Teaching international students: The value of having experience from teaching in a foreign country

Glenn Johansson
Department of Industrial Engineering and Management, School of Engineering, Jönköping University, Sweden

Lennart Elmquist
Department of Mechanical Engineering, School of Engineering, Jönköping University, Sweden

ABSTRACT
Engineers, representing key competencies in companies, need to be skilled in acting in global settings and thus engineering students should be prepared to work in international organizations. In this paper we problematize around the complexity of teaching in an international education program with students representing different countries, cultures, languages, education systems and pedagogical experiences. We specifically exemplify with insights gained from teaching two different courses in China and compare with how the courses are taught in Sweden. Two main conclusions are presented. First, teachers that have international classes need to be aware of differences among the students due to their various experiences associated with national culture, different education systems and pedagogic approaches. Secondly, our insights convincingly indicate the importance of having experience from teaching in a foreign country. Therefore universities should continue to strongly encourage teachers to teach abroad to enhance the quality of teaching in international settings. Then teachers can become T-shaped, which conceptually refers to a person that is expert in the (main) pedagogic approaches used in his/her native country, but he/she has also complementary understanding of pedagogic approaches used in other countries.

Keywords – master programs, internationalization, teaching, T-shaped teachers

INTRODUCTION
In today's highly competitive environment where companies do business on global markets, internationalization issues are constantly present [1,2,3]. Representing various key competencies in companies, engineers face global contexts to an increasing degree. Communication with various actors such as customers, suppliers, investors, authorities, etc. in different countries has become central in the engineering activity. In accordance with this trend towards increased internationalization, the CDIO syllabus indicates the need of engineering students to be able to work with international partners at site or in other countries. Furthermore, the engineering workforce itself can be expected to become more mobile leading to that engineers work in other countries than from where they received their education and training. More explicitly the CDIO syllabus [4] states that engineers should develop a global perspective and be prepared to work in international organizations. For example, awareness of impacts on culture and tradition in companies as reflection of national culture is valuable for engineers when working in such organizations [5]. National culture may vary in different dimensions and affect the functioning of groups, problem solving patterns, ways of communication, etc. According to de Moij and Hofstede [6], national cultures can be distinguished in five dimensions: power distance, individualism/collectivism, masculinity/femininity, uncertainty avoidance, and long-/short-term orientation. These dimensions are reflected in peoples' behaviors

and doings. Engineers, working in international contexts, will thus be exposed to differences in these dimensions and need to cope with the differences in the daily operations. As a consequence, the studies at university should raise the engineering students' awareness of cultural differences and prepare for international careers [7]. Without doubt, internationalization is important and thus academic institutions increasingly provide international engineering programs taught in English where students from all over the world meet.

At Jönköping University, Sweden the ambition is to strengthen the profile as a truly international university. Already today, the university is one of the top universities in Sweden regarding international student exchange. Data from 2010 shows that 31 percent of students took part in exchange programmes and studied abroad, whereas the average among universities in Sweden was 17 percent. Incoming students 2011 accounted for 983 individuals, representing 56 different countries. Europeans represented 60,5% of these individuals, but the university also attracts students from other continents. North America is represented with 143 individuals from the U.S. and 185 students come from Asia, including 51 students from China. Students also come from Africa, South America, and Central America.

Taking the starting point in the need of engineers to become more international and the resulting challenge of providing educational settings that support this need, the purpose of this paper is to discuss our experiences as teachers and program directors of two master programs at the School of Engineering at Jönköping University. The programs, which are designed according to the CDIO principles, are *Product Development, specialization in Product Development and Materials Engineering and Production Systems, specialization in Production Development and Management*. Both programs have students from many countries in different parts of the world, including Sweden, Germany, the Netherlands, Greece, France, Italy, Ghana, Brazil, Mexico, Bangladesh, Pakistan, India, China, etc. We specifically exemplify with insights gained from teaching two different courses in China. The courses were given to master students at Changzhou University, China as part of a teacher exchange program with our university.

THE MASTER PROGRAMS

The two master programs are supported by a steering group with representatives from various industrial branches to ensure the industrial relevance. All courses are taught in English. The program *Product Development, specialization in Product Development and Materials Engineering* aims to develop the knowledge and skills that are needed to develop and design advanced products with the use of modern information technology regarding knowledge-management and modeling. It also aims to develop knowledge in applied mechanics, modeling, and simulation in order to optimize product function and performance, material selection, and manufacturing processes. This includes a deeper knowledge concerning technical materials and how they are manufactured, their structural design, properties, and how they can be used in products. An overview of the program and its progression is illustrated in Figure 1. The content of the program relies upon three research fields: Materials and manufacturing, Computer supported engineering design, and Simulation and optimization. Courses related to each of these fields, respectively, are provided in parallel throughout the program with increasing degrees of complexity. The use of computer based methods and simulation tools are extensive in most of the courses, and the program gives an understanding of the theory behind and the practical use of these computer based tools. In most of the courses the students have the opportunity to work in projects.

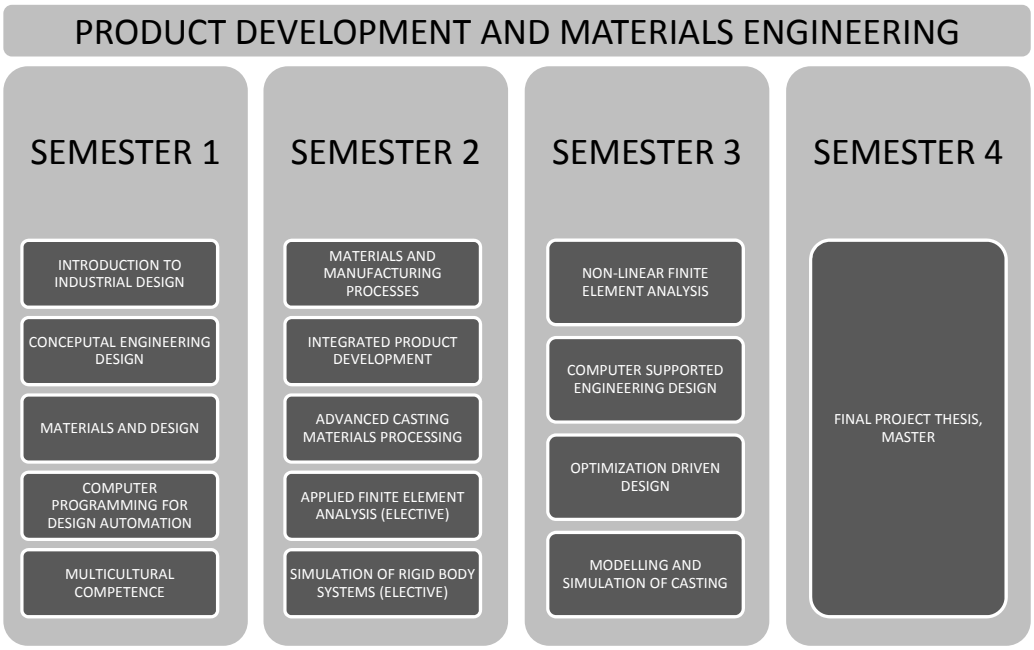

Figure 1. Program overview: *Product development, specialization in Product development and materials engineering*

The Master program in *Production Systems, specialization in Production Development and Management* aims at contributing knowledge and overall understanding about industrial production systems and competitive production. The program develops the knowledge and skills that are needed to organize and manage the design, implementation, start-up, operation, further development and maintenance of industrial production systems. The program structure is shown in Figure 2. The program starts with a few courses that give the students a common point of departure for the following profile courses that address industrial production from two perspectives: development and operation of production systems. The development perspective focuses on the design and development of the production system as well as the possibilities and limitations that are related to the design of products and the supply network. The operation perspective focuses on how materials and information should be planned, monitored and transferred within as well as to and from the production system. The operation perspective also focuses on how the production is organized to achieve efficient and effective production. Moreover, the interaction between technology and humans in the system is addressed.

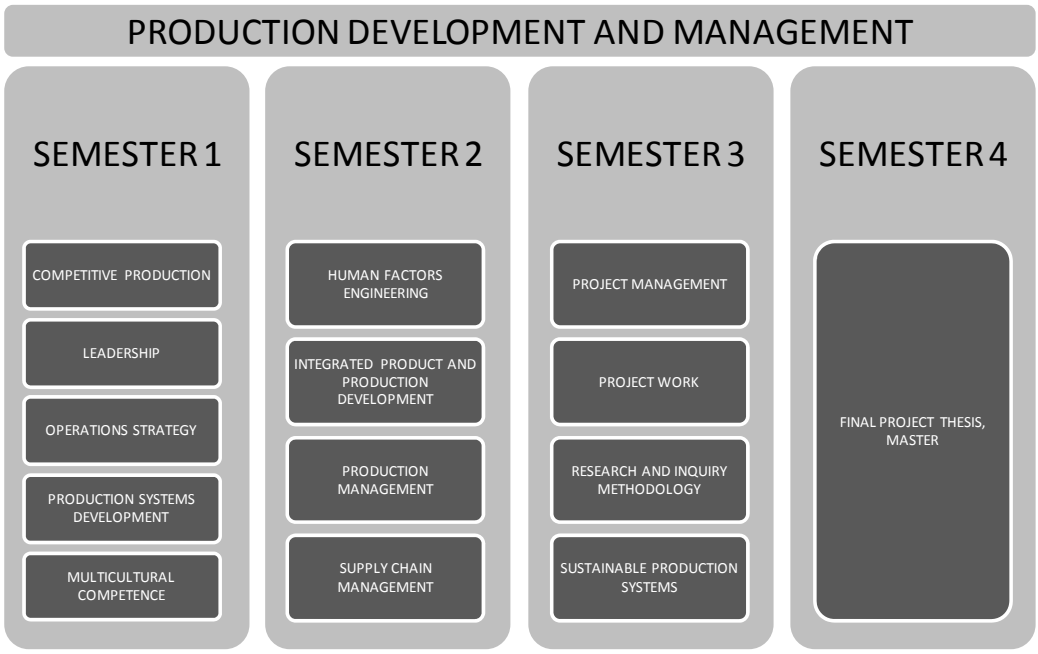

Figure 2. Program overview: *Production Systems, specialization in Production Development and Management*

METHODOLOGICAL CONSIDERATIONS

The insights presented in this paper originate primarily from our own teaching experience during late autumn 2011 as guest teachers at Changzhou University, China. After each teaching occasion we exchanged experiences with each other, which also were documented as written notes. In addition to our documented experiences the students were asked to provide written feedback at the final teaching occasion in our courses. This was done by collecting 'I wish/I like' statements from the students. Each student was asked to individually write short statements regarding what they liked about the courses and what improvements they suggest. These statements were then collected and compiled into a list of statements. The written feedback from the students was also complemented by informal discussions with the students about how teaching normally is carried out at their university and how they experienced our teaching approach in comparison. Directly after these discussions we documented the students' information as written notes.

In addition to our data collection in China, we also carried out an in-depth interview with a student from Changzhou University who spent time as an exchange student at the School of Engineering during spring 2012. The open-ended, semi-structured interview followed a predefined interview guide and lasted approximately 60 minutes. The interview, which was audio recorded, provided us with complementary insights into the differences in terms of teaching styles from a student perspective.

THE COURSES AND HOW THEY ARE TAUGHT IN SWEDEN

Two courses, one from each program, were taught at Changzhou University during late autumn 2011. From the program *Product Development, specialization in Product Development and Materials Engineering* the course 'Advanced casting materials processing' was taught. The aim of this course is to give the students' knowledge about

metallic materials and how their microstructure is developed during solidification, and its relation to mechanical properties. The course focuses on cast and heat treated materials. The objective is to optimize the material performance and design in engineering applications. An introduction to advanced software, experimental methods, and microscopy to explore material characteristics is discussed.

The Learning Outcomes are:
On completion of the course, the student should

- have an understanding how material properties depends on its microstructure
- have an understanding about the processing of cast materials, and their properties
- be able to make optimal selection of alloy, design and casting process for advanced components
- be able to investigate a metallic material from different perspectives and be able to discuss with a material expert about possible developments and alloy selection.

In Sweden, the course contains lectures, given by four different teachers, each one expert on a special cast material. Three home assignments are handed out during the course, and the students are given one week to solve the problems. The solutions are handed in individually, and evaluated by the course coordinator. The course includes also a small project, related to a material characterization problem. The project is part of the laboratory work that is done in the course. The project as well as the laboratory work is summarized in a report and presented at a project seminar at the end of the course. The students work in groups of 3-4 students. The laboratory work is based on three different topics with varying degree of hands-on activity:

- Mechanical and physical properties: a demonstration showing the principles behind the measurements of physical and mechanical properties in cast materials. Contains a lecture about the principles behind the different techniques and a demonstration showing the different methods and equipments.
- Microstructure and chemical composition: the students work in groups of two with a Scanning Electron Microscope (SEM). First they get an introduction to the microscope and how to use it. This is followed by their own work using the SEM, monitored by an instructor.
- Casting simulation: a computer session where a commercial casting simulation software is introduced followed by own work using the software.

During the lectures, the students normally interrupt and ask questions, or if they do not understand, ask the teacher to explain once again. The teachers also put some questions to the students in order to start discussions. Discussions are promoted and the lectures are very interactive. Sometimes the class is divided into smaller groups and the students have to discuss or solve a given task together. Then they present their solution to the other students.

The course taught from the program *Production Systems, specialization in Production Development and Management* was ‘Integrated product and production development’. The course aims at providing the students with knowledge regarding how activities carried out and decisions taken during product development affects the possibilities to achieve efficient and effective production in terms of low costs and high product quality.

The product's environmental performance resulting from the activities and decisions is also addressed. The course, when taught in Sweden, involves three main activities: lectures, literature seminars and a project assignment. Lectures are given in the traditional way, whereas the seminars are carried out as follows:

1. All participants must read the articles before the seminar
2. The teacher hands out questions that are to be discussed in groups during the seminar
3. The groups discuss the questions and, preferably, raise other interesting issues/questions that also can be discussed.
4. Each group summarizes and shortly presents the outcome of the discussions for the whole class.

The project assignment originates from a research project, addressing Interfaces in industrial processes, carried out at the School of Engineering together with another Swedish university. Based on extensive case descriptions of two industrial projects developed in the research project, the students are assigned the task to analyze the projects primarily concerning the challenges in the interface between product development and production. More precisely, the project assignment includes the following tasks:

1. Identify and describe the challenges that the project faced concerning the interfaces between product development and production. The challenges for the interface shall be described and categorized if possible.
2. Analyze how these challenges may affect production. Before the analysis can be done, production performance must be defined. Then the description should present how the different challenges affect the production performance.
3. Present recommendations for how the challenges can be managed in order to achieve high production performance. A thorough literature review must be carried out in order to identify recommendations.

The project assignment is carried out in groups. In order to carry out the assignment, the group has to plan the project and define more precisely how the assignment will be approached. The assignment must be carried out based on the information found in the case report. The analysis and recommendations must be firmly based on existing scientific literature. The project assignment should be presented in a written report as well as orally at a mandatory seminar.

EXPERIENCES FROM TEACHING IN CHINA

The reason for teaching in China is that Changzhou University since April 2011 is a partner university to the School of Engineering, Jönköping University. As part of the agreement between the universities, students as well as teachers should participate in an exchange program. Our visit at Changzhou University was the first part of this agreement, and we stayed at the university for three weeks. Following the exchange agreement, two students from Changzhou University have been studying at School of Engineering, Jönköping University during spring 2012. Moreover, a teacher from Changzhou University will later visit the School of Engineering, Jönköping University.

Findings from the teaching occasions

According to the students at Changzhou University, our two courses were the first engineering courses taught in English at the university. It was also the first time that

foreign, non-Chinese teachers provided a course. The course ‘Advanced casting materials processing’ only contained the lectures when taught in China. There are several reasons to that, among others, the time was too short and necessary equipment was not available. The shorter time also led to some fewer lectures. In Sweden many physical examples and demonstrators are shown during the lectures, but this was not possible in China. Discussions and group work during the lectures were tried early in the course, but abandoned due to some difficulties experienced. One of the difficulties was clearly related to language issues. Even if some of the students would like to discuss and talk with the teachers, they were not comfortable with the English language. The language barrier also became evident when students were asked to present their solutions to a minor home task. The teacher found it impossible to get the students to present their solution voluntarily, but even when randomly selecting students it was difficult to get an answer. In the same situation, the Swedish students are often eager to get attention and to present their solutions.

The other course, ‘Integrated product and production development’, was also taught via lectures. Due to the lack of English skills among many of the students, using literature seminars based on academic articles written in English was not feasible. This was also the situation with the project assignment, which is based on a case description written in English which the students are expected to use for their analysis. However, during the lectures the teacher requested the students to become actively involved through a number of group discussions (see figure 3 for an example).

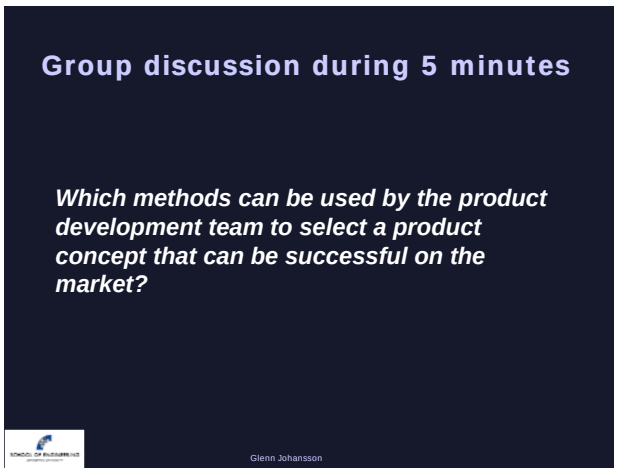

Figure 3. Example of a group discussion question.

The experience from these group discussions was that some students, but not all, engaged in the discussions. However, no one in the groups volunteered to provide the outcome from the discussions for the class and the teacher. Actually, the teacher had to appoint a person to share the results of the discussions. The unwillingness to share the results from the discussion can certainly be associated with the lack of English skills, but another reason was found during the informal discussions with the students. These discussions revealed that the students were not used to take initiatives to voluntarily present their results. Rather, as explained by the students, they expected the teacher to appoint a person to present the results. Thus, this was a clear difference in the teaching situation for the teacher who initially was not aware of this. So after the first attempts to receive input from the students regarding the group discussion questions posed, where

not such input was provided by the students, the teacher started to appoint individuals to represent their group and present the outcome of the discussions.

Findings from the collection of ''I wish/I like'-statements

At the final lecture, 'I wish/I like'-statements were collected from the students and 73 out of the 120 students provided such statements. Among the students, some statements appeared to be shared across many individuals. Several students mentioned that their English language skills was an obstacle during the courses, even though a number of the students mentioned that being taught in English was as a positive part of the course as it provided an opportunity to listen to and practice their English. Still, many students thought a common problem was that we spoke too fast but they did not dare to tell us.

> *"Although I'm not good at English listening and speaking, I like you course very much"*
>
> *"I wish you can have more lectures so that I'll improve my English a large"*
>
> *"I think you have helped my English"*
>
> *"Sometime I can't understand what the teacher say, so I wish the teacher speak slowly"*

Most of the comments concerned our teaching style, which displayed differences with what the students were used to.

> *"I like teachers attitude for students"*
>
> *"I like the course you teach us, and your teaching ways"*

Interesting is also that several students mention that they would like to communicate much more with us. This shows that even though facing some problems with the language they would like to participate more actively during the lectures and practice their English.

> *"I wish that teacher and students should have more communication in the class"*
>
> *"I wish that you can have much more communication with us during the course and let's talk with each other more"*

The following two examples are 'I wish/I like'-statements from two students, but they cover pretty much the general opinion.

> *"I wish I could interact with you better*
> *I like your class very much though sometimes I can't understand you very well because of my poor English"*
>
> *"Firstly, I really like the way you teach us, which is relaxing. Secondly, I wish you could speak Chinese. Thirdly, I wish you could communicate with us after class"*

Another recurring comment is regarding practical contents in the course. This is of course not a surprise to us as we had to remove such parts. However, these comments are important as they indicate the necessity to combine theoretical and practical moments in a course like this.

> *"I'd like to make an experiment by myself"*
>
> *"I wish we can take part in the practice"*
>
> *"I wish you can give some experiment about what you have taught in class. So we can learn more about what is going on"*

Findings from the student interview

The interview with the student from Changzhou university, who spent time as an exchange student at the School of Engineering during spring 2012, confirmed our experience from teaching in China as well as many of the 'I wish/I like'-statements from the Chinese students. According to the interviewee, the teaching style at his university often reflects a pedagogic approach were the teachers give lectures and the students are expected to listen and be able to recapitulate the information provided during the lectures. Actually, the students view themselves as pupils who are expected to 'listen and learn' from the teachers. Thus, the interaction with the teacher is not extensive. Furthermore, the learning style is mostly focused on facts rather than the problem-solving skills that requires analysis. Or as stated by the interviewee:

> *"We only listen to the teacher to get some knowledge about this area"*

The interviewee also identified differences in the relationship between the teacher and student. In China, the relationship between the student and the teachers is of a more formal character, whereas in Sweden the Chinese student experienced that the teacher-student relationship is often more informal though this does not mirror a situation where the relationship does not include respect. The interviewee also mentioned that many Chinese students are not so skilled in English.

THE T-SHAPED TEACHER CONCEPT

In a previous paper presented at the CDIO conference 2011 in Copenhagen, a paper discussed the concept of T-shaped professionals, i.e. people that have interdisciplinary capability [8]. T-shaped professionals are attractive in projects related to product development in the industry and their capabilities will be more requested in the future. These skills are also related to international aspects [9]. T-shaped professionals are well prepared for working in project groups where they together will create tacit knowledge, which is more than the additive knowledge.

Teachers must be aware of potential challenges related to teaching students from many diverse countries and cultures, because the students have different experiences regarding the pedagogic approaches. As teachers, we are supposed to train and prepare students to become T-shaped professionals. However, in order to do that, teachers also need to be T-shaped. We suggest that a T-shaped teacher conceptually refers to a person that is expert in the (main) pedagogic approaches used in his/her native country, but he/she has also complementary understanding of pedagogic approaches used in other countries. For example, in some countries group work and reflective literature seminars are key ingredients of the pedagogic approach. In other

countries, more reproductive learning styles are common [11]. A T-shaped teacher is aware of these potential differences and is able to take the differences into account during the development and performance of the engineering courses. As globalization increases, teachers having T-shaped skills will be better prepared to meet international students. Experience from teaching abroad is therefore a valuable asset when individuals strive towards becoming T-shaped teachers and thus more complete as pedagogues.

DISCUSSION AND CONCLUDING REMARKS

When comparing experiences from teaching Chinese and Swedish students we recognize some differences. First, the skills in the English language differ considerably. In general, Swedish students are rather skilled in English despite it is their second language. For example, many engineering courses at our home university use literature written in English, whereas we found that this is not common at Changzhou University. To have skills in the English language is an important precondition for engineers who want to pursue an international career and has also been reported in a study of Japanese students [10]. Today, there is some support for students who have problems with the English language. However, in order to come around the language barrier, this support should be increased.

Another difference we experienced was that the Chinese students seem to be used to a more disciplined and fact-oriented teaching approach with less interaction with the teacher compared to the Swedish students. That is, the Chinese students are more used to reproductive learning styles [11]. Accordingly, we experienced some difficulties to interact with the Chinese students, not only because of the language barrier but also because the students were not so familiar with a learning style where the teacher poses questions to be discussed among the students. Instead, the students were used to that communication during the lectures goes primarily in one direction, from the teacher to the students, and less so in the other direction. The Chinese students explained that they are not used to have a dialogue with the teachers during the lectures. This became obvious when we tried to start discussions in the class as we usually do when teaching in Sweden. However, the ‘I wish/I like’-statements showed that they are motivated for such a teaching approach and were eager to have more discussions during their lectures. Though they seem to be more familiar with reproductive learning styles, our way of teaching might have provided the students with insights of a pedagogic approach were the students become more involved during the lectures. As a contrast, Swedish students are more used to an environment in the class room where they are active, argue and put questions to the teacher as well as answer questions from the teacher. Therefore, our insights are that when teaching multi-cultural classes we should not expect a quiet student to be less interested or focused, because it can actually be a result of the student’s experience pedagogically (c.f. [7]) and culturally (c.f. [5,6]).

The students also informed that they seldom work in groups, or with different projects. Thus, we found that, according to the students in China, project-based learning [12] is not very common as the pedagogic approach. However, even though we practice that in the courses at our home university we have encountered some problems when teaching multi-cultural classes. One of the prominent reasons seem to be the fact that some of the students lack of experience of that pedagogic approach and thus from working together with people to jointly solve an assignment. Similar findings have been reported by [11], who assert that students arriving to Australia and have English as a second language may have had limited exposure to critical thinking in their previous learning.

That the students possess such thinking is central when a project-based learning pedagogic approach is used. Part of the explanation why students have difficulties to take on project assignments can thus be that the students have different backgrounds and come from different cultures. Therefore, at the School of Engineering, Jönköping University, all master programs include a course in Multicultural competence. This course primarily aims at training national and international students in the basics of intercultural communication that leads to multi-cultural competence. It covers a number of issues, including communication and culture, worldview, ethnocentrism, egocentrism, be a likeable person, avoid stereotyping, cultural values, language and non-verbal communication, the cross-cultural adaptation process, and becoming inter-culturally competent. Still, the students sometimes find it difficult to work collaboratively in projects. However, this might not only be due to different nationalities of experience of pedagogic approaches, but it can also be because of interpersonal reasons. One concern can be related to how the project groups are assembled, where the students often select their group members themselves. An alternative approach could be to use some kind of tools when defining the groups, like for example Myers-Briggs Type Indicator, as described by [13]. In that case it is possible to intentionally put students together with very different background and experiences, in order to train the students in working together. However, such advanced tools are not yet used at the School of Engineering, Jönköping University. A course, such as the Multicultural competence, together with extensive training in project work and active support through feedback, may be used to change attitudes to group work and encourage an active participation in discussions.

Our experience is also that teaching in a foreign country provides valuable insights about the education system and, perhaps more importantly, the pedagogical approaches used in that country. Meeting students in their conventional education context provides an understanding that is very valuable for a teacher in order for him/her to be able to understand and appreciate the different prerequisites of the students when they join an international education program. This experience can also be used to understand and explain why students from different countries and cultures respond differently to the different pedagogic activities within a course. Moreover, such an experience makes it possible to develop and adjust the education program, its courses and the pedagogic approaches to better meet the challenges that are associated with the differences among the students.

Our insights allow us to conclude two main things. First, teachers having international classes need to be aware of differences among the students due to their various experiences from different education systems and pedagogic approaches. For example, when a course includes a project assignment the teacher needs to be aware that all students are not equally familiar with project-based learning (c.f. [12]) Thus, the pedagogic approach require some preparatory work to ensure that all students know what a project is, how it shall be carried out, and what the expected outcome is. Secondly, and most importantly, our insights convincingly indicate the importance of having experience from teaching in a foreign country. The insights we gained by teaching in China would be impossible to get without being present there, teaching a course, and discussing with the students. Thus it is not only important that the students are fostered in an international setting during their studies, it is equally important that the teachers have international experience and develop a genuine understanding for the cultural differences. Therefore universities should strongly continue to encourage teachers to visit and teach at other universities to enhance the quality of teaching in international settings. Then teachers can become T-shaped, which in this paper

conceptually means that they have deep insights in pedagogic approaches used in their native country and complementary understanding of pedagogic approaches used in foreign countries.

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Biographical Information

Glenn Johansson is Associate professor in Technology Management and Economics at the School of Engineering, Jönköping University, Sweden. He leads the research area Industrial Production and is the former program coordinator of the Master program in Production Systems, specialization in Production Development and Management. His research interests include areas such as innovation management, design-manufacturing integration, and sustainable product development and manufacturing. Recent publications have appeared in *Management Research Review*, *International Journal of Production Research*, and *Journal of Cleaner Production*.

Lennart Elmquist is Assistant professor in Materials and Manufacturing at the School of Engineering, Jönköping University, Sweden. He is program coordinator of the Master program in Product Development, specialization in Product Development and Materials Engineering. He is teaching in courses about Materials and manufacturing, and is coordinator for courses on both bachelor and master level, but also for a course to the industry. His research is about casting, especially cast iron. The focus is on solidification and how the solidification structure and defects formed affects the properties of a component. He has recently been appointed responsible for the research concerning material characterization and material modeling.

Corresponding author

Glenn Johansson
Dept. of Industrial Engineering and Management
School of Engineering, Jönköping University
P.O. Box 1026
SE-551 11 Sweden

glenn.johansson@jth.hj.se