

## CHAPTER 33.

# MULTI-DISCIPLINARY, MULTI-LINGUAL ENGINEERING EDUCATION WRITING DEVELOPMENT: A WRITING PROGRAMME PERSPECTIVE

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*The Centre for Language and Communication at Chalmers University of Technology is enabled by the university's curriculum structure to arrange productive collaborations that promote student development in language and learning throughout three- and five-year programmes, including successful completion of BSc theses. This profile describes two such in-depth collaborations, in mechanical and civil engineering. It goes on to describe the special challenges of providing the best interventions for the diverse students at the MSc level. That the Centre provides programmes in both Swedish and English is another important feature of its work.*

## INTRODUCTION

Chalmers University of Technology is a research university with a long history of engineering education. It is situated on the west coast of Sweden in Gothenburg, which is Sweden's second largest city with some 500,000 inhabitants. The institution was founded in 1829 and became a governmental university in 1937, only to become a private university owned by a foundation in 1994. The university's vision is "Chalmers—for a sustainable future" and its mission statement emphasizes its research profile, its educational appeal, and its professional context: "Chalmers shall be an outward-looking university of technology with a global appeal that conducts internationally recognised education and research linked to a professional innovation process" (Chalmers 2010a).

The annual report tells its readers that the research profile of the university is informed by its three initiatives—material and bio, systems and environment, industry and communication—as well as by its close collaboration with the research and development activities of the industries in the region (Chalmers, 2010b). Chalmers consequently runs four centers of excellence with industry, also works closely with the Swedish Ship-owners' Association, and works with a number of companies in the vehicle and safety centre as well as with the Volvo group on electronics, safety, and environmental issues. The sustainability profile of the university is also present in its work with the Alliance for Global Sustainability, as well as with the Swedish Hybrid Vehicle Centre.

It is not a large institution. The annual report (<http://www.chalmers.se/en/about-chalmers/annual-report/Pages/default.aspx>) statistics reveal that it numbers approximately 12,000 individual students with some 2,000 first year students. Approximately 25% of the students are women, with a slightly larger proportion of women at the PhD level (30%). The various engineering disciplines are taught through three- or five-year long programmes (there are two different categories of engineers in the Swedish work force). Across all the programmes and educations at the university (BSc Eng; BSc; MSc Eng; MSc; MSArch), there are almost 1,000 international students, most of whom are enrolled on one of the 44 international master's programmes. The university staffs some 1,500 teachers and researchers.

The university has a two-part structure, with the required courses within the departments on one hand and an educational organisation outside of the discipline on the other. The educational organisation outside the department places orders for courses with the relevant departments. For the undergraduate level this often means that a program buys courses from three or four departments, whereas for the master's level the programmes tend to be more specialised and involve fewer departments. So for instance, none of the engineering programmes deliver their own math courses in the first three years and instead buy or order these from the Department of Mathematical Sciences. Similarly, many programmes buy project management courses from the Department for the Management of Technology.

In this educational structure, our privileged situation at Chalmers allows us to set up writing in the disciplines, by which we deliver courses and modules for many programmes, allowing more than one encounter with language and communication as well as gradual and challenging progression through sequencing interventions, assignments, and courses. Our work relies partly on the professional applications of the engineering profession and on the current Swedish language law, which demands all agencies and institutions to promote Swedish as the official language, but also on the current European effort toward greater

mobility and internationalization. This means that we must on one hand introduce communication for specific purposes in Swedish but subsequently turn to our international context and focus on English for specific purposes in an engineering/technical setting. Given the integration and progression, our language and communication activities are never isolated from the disciplines, and communication becomes a dimension of disciplinary knowledge.

## **WRITING AND LITERACY AT CHALMERS UNIVERSITY OF TECHNOLOGY**

There is no equivalent to US general education in Swedish higher education. Therefore, students are admitted to a programme or to individual courses, and it is up to the individual programme manager to design learning outcomes and activities for the students. One of the consequences is that there is no predictable background in, for instance, writing instruction at a given point for a student in Swedish higher education, other than phrases in the higher education act. Similarly, literacy as a term has not had much impact, except information literacy. However, what has had greater impact is the emphasis in European higher education on generic and transferable skills. At Chalmers, and at many institutions with professional-oriented programmes, there is, also, a very strong sense of professional orientation that promotes meeting employability requirements.

Predictably, this kind of situation gives rise to a very instrumental and transactional view of writing and literacy. Most of the writing that gets done is focused on reporting learning for grading in connection to exams, project work, and theses. Assignments typically involve various types of reports and presentations, and there is often a strong connection to end-user applications of working in industry. In some programmes, there are projects in the third year or later with industrial representatives; many BSc and MSc theses are done at, with, or for industries, and all programmes have industrial representatives on their committees to help expand industrial networks.

The emphasis on transferability and employability in combination with a compartmentalised view of learning often leads to a situation where there is initially less writing and instead a greater focus on lectures and exams. As employment approaches, writing and discipline-specific communication are allowed more room in learning outcomes and learning activities. This situation is possibly understandable in view of the fact that it is primarily the programme managers, apart from faculty at the Centre for Language and Communication, who care for writing at the university. Beyond the higher education act and ad-

aptation to European standards, there is no university commitment to writing or communication across the curriculum.

## **WRITING-TO-LEARN AND LEARNING-TO-WRITE IN SWEDISH AND ENGLISH**

Adaptation to European education also means that writing tends to start with interventions in Swedish and, by the end of the three- year and five-year programmes, writing is also done in English. Initially, the assignments are restricted to smaller course projects; whereas, towards the third year and onwards, projects might involve BSc theses or MSc theses or other similarly demanding writing projects.

Our interventions vary in character. At times they are little more than a sequence of two or three courses in a three-year programme employing a rather superficial approach to writing that focuses on reporting and proficiency. Such designs give rise to a subsequent imbalance between learning-to-write activities and writing-to-learn activities. Increasingly, however, we are also fortunate to work with programmes where there are opportunities and conditions to integrate language and content more closely.

In such embedded contexts it is easier to promote a view of disciplinary language practice as informing the negotiation of and engagement with knowledge formation and hence learning. In these educational settings, our work with generic and transferable outcomes therefore becomes situated in a learning paradigm where the individual student needs to be able to access and contribute to a specific engineering discipline. Therefore, many of our courses and interventions are informed by basic CARS-applications (Swales, 1990; Swales & Feak 2004); by a peer learning framework (Boud, Cohen & Sampson, 2001); and by an effort to move beyond instrumental notions of literacy (Barrie, 2007; Lea & Street, 1998).

## **TWO ENGINEERING PROGRAMMES AT CHALMERS AND THEIR WRITING INTERVENTIONS**

In this profile, we have chosen to focus the examples of our activities around the two main types of integration and progression that we have been able to promote. The five-year programmes with their integration into courses and the three-year programmes that are set up more around collaboration between separate courses. The three-year programmes are often very good; the student

writing experience progresses well throughout the three years, even it is often communicated by us in our courses rather than primarily by the programme-specific faculty in their courses. However, since our efforts in three-year programmes have been profiled elsewhere (Ericsson & Gustafsson, 2008), we provide more description here of two of the five-year programmes.

Two interesting programmes to look at are mechanical engineering and civil engineering. These two programmes are relevant to our profile because they exemplify how we integrate activities inside “content courses” and work with faculty more, or in different ways, than we do in most three-year programmes. Both the programmes have also run educational development projects that have involved faculty from the Centre. The educational development project for mechanical engineering started in the 1990s with their commitment to the Conceive, Develop, Implement, and Operate (CDIO) initiative and involved reviewing the entire programme with all teaching faculty (Malmqvist et al, 2010). More than anything, the CDIO-effort has led to faculty being more involved with and aware of the communication dimension and the integrated learning we help design. In a similar manner, the educational development project for the civil engineering teaching faculty involved colleagues from the Centre who worked with programme faculty on course design of language and communication interventions

In both programmes, the actual interventions for the engineering students and the faculty are all connected to courses where students do projects. In their first year of mechanical engineering, we are involved in the planning and running of the course “Introduction to Mechanical Engineering,” where groups of students work in Swedish to write up a design project. The course manager is a mechanical engineering professor and works with a team of faculty on the course including two colleagues from our Centre. After the initial planning stage, our work is primarily oriented towards students rather than faculty and involves setting up a peer review process and responding on second versions of reports. The first-year intervention for civil engineering focuses on an introductory course called “Building in Society,” involving a large number of representatives from the department’s various interests. The writing component is almost entirely oriented towards the written (and oral) presentation of the project they do in this survey type of course. The reports and presentations are presented to faculty from the department and from the Centre. Planning, supervision, and assessment are shared between us and civil engineering faculty throughout the intervention.

In the second year of the mechanical engineering programme, we are involved in a more demanding design project, and the course manager similarly works with a team of faculty and us. In this project, we do more work with

faculty in providing joint feedback to students as well as sharing the assessment of oral project presentations. A specific effort has been to develop assessment criteria together with faculty; these criteria are used by faculty in summative assessment, as well as by students in formative assessment, where we scaffold a peer response workshop for the students.

In collaboration and discussion with the faculty, we decide the guidelines and requirements for the reports to be written by the students. For the civil engineering programme, the project is part of an advanced course in “Building Economy and Organization,” and the project students do is a larger component of the writing-oriented course. Our work is very similar to the first-year intervention, including having jointly established criteria and assessment design. The decisive difference is that the stakes are higher in the second-year course; the requirements are more demanding, with an explicit emphasis on critical reading and argumentation.

Apart from the actual integration with content, the important faculty work in both these programmes is the co-assessment of reports or the design of criteria as well as reflection tasks for the various assignments. A possible disadvantage with these programmes is the similarity of tasks for the students across the two years. They do not face many different genres and text types, but they develop a firm sense of what counts as engineering communication in their respective disciplines.

Another problem with writing at Chalmers that these programmes exemplify is that while they are well designed for the first three years and there are integrated and often progressively more demanding interventions, there is hardly any corresponding work at the MSc-level. Needless to say, there are some very ambitious and professional course managers, but the Centre is rarely involved. Instead, our activities at the MSc-level are currently focused on providing six elective courses; these range from proficiency courses to advanced level technical communication courses.

## THE BSC THESIS

For both these programmes, one factor that drives development is the recent new design of the BSc thesis in European higher education. As of 2007, all third year students have to write a 10-week credit (15 ECTS credits) individually-graded thesis. The key features involve projects advertised by supervisors and open to students from more than one programme, so we have cross-disciplinary project teams of up to six engineering students and shared writing and assessment guidelines across all disciplines. The Centre for Language and Commu-

nication has been integral to the design and development of this BSc thesis intervention and provides a seminar for supervisors across campus—writing guidelines, assessment criteria, and tutorials as well as lectures for students. All of this has been developed with the group of programme managers for the five-year engineering programmes. Our third intervention, then, for many of the engineering programmes is the scaffolding of the written documentation as well as the written and oral presentation of their BSc-thesis projects.

## **INCREASING FACULTY WORK AND OTHER SIGNS OF SUCCESSFUL PROGRAMME DEVELOPMENT**

The requirement for a campus-wide, cross-disciplinary bachelor's thesis thus provides an opportunity to promote writing in all programmes and work towards more careful design of the writing interventions leading up to the BSc thesis. Thus, it is in the BSc thesis intervention that we see how the small but integrated courses we do in years one and two generate a good foundation. We also see how writing cultures differ between departments, and to some extent we have been able to adapt our activities accordingly.

So, for example, one of our successes is that three chemistry-related programmes contacted us to set up preparatory activities in the first year. Predictably, the Centre provides scaffolding for the first project report the students write in the first year by initiating a peer response process and a more deliberate writing process. The decisive difference with this intervention is that with these programmes we have designed a continuous annual fall seminar with PhD TAs who supervise the first writing efforts of the engineering students. The seminar focuses on how to integrate writing into the lab and how to promote learning as well as a shared instructional orientation among lab assistants during year one. While we do not yet see many of these PhDs as course managers or thesis supervisors, we do still see how a writing culture around the first-year chemistry students is beginning to form.

Another success we have been seeing is our being invited into other programmes to enhance the programme rather than just provide writing support. We see such examples in the Architecture and Technology programme (Swedish only) and in the most recent of Chalmers' three-year programmes—Economy and Production (Swedish only). In this programme, we do a short introductory intervention in the fall term of the first year and continue with a "course" in the second year that on the one hand integrates with a previous course and completes the documentation and presentation of an argumentative economic analysis industry case. More significantly, this second-year course also inte-

grates seminar assignments and activities with a mathematical statistical analysis course. Here we get involved with assignments that focus less on learning-to-write and much more on enhancing learning with writing. The fact that programme and course managers are now also interested in such assignments makes our work more meaningful.

## **THE SHIFT TO TEACHING MSc PROGRAMMES IN ENGLISH**

Much as the dean's decision to focus the BSc thesis assessment heavily on the written presentation affected the institution and us profoundly, a subsequent decision has been even more influential. In 2005, management decided that by fall 2007, all MSc-programmes would be delivered in English, to align more effectively with the European higher education arena and global education. Many education development projects have been initiated and some completed (Chalmers, 2010c). Our activities have been two-pronged. We were fortunate enough to be able to design and deliver "teaching in English" courses to faculty (Gustafsson & Räisänen, 2007). These courses are still in the staff development offer to faculty. For students, in view of our difficulties of establishing a sufficient number of integrated interventions at the MSc level, we decided to open Chalmers Open Communication Studio (CHOCS) (Chalmers, 2010d). CHOCS is a peer tutored writing-in-the-disciplines writing centre. It is a two-campus studio, staffing 8-10 student tutors from the engineering disciplines and catering primarily to students at the MSc-level.

In past years we have been focusing largely on students; however, we have also been able to increase our work with faculty and consider that one of our successes. Our meetings with BSc-thesis supervisors show us how their focus is initially often and justifiably on the documentation of the project and the accountability of the members in the projects. With a discussion of ways of enhancing learning through writing, they seem ready also to make more informed use of writing during the process leading up to the final presentation. Similarly, with the faculty we meet in our courses for "teaching in English," where we see an initial and necessary focus on proficiency, we see that gradually it also becomes rewarding to them to discuss issues like information structure, genre awareness, and actual critical reading. Such seminars tend to result in more enthusiastic supervisors, who see the strength of a communication-oriented approach and generate new integrated interventions or, at the very least, articulate better assignments that include using the writing centre—CHOCS—to scaffold the writing process and help promote writing-enhanced learning. As of 2010 we are also integral to a



university-wide effort to promote high quality learning through constructive alignment (Chalmers Learning Centre, 2010), which offers additional venues for working with faculty to enhance learning with writing.

## **STUDENTS' VIEWS OF WRITING IN THE DISCIPLINES AT CHALMERS**

For this section of the profile we summarize student comments to represent the student perspective. We show how students perceive the writing interventions they face and show to some extent how we have responded to the student feedback. This summary also allows us some room to articulate what happens at the MSc-level, where the writing interventions are less structured or not as explicitly designed by us at the Center for Language and Communication.

It comes as no surprise that many students in the civil and mechanical engineering programmes (described above) comment on the first-year writing experience as a useful one. Basically, this first-year writing intervention is seen, appropriately, as an introduction to the discipline focused on the writing of a report. Since writing reports is something engineers do very often, this first course, which includes many lectures about how to structure and formulate and formalize the written word, is greatly appreciated. While the two programmes described here do offer interventions also in year two, with a design for progression and greater complexity in the writing assignments, not all programmes do that yet or not all students experience the second year writing as different in terms of character or complexity. So, for some students, it is not until the writing of the BSc thesis near the end of year three that report writing is advanced to a significantly higher level. That is due to the mandatory meetings with the Center for Language and Communication, where feedback is provided in a professional manner.

Interestingly, when students have noted to us or to their programme managers the lack of year-two attention to writing, we can begin to address it in the various year-two interventions. The current second year interventions in various programmes exemplify different ways of bridging that gap. Such progression is crucial to developing writing ability even more before arriving at the BSc thesis intervention.

## **WRITING INSTRUCTION AT THE MSC LEVEL**

Entering into the MSc level, where English is most often a second or sometimes a third language among student peers, most students find the first se-

mester quite frustrating. For instance, in addition to having to cope with compulsory writing assignments, which sometimes lack clear purposes or contain misaligned intentions, students who have been through the first three years and the writing interventions in them have to be “teachers” for those who have not had the privilege to study English in the context of basic sentence structuring and paragraphing. Such courses are available among the electives for the third-year students in the many engineering programmes before entering the MSc. Increasingly, we are beginning to hear students in their MSc-courses suggest that these currently elective communication courses should be made mandatory to all students at the MSc-level. Furthermore, the progression in the writing assignments at the MSc-level include genres other than reports; thus, mandatory writing interventions preparing students for genres like essays and articles make perfect sense as students are introduced to entirely new activity systems.

After the first semester is completed, there are some indications that convergence in both the oral and written proficiencies has occurred. However, it is all too often the case that the student “teachers” still end up as project managers and editors on written group assignments to maintain coherence and structure. Sadly, some students express a new sense of frustration, as they see how their personal development as writers is hampered due to the failure—at programme level—to increase the written proficiency level and requirements while adjusting to the heterogeneous student body. So, in an idealized MSc programme, we need, on the one hand, higher entry-level standards for communication and, on the other hand, a more structured scaffolding of the written progression for the various categories of students. The third need to address at a more consistent level, according to many students, is for the lecturers to be trained to design, give feedback to, and assess the increasingly more demanding and complex communication assignments at the MSc-level. If lecturers cannot keep up with the level required of students, awkwardness would surely arise that would not foster progression in the subject at hand nor in technical communication.

## CONCLUDING REMARKS

From this brief profile it seems possible to say that designing a multi-disciplinary, multi-interventions, and engineering-education-specific writing programme for the first three years of undergraduate studies in Swedish higher education can be done successfully. The target of arriving at the third-year spring term prepared to take on the BSc thesis project in terms of its communication dimension is a feasible one that generates effective interventions in the first

three years. These interventions prepare students well not only for the BSc thesis, but also for the writing at the MSc-level.

At the MSc-level, however, we have not been equally successful in our efforts to integrate the necessary writing interventions and find ourselves relying largely on electives and on the writing centre. Our intention, therefore, is to increase our work with faculty, for which we are in a good position. Our courses for “teaching in English” provide a natural meeting ground to discuss ways of enhancing learning at the MSc-level.

The main challenge right now appears to be addressing the heterogeneous student body at the MSc-level in terms of writing development and technical communication. We want the students who have been through the first three years at Chalmers to maintain their developmental momentum for writing competence. Our second challenge is to reach a larger number of the faculty at the MSc-level with our courses for “teaching in English” and, therefore, to increase our participation in educational development across Chalmers.

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