mistakes, and safety matter consequences can be eliminated or reduced by a proper communication level, which is the critical comment from this report.

Conclusions

The organized survey of the course through the daily evaluations of the course flow by the student groups came very useful for responsible teachers and future students. Even though most of the comments pointed to planning issues are known to us from before, the current study helped to re-evaluate the issues and find approaches to improve them. In some cases, real action on improvements will be taken; in others cases, it will be enough to communicate to the students in advance that some gaps in the course flow are unavoidable and are part of the complex research-based education environment (Figure 3). This would reduce many frustrations and improve the group environment.

The main findings of this study can be formulated and implemented as follows:

- The only comment directly related to the learning outcomes pointed to the need to include more time for preliminary analysis of the data collected in the field the same day. This would help students to evaluate their achievements of the day at once on the site and find out whether collected data are good/correct. This should be possible in the current setup of the course, though an extension of the field campaign by one day can be proposed too (with some consequence of budget growth for better learning outcomes)
- Planning should be improved where possible, while for the other occasions, it must be communicated in advance to the students that some planning issues they will experience are related to an aspect of managing Big Group Environment (Figure 3)
- I step on the strategy that students should be left face to face to some practical issues in the field achieving good performance of equipment and quality of collected data by own faults and findings, instead of being delivered a ready solutions to the level of every small

practical hints. Such an approach precisely allows students to be actors rather then spectators.

- Origins of waiting times must be explained to the students, especially that "forced waitings" are caused by the fact that tasks related to the safety cannot be compromised and delegated to students

Thus, balancing education and research (Figure 5) remains a not straightforward task to manage several components of the Arctic campaign and within a big group environment. With the help of students' feedback and organizing the environment when the "Group is disciplined, and people are not afraid to ask for help" (Table 1: Day 1, Group 4), such task can become more effectively manageable. As a result, more learning outcomes will be achieved, and more research data points obtained. As students realize themselves "Stuck with the same role for better efficiency" (Table 1: Day 2, Group 3), this scenario can or should be chosen in case of the "Research in focus" priority of the campaign (Figure 5). Otherwise, students can be offered "Switching effectively between stations" (Table1: Day 3, Group 3) for "Education in focus" priority.

In principle, the situation with the balance between education and research (Figure 5) during this course was seen before this study too. However, this survey showed the case from several, not trivial aspects that will improve the course's flow and learning outcomes. Classification of Healey (2005) (Figure 1) was rebuilt into the diagram for this course (Figure 5). Whether to choose Education in focus approach (Student-focused, Students as participants, Actors) or Research in focus approach (Teacher-focused, Students as audience, Spectators) remains open depending on priorities and the current research situation. Important that the balance is kept as much as possible.

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