

Ideas for Engineering Education Inspired by Liberal Arts Colleges, Part One

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Abstract—After spending the fall 2008 at one of the best colleges in the United States, Williams College, I have stolen several ideas that could be used to improve Swedish engineering education. The first four of these ideas regard admission, study results monitoring, examination demands and sabbaticals. I hope that the remaining ideas can be presented at this conference next year.

Index Terms—Engineering education, Liberal arts education, Management.

I. INTRODUCTION

IF we are really serious about improving our education, the best place to be inspired is where the best education is given today. Williams College has for a long time been the highest ranked Liberal Arts college [1] in the USA¹. On a more general ranking [2] Williams College was ranked as number four in USA after Princeton, Stanford and University of North Carolina, but before Yale and Harvard. There are several opinions on what Liberal Arts education is [3], but the important point here is that the best Liberal Arts colleges focus on excellent education, rather than excellent research as Swedish universities. This does not mean that there is no research at these colleges nor that their research is less than excellent, but the *purpose* of their research is to improve the education, not to merit the researchers. The argument is the same as we use in Sweden (you need a connection to the present research in order to be a good teacher). However, with the general lack of research funding in Sweden for the research-wise not very successful teachers, this ambition is more of a paper tiger than an action plan in Sweden.

I do not claim to have knowledge on how engineering education is structured or implemented in all Swedish universities, so the situation described here may in parts only apply to KTH. However, my encounters with numerous teachers from other universities have led me to believe that the educational problems discussed here apply to many more universities than KTH where I have been involved in teaching since 1984.

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¹ In 2008 Williams tied with its archrival Amherst College.

After spending the fall 2008 as a STINT Fellow at Williams College I have been inspired to several changes in the way we implement engineering education in Sweden. These changes involve students, pedagogical structure and teachers.

II. PROPOSAL

The four suggestions presented here are: Admission based on other data than grades only, Active student progress monitoring, Grade average demands to replace passed courses and Sabbatical leaves.

A. Admission based on other data than grades only

The admission system we have today provides us with the students we have today. If we would like to change that, for example by reaching out to students from non-academical families or (for most parts of engineering education) to reach more women, we have to change the admission system.

At Chalmers, admission tests have been used with promising results [4], but at an economical cost. The ideal system from a university's point of view would be based on data that can be easily obtained, for economical screening purposes, and data that we do not have today, but is highly correlated with successful university studies.

One idea is to use the highest grade in Mathematics and Physics (the only grades from high school that can be used as predictors for success in engineering studies [5]) for screening purposes, together with excellence in other fields such as music, sports, science and/or leadership roles in organizations.

The argument for using these areas is if a person knows what it takes to achieve excellence or a leadership position in some area (usually hard disciplinary work), he/she can apply that knowledge to other areas, such as academic studies, as well.

One counter argument is that some US colleges and universities focus too much on for example the athletic abilities and too little on the academic, but since we do not have varsity sports at all in Sweden, that argument does not apply here.

B. Active student progress monitoring

The hardest demands on students' academic performance is strangely enough not made by their university, but rather by CSN (Swedish Board for Study Support). In general, these demands does not become a reality until the 2nd year despite the knowledge that successful academic performance the first year is very important for the probability to graduate at all [6].

The Swedish way appears to be very tolerant for students that wish to do other things besides studying, but it is a false façade. As soon as you have failed one course, it is very difficult to catch up. Due to the system with mandatory courses the next course often build on knowledge that should be acquired during the failed course. The failed course may not be possible to follow until next academic year, and due to the scheduling system, following courses in two different grades inevitably leads to collisions, which result in more failed courses in a death spiral with no way out besides academic failure and debt.

Since we know the importance of a successful first year, we should be monitoring the students progress closely the first year and offer active support for students falling behind (such as mentors). We should also reconsider the system that pretends to be flexible and make it flexible by for example offer repetition courses that do not collide with other mandatory courses. Another way to improve flexibility for the students would be to modularize the schedule so that there are several different ways to take the same set of courses without schedule collisions.

C. Grade average demands to replace passed courses

The Swedish system today that requires a student to demonstrate a minimum level of subject understanding for a passing grade “guarantees” a minimum level of knowledge in each course. However, hand over heart, is that minimum level the same for the first exam as the student that finally makes it after seven written and one oral exam? As long as the precision in exams is blunt we should be careful with sharp limits for passing grades.

An alternative would be to use the entire possible scale from 1 to 5 or 0 to 100 and put demands on a minimum *grade average* for graduation. This would improve throughput, which would benefit both students (shorter time to study), universities (graduation bonuses) and industry (no need to offer time off for studying and tests for students that are almost finished). The downside is of course that you cannot trust each graduated individual to achieve the artificial minimum level of knowledge in each course. However, the grades on individual courses are still available on the degree certificate, if that should be important.

This is not a solution for courses that depend on each other. However, it does not make that situation worse. Even today students are most often allowed to continue with the 2nd course even if they failed the first. One reason of the failure might be as simple as being sick during the final exam.

Also, with infinite time, anyone could pass a Master of Science in any subject. However, infinite time is rarely available in academics and never in industry. Companies and organizations compete with the quality they have produced in the limited time and with the limited resources they have available. A successful career cannot be built solely upon a single high quality performance – quantity is also needed.

D. Sabbatical leaves

Mobility in the academic work field has for a long time

been advocated, but partly due to the limited Swedish language area and the Swedish family structure with two income families, the number of exchanges has so far been at best limited. With the introduction of tenure track positions in Sweden (biträdande lektorat), the situation will become worse.

If we truly believe that exposing ourselves and our colleagues to new or other ideas and systems than the ones we have had for years or even decades, we need to make mobility pay off for the individuals who take on these endeavors.

The pay-off could be using past mobility as a merit for appointments to assistant, associate or full professor and in promotions to associate and full professor. Now, we already do that, but I argue that as long as we do not make mobility a requirement, we need to define a more scientific process for weighing different pedagogical merits and achievements against each other. We also need a transparent way to weigh research merits against pedagogical merits.

With a similar system as in many US universities and colleges, where the sabbatical is not fully funded, this does not have to be an economical issue for the university.

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REFERENCES

- [1] U.S. News and World Report (2008): [Online]. Available: <http://colleges.usnews.rankingsandreviews.com/college/liberal-arts-search> (URL)
- [2] Ordo Ludus College Ranking (Overall Average Ranking). [Online]. Available: <http://www.ordoludus.com/> (URL)
- [3] Mehrens P. (2006): Learning from Liberal Arts Education. [Online]. <http://info.uu.se/uadm/dokument.nsf/sidor/CA22773F261C0750C1256FA400501C8A?OpenDocument> (URL)
- [4] Utvärdering av matematik- och fysikprovet 2007–2009. [Online]. <http://www.kth.se/utbildning/skolsamarbete/unging/delprojekt-1/1.29133> (URL)
- [5] Samband mellan betyg i gymnasieskolan och prestationer i högskolan Högskoleverkets rapportserie 2007:21 R.
- [6] Ung Ingenjör - attraktionskraft och genomströmning (2009) [Online]. <http://www.kth.se/utbildning/skolsamarbete/unging/delprojekt-2/1.29108> (URL)