

Introducing Global Competence in Swedish Engineering Education

Björn Kjellgren
Department of Learning in Engineering Sciences
KTH Royal Institute of Technology
Stockholm, Sweden
bjoern@kth.se

Elizabeth Keller
Department of Learning in Engineering Sciences
KTH Royal Institute of Technology
Stockholm, Sweden
ekeller@kth.se

Abstract—This innovative practice work-in-progress paper describes a recently launched university-wide initiative to strengthen global competence education at Sweden's largest technical university, KTH Royal Institute of Technology. Current engineering education is expected to equip graduates with the skills needed to work effectively and ethically in environments characterized by social and cultural diversity. While this is commonly agreed on, adjusting program curricula to meet this need has proven to be a challenging task. To address this issue in a pragmatic way, KTH decided in 2016 to introduce an extra-curricular Certificate of Global Competence as a non-intrusive way of complementing existing programs. The certificate is made up of two courses and an international experience. This initiative has been designed to not only help students develop global competence but also to encourage and ensure quality in international mobility. As the certificate courses are elective for all programs at the university, students are presented with an opportunity to work closely together with people from different programs and backgrounds. This fosters cross-disciplinary understanding and encourages internationalization at home. The novelty of the certificate—nothing like it existed at any Swedish university—created uncertainty at the top management level. Even though one of the advantages of the certificate was the fact that it would strengthen the university's global competence education while leaving existing programs untouched, the validation process took more than two years. However, the final result, this bottom-up initiative, is now endorsed by top management and part of the university's internationalization endeavors. This paper presents the process of introducing the certificate as well as initial findings from the first courses. It also contains plans to extend the global competence initiative to faculty members in order to make the certificate an integral part of the university's overall internationalization agenda.

Keywords— internationalization, global competence, Swedish engineering education

I. INTRODUCTION: THE EDUCATIONAL CONTEXT

The political and linguistic landscape of Europe have historically confirmed that internationalization and its often times disastrous consequences were never far from the everyday life of Europeans—or from people that the Europeans came into contact with. Internationalization was also, already from its medieval onset, part of university education, both as an ideology and as a practice. The present focus on internationalization of Higher Education in Europe is, however, no older than a few decades. During this time, the original driver for internationalization of HEI (Higher Education

Institutions) was the political will to bring about the EU project's vision of a strongly integrated union whose citizens could identify themselves with, and move more effortlessly within Europe. This led to great importance being placed on student mobility, which remains one of the absolutely most important factors when measuring the level of internationalization of a HEI, together with related indicators such as the number of international (in practice mainly European) study agreements, such as, for example, double or dual degree programs [1].

Although not always explicitly formulated, the underlying idea was—and to a large degree continues to be—that mutual understanding and the ability to communicate, work and function effectively in culturally heterogeneous environments, i.e., global competence, will occur more or less by itself if a person is only exposed to suitable surroundings. This integration-by-proximity has been applied to engineering students in the same way as to immigrants, and made internationalization easily accountable for in terms of structural indicators, e.g., the number of incoming and outgoing exchange students, the percentage of staff or doctoral candidates from other countries, etc. As long as only structural indicators are used to measure internationalization and its supposed benefits, increased mobility also logically appears like the right answer to the call for increased internationalization of HEI [2].

In the past few years the situation has started to change. Among the reasons for this change are the partial realizations of the political vision. At HEIs this was linked to the introduction of a common European model for university education, the Bologna process [3], increased international mobility, which also somewhat blurred the line between studying at an international university and at a foreign one, and the turn away from a primarily politically motivated internationalization towards a multifaceted situation where academic (higher quality) and economic (new funding) rationales matter more.¹

From the university's perspective, the changes have been motivated by both push and pull factors, and increasingly internationalization shifts from being a side project to more of an ever-present dimension of the university as a whole,

¹ The UK was, in the EU context, an exception thanks to its native language of instruction but also to some extent its colonial past, followed the US and Australia earlier than other European countries in taking the economic turn in international education.

something Hahn & Teichler [4] calls the “mainstreaming of internationalization”; a situation related to what Hudzik [5] calls “comprehensive internationalization”. This shift comes together with the reasonable questioning of the often unassessed benefits of international experience (home or abroad) not linked to or supported by dedicated learning activities [6].

As a sign of the zeitgeist, a recent Official report of the Swedish government [7], formulates a vision of Swedish higher education where “International understanding and intercultural competence shall constitute an unquestioned and integrated part of education and research.” This is very much in line with KTH’s alignment with the CDIO model [13] for engineering education, where the acquisition of engineering skills needed—among them what may be called global competence—is integrated with the teaching of technical knowledge in the programs. The perceived importance of intercultural competence is clearly part of a global educational trend echoed both in locally formulated visions—e.g., KTH’s development plan—and international strivings such as those of the EU, the OECD (Organisation for Economic Co-operation and Development), and the UN.

II. FROM IDEA TO IMPLEMENTATION

A. Structural and personal factors

Considering contextual factors and educational trends, the introduction of global competence in Swedish engineering education seems almost “overdetermined”, to speak with Althusser [8]. Nevertheless, KTH has relied heavily on the assumed effects of international mobility, which lacks a major-minor system, and professes to be able to deliver all desirable outcomes through the integration of “soft skills” in the program curricula. These facts made the introduction of a dedicated add-on certificate a counterintuitive choice for the university, and there was also nothing comparable being offered at technical universities in Sweden or in any neighboring country. For this reason, and before we move to the details of the certificate and the experience gained from it so far, we should portray the process of introducing the certificate—pitching it to the university, as it were.

Organizational change, according to Kotter [9], should preferably start from a sense of urgency. In our case, there was in fact a widespread sense of urgency among parts of the university’s management and staff, but they had not necessarily shared this feeling with each other, and the structural indicators of internationalization gave no real reason for concern although the balance of students on international mobility was somewhat off, with more incoming than outgoing students. A more urgent concern was felt at the university’s unit of language and communication, a unit dedicated to supporting internationalization and the acquisition of communicative skills.

The unit, small but still unique in its size and scope among the Swedish technical universities, started with French courses in the late 1980s, and grew to deliver an array of courses in Swedish, English, French, Spanish, German, Japanese, and Chinese, as well as skill-focused courses in communication. By 2010, however, the number of students attending courses in foreign language was declining, due both to new university

regulations restricting the students from taking extra university credits and—ironically—to the development of European international education. In the wake of the implementation of the Bologna model, and hoping to attract new (fee-paying) students from outside the EU, increasing numbers of European universities started to offer Master’s courses taught in English. Some institutions, including KTH, were in fact delivering advanced courses almost exclusively in English, seemingly doing away with the students’ need to learn additional languages. For Swedish students looking for more remote international experiences, there were also other English-speaking possibilities, such as Singapore, which besides the appeal of its excellent universities also seemed to offer an “East Asia Light” option; which excluded the need to master any new and difficult language.²

Foreign language studies had traditionally been the most important way to learn about other cultures, but when it appeared as if “the international” was all speaking English, every new country appeared to be more instantly approachable, through the medium of Mid-Atlantic English, and the need to painstakingly learn about cultural codes embedded in local languages seemed superfluous. There was certainly plenty of room for education catering to the needs of these new English-speaking internationalists. In 2013, when KTH announced a major initiative for educational development inspired by the Carl Wieman Science Education Initiative [10], a teacher from the department of language and communication, with a background in China studies and social anthropology, successfully applied to the position of “pedagogical developer” with the explicit aim of looking into what could be done in the area of global competence for KTH’s program students [11]. This was then done in collaboration with two colleagues from the same department, teachers with Japanese and Brazilian-Japanese backgrounds, and both with the same keen interest in intercultural communication.

Two of these three teachers had previously been directly involved in an earlier attempt to give programs a firm international profile at KTH by including language courses and a longer period of studies abroad towards the end of the five-year programs. These programs had been successful in attracting students but had failed miserably in other aspects. One of the main issues was the program director’s inability to make room for language courses, turning these into extra study burdens instead of integrated parts of the programs, but also decreasing the academic flexibility for the students. As it were, students not following any of these programs seemed to miss opportunities for internationalization open to the students following the special programs, while the programs generated much extra administrative work to the university. This first-hand experience of the programs’ difficulties to accommodate new content outside their core subjects, and the students’ need

² Monolingualism has not been a big problem in Sweden for a long time. English became a compulsory subject for secondary school students studying math or natural sciences already in 1849, despite German being the first foreign language for Swedish students until the government decided to switch the order of those two languages in 1939. Today, most students start studying English at the age of 7, and a second foreign language (Spanish being the most popular these days) at the age of 12.

for flexibility and individual choices, were important points of reference for the process of designing the certificate program.

B. Selling KTH's Certificate of Global Competence to KTH

KTH proved to be a typical example of Swedish organizational culture, with much stress on consensus and a relatively short distance between the “teacher on the floor” and the university’s top management group. The model was first processed in a small consultative group consisting of a pedagogical developer, the vice dean of faculty, the head of international relations, and two student representatives. The proposal was then presented to no fewer than eight committees at the university, representing KTH’s program directors, the schools’ directors of first and second cycle education, faculty members, and administrative staff. The proposal was also discussed with colleagues from other Swedish universities at a national conference for engineering education [12]. When pitching the idea to the university, stress was put on the benefits both for the university and for its students:

a) Benefits for the university

- attract students to more rewarding foreign studies and increase internationalization activities
- increase quality review and quality assurance for studies abroad
- provide current education programs with a complete model to be introduced without having to change their educational plans
- strengthen the university’s international profile and broaden recruitment of new groups of students
- support and encourage successful meetings between domestic and international students.

b) Benefits for students

- utilize an attractive and flexible model that offers an official certificate
- facilitate the students’ studies of global skills
- acquire global competence while at university
- enhancing their employability
- strengthen their further developing of global competence after graduation.

There were in the end mainly two reasons for the university’s hesitation in approving the certificate: the proposal was not in line with the CDIO’s integrated learning model [13] of which KTH was one of the four original developers, and there were no precedents for such certificate, neither at KTH nor at any other Swedish technical university. The initiative as such was, however, highly welcomed—it seemed like there was much to gain and little to lose. After a consultation process of more than two years, the failure of the “international programs”, the unbalanced international mobility, and the widespread feeling that the time was right for this kind of initiative, the university finally endorsed the certificate.

C. The Certificate model

KTH’s Certificate of Global Competence (CGC) draws on theory and international examples of best practice, and was designed to be achievable within the different programs’ often highly limited room for elective credits. The CGC is to be issued together with the degree certificates. It consists of three consecutive and compulsory elements, two courses with one international experience in between, to be done in consecutive order:

1. Intercultural Competence, 4.5 ECTS
2. Exchange studies or equivalent
3. Global Competence, 3 ECTS

For the international experience, the time limits were set to 12 weeks or longer for exchange studies, or 8 weeks or longer for minor field studies, degree project, or internship abroad. For international students, the time in Sweden counts. The qualitative difference between having an international experience abroad, and being involved in an “international” experience at home can be argued, but its inclusion was meant to encourage Swedish students to take the opportunity to spend part of their university time abroad, something that, as mentioned previously, was seen as a problem. The motive to issue the certificate only upon graduation was also meant to serve as an encouragement for students to actually finish and collect their degree certificate (many KTH students are lured by job offerings towards the end of their education).

For students on short-term exchange, those who are not planning to study abroad, or the ones who have already studied abroad but still want to improve their global competence, it is possible to only take the course Intercultural Competence, even though they will not be working towards obtaining the certificate. In fact, short-term students will in the future be more encouraged to apply to this course since this will help them get more out of their visit to Sweden while it at the same time will help the university with its efforts towards “internationalization at home”.

Since not all students will go through the full program, it is not designed purely as a before-during-after international experience education. This means knowledge, skills and attitudes are introduced in a way to make them relevant already from the start. Self-reflection, target-setting, and documentation are central to both courses, but the temporal focus differs. In the first course, much focus is put on how the students can develop their competence while still at the university, while the second course looks further into lifelong learning. The certificate does not feature mandatory language training, but the importance of language skills is highlighted in the first course, and language studies are encouraged. A more detailed description of the two courses’ learning outcomes, learning activities and assessment can be found in [14].

III. OUR EXPERIENCE SO FAR

At the time this paper was being written, the Intercultural Competence course had taken place twice—a pilot in the fall term period of the second course is scheduled for the fall of 2018. Altogether there were slightly over 80 students attending the two given course offerings. These had a limited number of

participants and were both full. We used a blended approach with a combination of interactive online lectures and face-to-face meetings in the form of workshops in the classroom. Continuous assessment was done, combining formative and summative assessments. Students were assessed individually and in groups before, during and after the classroom meetings. This was meant to avoid the cramming of content and summative assessment at the end of the course. Work on self-reflection journals were used to help the students increase self-awareness and expand their comfort zones. The course had been designed to systematically work towards:³

- an open and inclusive learning environment
- coaching as opposed to formal educational tools to encourage student-centered learning and enhance motivation
- hands-on tasks and learning by doing to allow new knowledge to be tested in real life already from the start
- flexibility and the inclusion of students as course co-designers based on their continuous evaluation of the course
- continuous feedback and support, from the teacher as well as from peers in smaller groups formed at the first meeting.

Evaluation was done by looking at three components: completion rate; course activity, and course evaluation. Completion rate was high compared to other extracurricular courses KTH offers students. The first course period had a completion rate of 0.97 and we are expecting similar results from the second course. In order to measure the students' learning experience, KTH has used the Learning Experience Questionnaire (LEQ) for a few years as the main tool for course evaluation [11]. The LEQ analyzes students' experiences of courses on three levels: the emotional level (meaningfulness), the cognitive level (comprehensibility), and the instrumental level (manageability). The tool has been used both to compare different occurrences of the same course and as a vital part of course development work. Since students were given ample opportunity to give feedback throughout the course, the response rate of the after-course evaluation may have been negatively affected, but the overall picture from the course surveys as well as from in-course surveys were very positive.

As for the question of whether the introduction of the certificate has started to deliver all the assured benefits, there are no answers at this early stage. However, looking at the benefits for the students, listed previously, we have evidence collected from the first course to support the notion that we are moving towards our goals. Concerning the benefits for the university, the effects of an intervention such as this will need even more time to show. In fact, it will likely not be feasible to assess the effect of this certificate program isolated from other projects. Some of the benefits, e.g., those linked to the quality assurance of studies abroad, should be assessed as part of the work with the certificate program, but the causal relationship to

other benefits will be much harder to establish. Given that internationalization is one of three focus areas for KTH's current president, the measures to support internationalization already in place are likely to be complemented by new ones. In the end, it will be the totality of efforts that will matter, in combination with a host of factors external to the university.

IV. CONSIDERATIONS AND THE WAY FORWARD

Out of KTH's nearly 100 educational programs, students from 27 programs attended the courses, with two programs that already take communicative skills seriously—industrial economy and computer science—were clearly over-represented. The gender ratio also shows that the course has attracted a partial slice of KTH. The university has some 13,000 full time students, of which 33 per cent are women and 67 percent men, whereas this course attracted 61 percent female students. The course clearly attracts students interested in this area of the engineering profession, but a question remains—how successfully the course will attract students that need the course the most.

As noted earlier, the comprehensive integration of the certificate with undergraduate engineering programs, in line with what the CDIO initiative advocates, has not been addressed, but circumvented. The certificate has given the students a viable option to develop important competencies, empower and encourage them to further hone their skills. However, the connections to regular program activities have been left for the programs to make on their own. Raised awareness of global competence among the faculty would probably contribute positively to the long-term project of making comprehensive internationalization a more salient part of the university culture. This knowledge would also help create a positive feedback loop which would inspire even more students to engage with the certificate and with internationalization. In the long run, we should strive to make teachers and program directors keen and able to integrate these skills in the regular courses. For this to happen, the logical next step will be to provide the teaching faculty the same tools that we now offer only to the students. This will most likely be in the form of a dedicated course in teaching and learning in higher education. In the spirit of Scholarship of teaching and learning, we will continue to document and evaluate the certificate and related efforts.

REFERENCES

- [1] H. de Wit, E. Egron-Polak, L. Howard, & F. Hunter. *Internationalisation of higher education*. Brussels: European Parliament, 2015.
- [2] H. Spencer-Oatey, & D. Dauber, "How internationalised is your university? From structural indicators to an agenda for integration." *UKCISA, Occasional Paper*, 2015.
- [3] European Higher Education Area and Bologna Process <<http://www.ehea.info/index.html>> retrieved 09 July 2018.
- [4] K. Hahn & U. Teichler, "Internationalisation mainstreaming in German higher education". In H. Futao, K. Yokoyama, & F. Huang, *Globalization and higher education*. Hiroshima: University of Hiroshima Research Institute for Higher Education, 2015.
- [5] J.K. Hudzik, *Comprehensive internationalization: Institutional pathways to success*. New York: Routledge, 2015.

³ This section of the paper builds on the course analysis made by the course responsible, Björn Kjellgren, and the course teacher, Alena Ipanova.

- [6] K. H. Lou, R.M. Paige & M. Vande Berg, (Eds.), *Student learning abroad: what our students are learning, what they're not, and what we can do about it*. First Edition, 2012.
- [7] Internationaliseringsutredningen, "En strategisk agenda för internationalisering", Stockholm: Regeringskansliet, SOU 2018:3, p.37, 2018
- [8] L. Althusser, *For Marx*. [New ed.] London: Verso, 1990.
- [9] J.P. Kotter, *Why Transformation Efforts Fail*. Harvard Business Review, Reprint No. 95204, 74, 2, 1995.
- [10] C. Wieman, K. Perkins, S. Gilbert, "Transforming Science Education at Large Research Universities: A Case Study in Progress", *Change*, March/April, 7-14, 2010.
- [11] A. Berglund, H. Havtun, H.B. Johansson, A. Jerbrant, M. Andersson, B. Hedin, & B. Kjellgren, "The Pedagogical Developers Initiative – Changing Educational Practices and Strengthening CDIO skills", *Proceedings of the 11th International CDIO Conference*, Chengdu, China, June 8-11, paper 129, 2015.
- [12] B. Kjellgren, C.J. Carlsson, R. Bergman & Å. Carlsson, "Interkulturell kompetens: Vad gör vi för studenterna, och hur bra?" In *Proceedings 5:e Utvecklingskonferensen för Sveriges ingenjörsutbildningar*, 2015.
- [13] E. Crawley & J. Malmqvist & S. Ostlund & R. D. Brodeur. (2007). *Rethinking Engineering Education: The CDIO Approach*. 10.1007/978-3-319-05561-9, 2007
- [14] B. Kjellgren, E. Keller & Y. Takau-Drobin, "Add-on certificate in global competence: A pragmatic answer to a challenging question", In press: *Proceedings of the 14th International CDIO Conference, Kanazawa Institute of Technology*, Kanazawa, Japan, June 28-July 2, 2018.