

Martin Viklund

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Teaching Sabbatical, Amherst College, fall semester 2017



Part of the Amherst College Campus: Greenway student dorms (to the right) and the Science building where the Dept. of Physics and Astronomy is located (to the left).

Brief facts about Amherst College

Amherst College is a small private >\$2-billion-endowment liberal arts college in the city Amherst, Western Massachusetts. The nearest major cities with flight connections are Springfield/Hartford to the South (national airport, reached within 1 hour with car) and Boston to the East (international airport, reached within 2 hours with car). The college was founded in 1821 and was for a long time an upper-class men's college until 1975. Today, however, Amherst has a diverse student body with 50% female and 50% male students from 54 different countries, and is ranked 2nd best liberal arts college in the country, just after Williams College (also a STINT host) who is currently ranked 1st [*US News & World Report*]. The tuition fee is about \$60.000 but more than 60% of the students receive scholarship aid, primarily from the College itself. There are about 1800 undergraduate student enrolled within 40 major programs in an open curriculum during the first two years of the four-year college education. The open curriculum means that students do not follow any core curriculum and have a large freedom to define their own curriculum, including a cross-disciplinary Major, or even several majors. In addition, with a faculty of more than 200 teachers, the teacher-student ratio is as small as 8:1, which means that most regular classes are small with typically 10-20 students per class, and some special-topics classes have even less. The college is a member of the Five College Consortium, which allows students to participate in courses from Mount Holyoke College, Smith College, Hampshire College and University of Massachusetts (all reachable within less than 20 min). The latter, "UMass", is a major public state university with its main campus located in Amherst and with more than 30 000 students. This means that the city of Amherst, although being small (approx. 35 000 habitants), has a significantly large student and faculty community which completely dominates the city and close surroundings.

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Preparation and planning

I was notified by STINT about the offer to spend a Teaching Sabbatical semester during the fall 2017 at Amherst College just before the Christmas break in December 2016, and I approved the offer a few days later. I was connected to two contact persons at Amherst College: Janet Tobin (Vice Dean of Academic Administration) and Prof. Kannan “Jagu” Jagannathan (Chair of the Dept. of Physics and Astronomy, for the academic year 2017/2018). After contacting them, I was also connected to two additional contact persons: Prof. William “Will” Loinaz (Chair of the Dept. of Physics and Astronomy, for the academic year 2016/2017), and Alice Simmoneau (Department Coordinator, Dept. of Physics and Astronomy). After considering the calendars of all involved contact persons I finally decided to go to Amherst for a planning week in the beginning of April 2017.

Before the planning week I was discussing different teaching opportunities with Will and Jagu. I offered to participate in co-teaching in an existing physics course as well as teaching a new special-topics course. It was clear that the latter was more preferred by them. The Department was involved in a relatively new Major program in Biophysics and Biochemistry (BPBC), and they thought a course with a topic matching my research expertise (ultrasonics) would fit nicely into this program, as well as in the Major program in Physics (PHYS). Therefore, it was decided that I should give a course with the title “*Physics and Biology of Ultrasound*”. This course was eventually approved at a Faculty meeting that happened to coincide with my planning week in April.

During my planning week in April 2017, I took the opportunity to visit all faculty members at the Department and I also visited several of their lectures held that week in order to get a hint of how teaching was performed at the College. The planning week was prepared by the Department Coordinator, Alice Simmoneau, who was extremely helpful. I also visited the schools where our children were offered to go to (Crocker Farm Elementary School, and Amherst Regional Middle School), as well as the house we were offered to rent (Blossom Lane, South Amherst). It was very important for me and my family to arrange the stay in the best way possible for all of us, not only for myself.

Tasks and responsibilities

I was given the full responsibility to develop and implement the new course according to my own preferences. The only change from my original plan based on the feedback I got from the faculty concerned the course title. The title was slightly modified in order to better match the Liberal Arts curriculum. In practice, this meant that keywords like “application” and “engineering” was preferred to be avoided. Apart from this minor preference, I was given a complete freedom in developing the course, which included deciding the course topics, literature and teaching activities. The Department Chairs (Will and Jagu) were always available for supporting and guiding me through the planning and developing phase, but in the end I was allowed to make my own decisions about everything concerning my new course. This situation was very different from what I was used to at my home University (KTH), where teacher autonomy is not as high. This full academic freedom made it possible to create and implement the course in a very late stage, for good and for bad. On the good side, this actually made it possible to receive full teacher responsibilities (including examination, grading, etc.) during a sabbatical leave

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planned only a few months in advance. On the bad side, it was on the other hand difficult to reach out to all potential students in time and inform them about the upcoming course since they got the information quite late. I met several students later during the semester who told me that “if we only knew about this course, we would have taken it”.

As a STINT Fellow at Amherst College, you are counted both as new faculty, as well as visiting faculty. This means that you are included in all general activities provided by the College for these two categories, including several workshops, lunch seminars/meetings and social events and ceremonies with various themes covering, for example: “*What I wish I had known when I first arrived at Amherst*”, welcome barbeque (including my family), convocation ceremony, library resources, Moodle support, student rights/problems, faculty responsibilities, Title XI federal law, universal course design and inclusion, role of athletics, and more. These meetings were extremely valuable in order to understand the context around higher education in USA, and in particular at Amherst College. It should be noted that Amherst College, in particular thanks to the Vice Dean of Academic Administration, Janet Tobin (who is responsible for the STINT Fellow program), is taking such good care of the STINT Fellows by providing such a well-planned and structured program for the Teaching Sabbatical period. STINT Fellows are well-known by all faculty and there is a mutual trust built since long ago between STINT and Amherst College which is very beneficial for each new STINT Fellow arriving to Amherst. When I met new professors, they often said with a big smile “so you are the new STINT Fellow”.

Activities during the semester

When I arrived to Amherst College and my new host Department in mid-August I was given a large office equipped with anything I needed (computer, printer, desk, chairs, tables, whiteboard, bookshelves, etc.) The room was larger than at my home University and I could also use it as a reception for students during office hours. The Department Coordinator had prepared the set-up of my start in advance, including information about how to receive an e-account and email, mailbox, keys, parking pass, telephone and ID card. My teaching was performed in a lecture room down in the corridor, and I also used the research lab owned by Prof. Ashley Carter who helped me implementing labs and project works in the course. During all my regular lectures, the (former) Dept. Chair Prof. Will Loinaz participated, although passively and not as a co-teacher. This meant that I got all possible support I could think of.

Each semester at Amherst College starts with a two-week “add-drop”-period, where students are “shopping” courses. This means that students sit in various classes they might be interested in to find out if they should take the course or not. I was warned about students being “aggressive shoppers”, which means they will only stay if they find you and the course interesting enough during this period. After the add-drop period, students need to claim their courses for the semester (typically four courses) and once they are registered they are not allowed to drop out. I had four students following my course. In my perspective, this number was very low, but on the other hand, there were very few students available with the correct prerequisites that were allowed to select the course. Actually, among the ~1800 students at the College, there were less than 10 students per year declaring a major in Physics.

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Because of the very few students following my course, I decided a couple of weeks after the course start to revise the course content and activities. Instead of the originally planned course based on regular lectures, home assignments and labs, I replaced the second half of the course with individual research projects. This revision was obviously allowed and not at all surprising among my colleagues (“do as you wish” I was told). A similar revision after the course start at my home University would not be allowed (since you must follow the approved course plan). In collaboration with Prof. Ashley Carter, I offered the students various experimental research projects. The topics were selected from different ideas I had but that were not tested before. Some of these ideas were quite risky, but I thought they were worth trying out. The projects were designed in a similar way as we design Bachelor Thesis projects offered to Engineering Physics students at KTH, but with the difference that the projects were from my perspective more regarded as a learning activity than a project separate from the course. The projects the students selected were: “*Build an acoustic microscope*”, “*Build an acoustophoresis microchip*” and “*Build an acoustic levitator and droplet atomizer*”. All equipment were kindly purchased and paid by Prof. Carter’s research grants (apart from some equipment I brought from my own lab in Stockholm). Finally, after this revision my course turned out to be designed and performed like this:

- First half (Sept-Oct): Theory lectures and weekly home assignment calculation problems (+ office hours)
- Second half (Nov-Dec): Individual experimental projects where the theory and calculations were applied, followed by written reports and oral presentations.

I was very happy about this outcome of the course design, which turned out to work very well. The students also appreciated this design in the course evaluation: To be able to directly apply the newly gained theory into practice with a high degree of freedom in choosing what to work with. Here are some individual free comments from the students (question: “What was the best aspect of the course”):

- *“The projects! It was fun to do something that built off lectures and directly apply topics we had discussed.”*
- *“The best aspect of the course was the freedom in the projects. We could completely design and execute our own experiments. Afterwards we could figure out how to interpret our results ourselves. It felt as if we were engineers or scientists.”*
- *“I really enjoyed applying what we learned into our research to see for ourselves that the theory holds up. Thank you so much for teaching this course! It’s not often such a nice course is taught at Amherst, so it was fun to be able to dive into one topic so deeply.”*

Important lessons

The most important knowledge I have gained during my stay at Amherst College is the perspective of the education system and practice at my home University (Engineering) and how it compares with a completely different system and curriculum (Liberal Arts) and with other restrictions regarding available resources and academic freedom. It was very interesting to compare how much better the student learning actually gets when the available resources are almost unlimited, compared to the Swedish system where resources are clearly limited and scaled by the number of students passing the exam. The

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course design I chose for the course at Amherst College would simply be too expensive (comparing my time and the number of students) if I would copy it for KTH. On the other hand, I think that the even if the learning outcomes for the Amherst College students were in my opinion higher than the outcomes for my previous KTH students in a similar course, this extra gain per added resource is not as high as the extra resource added. Nonetheless, I will try to implement some of the ideas (using projects as a learning activity of course contents) in my future KTH teaching.

Since I spent full time teaching only four students, the teacher – student interaction became very similar to the supervision of PhD students in my research group at home. I came close to the students in the same way as with my PhD students at home and I got to know them very well. This indirectly led to an even higher commitment from my side – I really wanted to help them out in the best possible way and I spent almost an unrealistically large amount of time per student, with office hours turning into long-lasting spontaneous private “one-to-one lectures” in my office. The result, I think, was a much more deep-learning environment and a possibility to form the course activities and partly the course contents differently according to each student’s preferences and qualifications. This is of course very far from the environment at home where we discuss quality assurance in education and course plans defined 1-2 years in advance and with static course and examination goals. The difference I guess is fundamentally related to the different purposes of a liberal arts education and an engineering education.

An interesting comparison I made was to use the same course evaluation form, “*Learning Experience Questionnaire*”, LEQ¹ (a standard form used at KTH) in the course I gave at Amherst College. This made it possible to evaluate two courses with similar content and learning outcome but with very different teaching activities and resources. The two courses are “*Physics and Applications of Ultrasound*” (my course at KTH) and “*Physics and Biology of Ultrasound*” (my course at Amherst College). The LEQ is a tool for course evaluation and development created internally at KTH that examines the students’ learning experience based on several evidence-based factors that are proven to be beneficial for the student learning. The LEQ contains 22 different statements that the students grade in between 1-7. The questions belong to three different sub-categories:

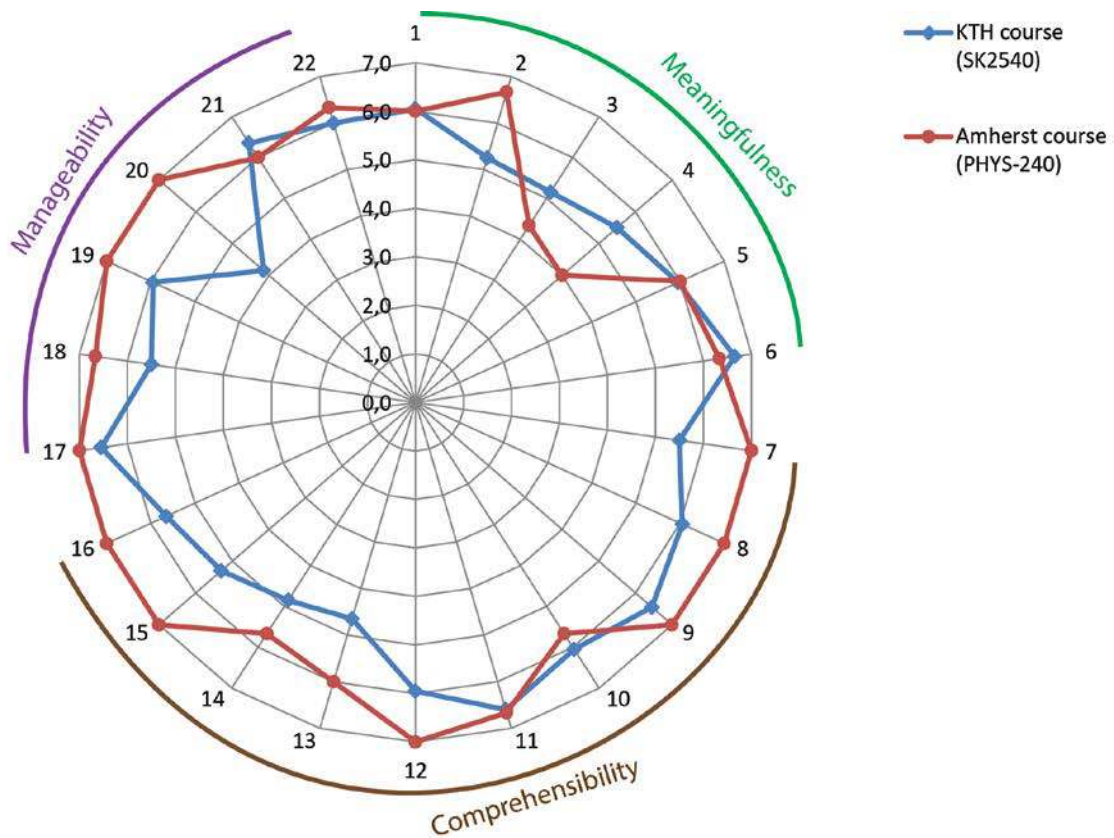
- **Meaningfulness** – whether the students experience stimulating challenges worthy of investment and commitment (questions 1-7)
- **Comprehensibility** – whether the students feel that the learning environment is structured, foreseeable and comprehensible (questions 7-16)
- **Manageability** – whether the students feel that the available resources and support meet their demands for overcoming the challenges and meet the goals (questions 17-22)

¹ https://intra.kth.se/polopoly_fs/1.661155!/LEQ_Guide_v2.pdf (the guide)
https://intra.kth.se/polopoly_fs/1.675086!/LEQ_v313.pdf (the questionnaire)

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Results from the KTH-developed LEQ (Learning Experience Questionnaire) comparing a KTH course and an Amherst course with similar course content (ultrasound) but with different course activities. The questions are sorted in the following learning environment categories: Meaningfulness (1-6), Comprehensibility (7-16), and Manageability (17-22).

From the diagram, one can conclude that the extra resources and different learning environment at Amherst College tend to be generally more beneficial for the students' learning experiences. However, it is interesting to note that questions 2-3 receive lower grades for the Amherst students compared KTH students. These questions relate to the time to reflect on what the students have learnt and whether they explored parts of the subjects on their own. My interpretation is that the Amherst students are generally very pleased with the learning environment but they are stressed and have limited time for doing something extra (in addition to what the teacher requires). But overall, I am very happy with the course design I was able to explore at Amherst College, and I will try to use part of this design in my upcoming courses at KTH.

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Comparison between Amherst College and KTH

- **Student population:** Amherst College has today a truly diverse student body, 50% female and 50% male students coming from 54 different countries and with a diverse ethnical and cultural background. This student population is clearly much more diverse than at KTH. As a comparison, most of KTH's engineering programs have a majority of male students and ethnical and cultural backgrounds are more homogeneous.

- **The relation between research and education:** At Amherst College, the primary task for the faculty is to teach their undergraduate students. Each professor is required to give two courses per semester, which officially corresponds to half time, but in practice it is rather full time work. If you have an additional administrative task, such as being Department Chair, your teaching duties can be reduced. The remaining time is typically used for research. However, the actual time left for research is in many cases very limited due to the high teaching load. Many professors use the time periods outside the regular semesters for their research, typically the summer period. At KTH, the teaching merits are today playing an increasingly important role, but compared to Amherst College most Swedish professors still see research as the most rewarding task when making a career. At KTH, very productive and successful professors can “buy themselves free” from teaching. This option is not possible neither requested at Amherst College. Personally, I think the optimal system lies somewhere in between: Teaching and research should be equally rewarded, equally supported, there should be enough time allocated for both duties, and each professor should see both parts as natural and important tasks that are strongly coupled and connected.

I was surprised when I arrive to Amherst College to find out that the research performed at the Department of Physics and Astronomy was not only existing, but also outstanding, despite their lack of a graduate school. The professors published their research regularly in very high impact journals (Science, Nature, etc), and this without any PhD student resources. Instead, they used their external grants for employing postdocs, and they also involved their undergraduate students in their research projects (supervised by them and their postdocs). Some of these Bachelor-level students were co-authors in papers in such high-impact journals before they even started their Master's Degree studies. Thus, my conclusion is that there is a large overlap and connection between research and education at Amherst College where both parts are mutually supporting each other. I was influenced by this environment in my own course, which resulted in offering students small research projects. One of these projects will continue as a research collaboration between my group at KTH and Prof. Carter's group at Amherst College.

- **The relation between teacher and student:** Students call you by “Professor”, even if you try to convince them that calling you by the first name is what you are used to. But apart from this, the communication between students and teachers is very informal and relaxed. To me, the interaction between me and my students at Amherst College was similar to the interaction between me and my PhD

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students at KTH. I really enjoyed this time, especially the office hours, and I actually miss my students from Amherst College a lot, since these individuals were the ones I spend most time together with.

- **The institution's view of breadth versus specialization in education:** The Liberal Arts curriculum is a completely different system compared to Engineering programs at KTH. Students at Liberal Arts can choose courses from any discipline and not only within Natural Sciences. The specialization comes during the last two years when the students declare a Major (their area of specialization). But the general philosophy behind the Liberal Arts idea is that education is a personal process and intellectual activity and not a form of production of labor for the society. An important part of this philosophy is to support diversity on all planes: Both within the student body and within the curriculum. This education philosophy is very different from the production of engineers at KTH.

- **Competence development for teachers:** Amherst College provides an ambitious series of competence development activities for teachers. However, an important difference between Amherst College and KTH is that none of these activities are compulsory: It is completely up to each professor to choose what activities are valuable and useful. The academic freedom is regarded as the foundation for all activities, from research to teaching.

- **Teacher recruitment, pedagogy and its importance:** Teaching excellence is the most important merit when recruiting new faculty at Amherst College. Opinions from all faculty members and also from students are very important in the evaluation process, for example when taking the step from tenure track to a tenured position. However, in contrast to KTH, formal courses in pedagogy and insights into pedagogy theory are not regarded as critical. The College offers workshops through the Center for Teaching and Learning and the Writing Center, but whether faculty actually attend such activities is purely optional. A great difference is therefore the amount of autonomy of the faculty at Amherst College compared to KTH faculty. Each teacher at Amherst College is expected to continuously develop their teaching skills and methods, without any formal regulations or requirements as we have at KTH, and actively seek the support they think they need.

- **The status of pedagogical merits compared to research merits:** My view is that at Amherst College, teaching merits have the highest status, but research merits are also very important when considering new faculty positions. At KTH, it is still the opposite situation, although pedagogical merits are much more important today than just 5-10 years ago.

- **To what extent educational programs conform to labor market needs:** Liberal Arts education is a personal and broad preparation before starting an education aiming for a certain profession. For example, many students taking basic physics courses were "pre-meds" aiming for Medical School. Others aimed for graduate school, which typically starts with one year Master's level courses. There is no similar education system in Sweden after the high-school level (gymnasium). In Sweden nowadays, most higher education has a direct connection to a profession and the labor market needs.

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Action plan – topics to address and if possible introduce in Sweden

- **Personally:** The most valuable experience for me personally was to be able to spend an entire semester with teaching duties only. At KTH my regular work day is much more fragmented with different tasks performed more or less in parallel (administration, teaching, research). Because of this, I was able to experiment more with teaching ideas and methods, and I had time to reflect on my teaching practice. I was also able to discuss different teaching methods with students and had time to study the teaching practices of my new colleagues. In addition, I had time to develop new course material I can use in new and revised courses at KTH, and I developed experimental projects that can be reused in future Bachelor thesis projects at KTH.

- **For the department (Applied Physics, KTH):** At my department (Applied Physics) at KTH, we teach basic courses in classical physics for many different engineering programs at KTH. These courses are very similar in content to the basic physics courses my colleagues were teaching at Amherst College. Even the course literature was the same. What both departments have in common is the tradition of offering laboratory work and physics demonstrations in the courses. Much of the inspiration and ideas for labs and demos I gained at Amherst College can be used when developing new or improving existing lab courses and demos at my Department at KTH.

- **For the institution (KTH), and in the Swedish research and education system in general:** Something that Amherst College has in common with the Japanese system (which I discussed with Japanese colleagues at the University of Tokyo during an education workshop last year) is to include undergraduate students in research, as a part of their education. Such education is best driven by project courses. At KTH, students typically perform their projects after having completed all regular courses within the study program, and we often recommend that all courses should be completed before even starting a degree project. At my department at KTH, we fully include the degree project students in the research groups, but only during their very last semester. Before this very last semester, Master's degree students are not really feeling welcomed at the Departments. Thus, this is an unwanted consequence of the degree project organization, which is based on the idea that students first need to study all theory and after that the theory should be applied in a degree project. I would rather see that we approach the Amherst and Japanese organization where a student is connected to a Department and a professor/research group already when they start their Major (US system) or their Master studies (Japanese system). This means they can work with a research project for a longer time in parallel with regular courses. With good planning, the courses and the projects can be integrated, which would also result in a better coupling between teaching and research. It would also generate a better study environment for the students if they feel they belong to a Department and a research group during all the time they specialize in a certain topic (typically during the last two years of studies). I think it would lead to a win-win situation since students will get more dedicated teachers and possibly more deep-learning effects, as well as the research performed at KTH would be supported and boosted by this unused resource. Furthermore, my own opinion (as well as my experience after this semester) is that a small research project that is directly coupled to a certain course topic can be seen as a learning activity and not only as a research. What I hope in the long run is that our Swedish University faculty in the

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future doesn't see teaching and research as two separate work tasks, but rather that the two tasks are different aspects of the same.

Acknowledgments

I would like to express my gratitude to the STINT foundation who generously made it possible for me and my whole family to spend a semester in US. As a bonus, I was able to study not only the higher education system in US, but also the elementary and middle school systems through my three children (8, 11 and 13 years old).

Furthermore, I would like to thank Janet Tobin, Vice Dean of Academic Administration, to carefully and with full commitment organize and maintain the STINT Fellow Program at Amherst College, which I think is of great value for both institutions: Amherst College and the STINT Fellow's institution. I also would like to thank my colleagues at the Department of Physics and Astronomy, in particular Will Loinaz, Jagu Jagannathan, Ashley Carter, David Hanneke, Michael Stage, Jim Kubasek, Brian Crepeau and Alice Simmoneau, with whom I interacted mostly with and shared daily interesting discussions and ideas.



View towards south from the Campus. Mount Holyoke Range State Park in the background.



My colleagues at the Dept. of Physics and Astronomy: David Hannake, Larry Hunter, me, Will Loinaz, Kannan "Jagu" Jagannathan, Michael Stage, Kate Follette and Ashley Carter. (Missing faculty: Jonathan Friedman and David Hall.) We are dressed up for the Convocation Convocation in the beginning of the semester.



Arrival day in August 2017 to our new temporary home.



Departure day in January 2018.