

Scholarship of teaching and learning: Learning diary as a field work report

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Introduction

My teaching duty at the University Centre in Svalbard (UNIS) mainly relates to the course called Middle polar atmosphere. This is a full semester autumn course at Bachelor level giving an overview of the whole wide theme on middle atmosphere (detailed course description of AGF-210 can be found at <http://www.unis.no/course/agf-210-the-middle-polar-atmosphere/>). Although many of the topics on the course curriculum are related on mesosphere (atmospheric layer at about 50–90 km height), which is also the focus of the research at UNIS, some important concepts must be included from the stratospheric physics (atmospheric layer at about 10–50 km) in order to understand the causes and consequences, i.e. the big picture. The learning outcomes of the course are equally broad as is the topic area itself, and consequently much less detailed and focused than those of the other geophysics Bachelor courses taught in parallel. All full semester Bachelor students will take two courses of 15 ECTS each. In geophysics, we currently have three courses to choose from. The middle polar atmosphere course goes well together with either the Polar meteorology and climate (AGF-213) or the Polar ocean climate (AGF-214) course, since the whole air-sea column is a very tightly coupled package with a lot of similar dynamical and thermal processes. In general, some students may have some background in meteorology but many come from pure physics being rather alien to both atmosphere and sea phenomena.

Each UNIS course includes a field work part. The field work periods for oceanography and meteorology are traditional setups of a certain number of days in a row on a research vessel or ground-based camp. The students operate scientific instruments to perform their own measurements, collect their own data, analyse them and report on the results. Often each student or a small student group is assigned to different science questions so that individual work becomes a significant contribution and the group effort turns out to be more than each individual report

together. In this context the field work report is a traditional report including introduction, description of the instruments, data, methods and results, just like the report of this study. On the contrary, the middle atmosphere course field work consists of a handful of introductory tours at different research facilities with different instructors and different data related tasks. The students are rarely allowed to directly operate advanced instrumentation (radars, lidars, spectrometers) which are permanently installed in large and expensive infrastructures. Data collection is highly automated and any operation mode changes are carried out by professional people e.g. site managers.

During previous years the field work report has been requested in the traditional form. I eyed through one set of earlier reports and found them containing rather little physics but a lot of copy-paste sections of technical details of a number of different scientific instrumentation. This project report investigates an experiment of turning the traditional field work report into a learning diary. In autumn 2015, the middle atmosphere course students visited Kjell Henriksen Observatory¹ (KHO) near UNIS for optical airglow observations, an incoherent scatter radar facility (EISCAT Svalbard radar²) and a mesosphere-stratosphere-troposphere (MST) radar called SOUSY³ site on the same mountain. In addition, we had did a four-day excursion to Andøya Space Centre⁴ (ASC) to learn about their atmospheric rocket programmes as well as a lidar (Light Detection And Ranging) facility called ALOMAR (Arctic Lidar Observatory for Middle Atmosphere Research) and an atmospheric radar MAARSY⁵ (Middle Atmosphere Alomar Radar System) site nearby. All site visits included introductory lectures by local experts and both optical, radar and lidar data were used in hands-on analysis exercises, but all the analysed data related to different middle atmospheric phenomena and could not be tied into one clear science question or objective.

Methods and data

A learning diary is a personal document to process individual learning, digest and analyse new information. Research on learning suggests that analysing your own learning helps to identify unclear items, support deeper understanding and connect the newly learned material to previously existing knowledge [4].

The students were advised to write an entry every day, if not after each learning

¹<http://kho.unis.no/>

²<http://www.eiscat.se/>

³<http://radars.uit.no/sousy/>

⁴<http://andoyaspace.no/>

⁵<http://maarsy.rocketrangle.no/>

session. The learning activities during the field days included lectures, tours, exercises, team work and experiments. The students were allowed to include critical comments or feedback about the teaching and learning activities as long as they were accompanied by reasoning and explanations. It was also emphasised that the main point of the diaries would be to reflect the learning process. As any other field report, the learning diary was a required document in order to pass the course. It was not graded but acknowledged as pass or fail. The students were also aware of the fact that the learning diaries would provide data for the author's pedagogic project.

The group consisted of seven students. They were asked to write an entry per day and include at least the topic of the day, a topic area where the student's understanding was advanced most, and a topic area which remained most unclear to them. A copy of the full learning diary assignment is appended to this report. The students were further encouraged to discuss how well the field work study visits connected to the theoretical knowledge of the lectures, and identify the things which they learned thoroughly enough to be able to explain the key messages in their own words a week after the learning activity. Half way through the field work days the students were requested to meet up with a fellow student, compare their learning experience of the day and report on the comparison. Finally, after all the field work days the students were asked to evaluate how they experienced the learning diary as a field report option and whether it contributed to their learning or changed their way of processing the new information.

The outcome of the field work part of the course was outlined as: "to introduce students to a wide range of ground-based instrumentation, measurement and analysis techniques which can be used to monitor key processes in the middle atmosphere. The goal is that after the field period you will be able to describe the challenges in middle atmospheric observations and choose efficient measurement techniques for your future project if it was related to middle atmospheric physics." As a part of the final learning diary entry the students were asked to evaluate where they were at with respect to the given goal.

Results

Since the learning diary was a compulsory course activity all seven diaries were delivered on time. The diaries ranged from listing the topics, themes and sites visited to fairly deep reflective thinking. No feedback time window was unfortunately implemented in the course schedule for the learning diaries. For two of the seven reports I requested adding a final wrap-up entry and received it for one of them. The most minimalistic diary, i.e. brief list of topics per day, was less detailed in

technical sense but in terms of learning report an equally thorough as compared to the previous years' traditional field reports.

Nobody was disappointed or against writing the field report in the form of learning diary. One student commented that the diary was an easy and informal way to report on the field days and site visits. In fact, the actual amount of work is probably not much less than in a traditional report but it seemed like the informal and individual way of reporting sparked thoughtful responses also in those students who would not otherwise volunteer to speak too much.

The majority of the students commented that just the process of writing helped the information to penetrate, helped in re-arranging the new information, in keeping track of unclear topics and one's own progress. These are very important findings particularly during our excursion to Andøya Space Centre where the programme was rather tight, several difficult and large concepts were brought up there for the first time, and a lot of the instrumentation were new to everybody. Without the daily processing of the personal level of understanding the total confusion might have accumulated during the field days into a much larger problem towards the end of the course.

One additional wrap-up question answer was received shortly after the final exam, although the major part of the report was delivered well on time before the exam. This single comment explicitly stated that some of the exam questions would have been left unanswered without the writing process required by the learning diary. The exam itself was processed anonymously, so I cannot compare the learning diary entries with the corresponding exam success. However, we had a discussion-based repetition session for the course where rather than listing the most important topics in the traditional lecture form we modified a Send-a-question active learning method. The students worked in pairs, picked topics from the course curriculum list, designed questions on things they found most central and important and posed them to their fellow students. This created a very fruitful and lively discussion. We ran out of time but it was the students who wanted to complete the exercise. During the repetition discussion it was obvious that the field work part of the knowledge had settled in better than some other equally challenging topics. We started to reach a coherent picture of the middle atmosphere at a group level. At that time I had already made the final written exam and knew that every student would pass.

Most of the learning diaries were direct thoughtful answers to questions in the instructions, which is not surprising since we never really talked about reflective thinking by the time the learning diary assignment was introduced. Nevertheless, several students labelled the radar part of the field days as difficult and too much new information at too fast pace while at the same time admitting that this is where they learned most. Looking back to it, I do recognise lack of background information which can be easily improved next time. The comments about fast learning

suggest that much of the new information was received and processed but the learning had happened at an uncomfortably high speed. The half-way task to compare learning experience with a fellow student was on an intense radar technique day. Many students criticised that they had not much to talk about because everybody seemed overwhelmed and confused after that day. However, it turned into a little bit of a relief to find out that nobody else was fully on top of the new knowledge there either. The question placement was not intended to match any particular topic but rather make a small change to the writing routine half way through.

A couple of particularly reflective learning diaries included discussions on how the new information gained during the field work ties into the theoretical background of earlier lectures of this course and the earlier courses of these students. Seeing the theoretical physics principles applied in real-life scientific measurement techniques to derive atmospheric quantities proved to be an eye-opening experience. These diaries concluded that some topics were understood at a superficial level while others more thoroughly and some remained unclear. They further specified which were the themes they would be able to apply to their future work and career as they currently see it.

Finally, five of the seven learning diaries concluded that what the students felt they learned was aligned with the learning outcomes given in the learning diary instructions, that is, a solid overview of the ground-based measurement techniques for the middle atmospheric studies. Clearly many students would have preferred a more detailed examination of one of two of them but I interpret these comments as signs of interest to explore further. In fact, three of the seven students expressed interest to do their Bachelor thesis on middle atmospheric or closely related topics.

Conclusions and future work

This study reports on results on using learning diary as a field work report of middle atmospheric physics course (AGF-210) at the University Centre in Svalbard. Seven students attended this full term Bachelor level course. The field work part of the course consists of a handful of different site visits and excursions conducted with different teachers, different instrumentation and measurement techniques. Since there is no obvious single story to follow a traditional field work report has previously been found somewhat inconvenient and not particularly well aligned with the learning outcomes of the course.

The learning diary, as any field work report, was listed as a required or compulsory learning activity for taking the exam and passing the course. Everybody delivered on time. At the end, only one learning diary lacked an answer to the concluding questions but since no time for feedback and improvements was imple-

mented in the course schedule all reports were approved.

The diary contents ranged from listing field day activities to thoughtful discussions of individual level of understanding, individual learning and tying the new practical information into the context of previously studied theoretical background. All learning diaries identified the most challenging topics very clearly and most concluded that the daily writing duty improved their understanding and gave them a tool to follow their personal progress. The students found the leaning diary less work than a traditional field work report. In reality, the actual amount of work may not be much less than in a traditional report but the time used in writing is distributed into smaller chunks over a longer period. It also seemed like the informal and individual way of reporting resulted in thoughtful responses also in spontaneously less active students. Furthermore, five of the seven reports concluded that the learning outcomes set to the field work part of the course were met.

As a side effect the learning diaries gave very detailed feedback on individual student learning which is invaluable for further developing of the course. Some of the critic pointed into insufficient background information level. Because the students come from many different universities with various backgrounds and because the backgrounds of the students vary very much from year to year, I will next implement a pre-course questionnaire to find out the largest gaps in the essential concepts [1]. These can then be allowed more time during the introductory lectures at the beginning of the course. Even if the introductions to the lacking concepts will be brief it is likely to support leaning during the field work since less of the essential concepts will not become as completely new topics.

Should the learning diaries be graded is a question I have no answer for. Grading would make students focus more on the reflective writing but potentially give a feeling of a less informal and more restricted outcome. Some grading criteria have been suggested based on the level of reflectiveness [2] or additionally the presentation style, length, regularity of the entries, level of alignment with course outcomes, level of creative and critical thinking [3]. Even if the diaries in this study could have been more reflective I feel the result was what I expected with just the daily writing process being very helpful. On the other hand, it would be fair to be able to reward thoughtful presentations better than the reports only including the bare minimum. One should bare in mind that the minimum acceptable report on this round was still comparable with the outcomes of the previously attempted traditional field reports.

Still undetermined about the grading, the learning diaries for the next course will have two deadlines: one fairly soon after the end of the field days including all the field day entries and other one later, maybe even after the repetition session or the exam to give an opportunity for improvements based on feedback. Another option would be to review the learning diaries after the first one or two entries but

that depends on how tight the field day scheduling is at the start of the period. This is, in turn, dependent on weather, for instance, as we deal with optical observations.

References

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- [2] Hatton, N., and Smith, D. (1994). Facilitating reflection: Issues and research. In Proceedings from the Conference of the Australian Teacher Education Association (24th Brisbane, Queensland, Australia, July 2-6, 1994).
- [3] Moon, J.A. (2006). Learning journals: A handbook for reflective practice and professional development. Abingdon, Oxon: Routledge.
- [4] Moon, J. (2010). Learning journals and logs. In UCD Teaching and Learning Resources. Retrieved from <http://www.ucd.ie/t4cms/ucdtla0035.pdf>

Appendix: learning diary assignment text

AGF-210, instructions for reporting field work and excursions

A learning diary is a personal document to process individual learning, digest and analyse new information. Research on learning suggests that analysing your own learning helps to identify unclear items and strengthen deeper understanding of newly learned material. It is to be written every day, or after each learning session whether it was a lecture, tour, exercise, team work or experiment. A learning diary should be honest and subjective. Critical comments or feedback about the teaching and learning activities are welcome. However, since the purpose of the learning diary is to enhance your own learning, I ask critical comments to be accompanied by reasoning and explanations.

What to include in the daily entries (at least):

1. Date
2. Topics of the day/session
3. Where was my understanding advanced most? Why?
4. What remains unclear or difficult? Why?

I encourage you to discuss how you felt about the learning process / method, how useful today's topics may become in the future, which part will you be able to teach your friend in a week from now and to what extent the field activity connects to the theoretical background of previously given lectures etc.

Day 4 additional question

After the fourth day on the field/excursion, discuss with another student in the group about the day. In addition to the daily entry, describe what you learned by sharing your experience with your fellow student.

End of the report extra question

After all the field/excursion days, read thoughtfully through all your entries. Describe how you felt about writing daily and personal entries instead of a traditional field work report. Did it make a difference to your learning experience or understanding of the topics?

The aim of the field and excursion days of the course is to introduce students to a wide range of ground-based instrumentation, measurement and analysis techniques which can be used to monitor key processes in the middle atmosphere. The goal is that after the field period you will be able to describe the challenges in middle atmospheric observations and choose efficient measurement techniques for your future project if it was related to middle atmospheric physics. Where are you at with respect to this ambitious goal?

Submission

The learning diary *is* your field report and it is a required document from everyone in order to take the final exam. It will not be graded, published or shared but it has to be passed and delivered on time.

The end result can be an electronic or hand-written document as long as it is human readable. Every field or excursion day (KHO, Andenes, SOUSY/EISCAT radar site visit) requires an entry (at least one). In addition, the Day 4 and End of the report questions must be considered. The length of an entry can be anything between one paragraph and one page.

The deadline for delivering learning diaries is 19 November, electronic notes to noora.partamies@unis.no or hand-written notes to Noora's mail box (3rd floor) by 5 pm Norwegian time.