

# Systematic course analysis – how infrastructure and research findings collaborate to support course development

*Abstract*—This work-in-progress research-to-practice paper describes how a technical university has worked to build a research-based course evaluation and analysis system into its IT-infrastructure and how it is used for course development.

We report an initial analysis made to see how spread the use of the system is over the university. We investigate the usage and the ownership of course evaluations and discuss different approaches of how the system has been utilized. By analysing the use of the system over the university we explore how the system has been received among faculty and how they make use of research findings in their course development process in a systematic way.

*Keywords*—Course evaluation, development, communities of practice,

## I. INTRODUCTION

Course evaluation and development is a common work task for academics. However, from a teacher's perspective, course evaluations are often viewed upon as a mandatory necessity, and the way they are constructed often give little useful information for a teacher that is interested in course development [1], [2]. Furthermore, the use of student course evaluations have been discussed and criticized not to measure what they aim for [3].

In this paper we present the development of a new approach to course evaluation and analysis with the idea of shifting focus from measurement of student appraisal of courses to acquiring useful data for course development. We will firstly focus on the main “building blocks” and show how we bring research into faculty and course development. Later, usage data for the system's first three years of operation is presented and discussed, and future development plans are highlighted.

### A. A research-based process for development of teaching and learning

Course evaluation and course analysis can be used with several outcomes in mind. Primarily it is used for quality

assurance, but it can also be used for course development as well as identifying needs for faculty development. The approach to include support in the entire part of the evaluation and development process reinforces the ability to enhance a development of teaching and learning grounded in research.

A system developed at our university combines several desired items such as collegial discussion, student involvement, as well as a questionnaire designed to investigate the students' learning environment and that has low threshold for use. Based on Wenger's [4] ideas of communities of practice, teacher's collaboration and a belief that quality enhancement in teaching and learning increases if it is a shared matter between teachers was central in the development of the system. In order to be able to facilitate the meeting and discussions between teachers, a common ground to evaluate a course offering was identified as a possible way forward. By developing a questionnaire based on knowledge and research on factors promoting learning, both experienced as well as inexperienced teachers could contribute to the collegial conversations on equal terms and focus on course development aiming to increase students' conditions to learn.

As a way of lowering the resistance to a new way of working with course evaluation and development, the main parts of the system are integrated in the university's IT infrastructure. By doing so, the faculty was enabled to focus on the analysis and development of the course by minimizing administrative burdens e.g. compiling questionnaire results, and producing statistics. The development was made in collaboration between educational developers and teachers and in accordance with modern agile working methods. One can say that both the structure and the procedures on how evaluation and development are carried out, as well as how the evaluation is made is built on existing knowledge on faculty development as well as on teaching and learning. Using the system in a repeated, cyclic, manner, the system can be used to systematically improve courses based on educational research and knowledge about factors we know support students' learning.

## B. Description of the system

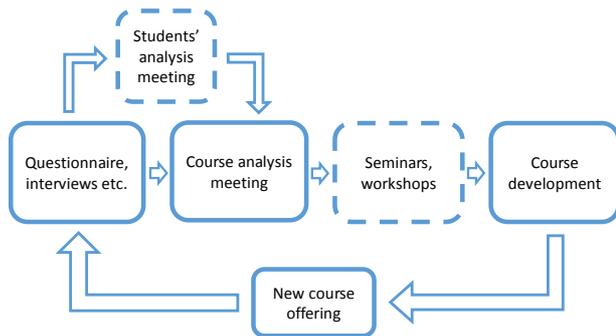


Figure 1: The elements of the course evaluation and analysis process.

The system is depicted in Figure 1. It all starts with a completed course offering being evaluated. To gather data of students' opinion about the course, the questionnaire developed at our university – or other methods – is used. The data gathering process is followed by a course analysis meeting at which exchange of experience and pedagogical ideas between teachers can take place. Usually, these meetings are arranged with 3-5 teachers participating and led by a pedagogical developer or an experienced teacher.

The course analysis meetings both serve as way to help individual faculty members identify areas of professional development by systematically analysing results from the course evaluations, and to identify areas for course development. Once a development need is found, the faculty member can choose to attend workshops offered by the educational development unit at the university. These workshops were developed based on identified needs, and are regularly used also in the pedagogical courses aimed at the university's faculty. The workshops provides opportunities for easily accessible professional development for teachers, and the content of the workshops is of practical nature in connection with presentation of research into learning in higher education. Finally, the teacher implements improvements in the course before the course is offered, and evaluated again in a continuous improvement loop.

Another dimension of the system is that it allows the possibility to also involve students to participate in the analysis and development process. This can be done in two different ways; either the students arrange a separate analysis meeting where they are given the evaluation data to analyse and report back to the teacher responsible for the course, or the students can be invited to participate in the course analysis meetings together with faculty. One can ask why students should take part in the process of identify areas for improvement at all. Our early experience shows that the students often have other views of the need for development and bring new perspectives to the faculty.

The possibility of involving students in the process was implemented in 2016, and how students influence course development has not been investigated yet.

In 2017, the president of the university decided on new regulations on course evaluation and analysis highlighting collegial experience exchange as an important required part.

An important reason behind this decision was the natural way students could be included in the process.

## C. Theoretical background to the questionnaire

### 1) Research-based learning factors

The questionnaire developed and used in the system is a tool for course evaluation and course development that has been developed by teachers and pedagogical developers at the university. It is inspired by course questionnaires at other universities, e.g. the Course Experience Questionnaire [5]. The questionnaire is one way for the students to voice their opinions of a course they just attended, but in this context the primary aim of the questionnaire and the results produced by it, is to contribute to discussion and experience exchange between teachers in the above described process.

The questionnaire investigates the students' perception of their learning environment in a course. It is based on factors that according to evidence-based research showing that we learn more efficiently if these learning factors are in place [6], [7], [8], [9] and [10].

In total, 14 learning factors have been distinguished. As an example, one learning factor is phrased “*A natural learning environment is characterized by the students working with problems that they think are important or exciting, and worth investing time and interest in.*” The corresponding statement in the questionnaire investigating this factor is formulated “*I worked with interesting issues.*” The questionnaire consists of 22 statements designed to probe whether the students agree or disagree to these statement on a 7-grade Likert scale. The 22 statements can be divided into 3 general areas describing the learning environment; meaningfulness, comprehensibility, and manageability. The questionnaire also includes 4 open questions allowing the students to elaborate on the best aspects of the course, possible aspects that could be improved, advice to future students, as well as other comments. The students are also asked to estimate their weekly workload spent on the course.

### 2) How it is used

The course-responsible teacher can set up the questionnaire in less than 5 minutes, and while the questionnaire is open, students that have not yet answered it are automatically sent regular reminders to do so. Once the questionnaire is closed, the students' responses to the statements are averaged and put in a report containing diagrams displaying the different aspects of the learning environment. For each statement, the distribution of responses is shown and the standard deviation is calculated.

Equipped with such a report, the teacher can then attend a course analysis meeting and discuss the evaluation results with fellow faculty members.

## D. Institutional culture and pedagogical development

The institutional climate will effect to what extent development can and will be made and to what extent it will happen individually or in a common and shared community. In this paper we will focus on “units” defined as the organization level formed by clusters of departments at the university. The 10 units described in this paper were already

defined by the organization of the university, all of them in different areas of engineering. According to Biggs and Tang (2011), organizational units can be divided into four levels. The most sophisticated and highest level is described as an organisation where quality enhancement is established as a part of the culture, and where an approach of scholarship and the willingness for collaboration is strong. Roxå and Mårtensson [11] use a socio-cultural starting point when describing different microculture environments at higher education institutions. In order to create a supportive environment with a high level of togetherness, both a high level of trust, and an expression of shared responsibility needs to be present [11].

## II. THE USE AND APPLICATION

The course evaluation and analysis system was officially launched as an integral part of the university's IT infrastructure during the spring semester of 2015. An initial analysis has been done by tracking the use of the system, and data from the first three years (2015-2017) has been analysed. In total, 473 individuals have been using the system for 1 323 course offerings. It could also be seen from the data that 773 unique courses had been using the system, meaning that several courses had been using the system on more than one occasion, and that individual teachers had used the system for several of their courses.

An increase in usage of the system could also be seen from the data; 9.7 %, 14.7 %, and 17.6 % respectively of all courses at the university used the system annually during 2015, 2016, and 2017. Thus, the overall penetration of usage seems limited. However, before the system was officially launched at the university (i.e. during 2014), the questionnaire had been extensively tested in parallel systems by a number of teachers. It is therefore likely that some of these teachers, instead of migrating to the integrated course analysis system continued using the questionnaire in the test environment to evaluate their courses. The number of teachers that did so is not available to the authors at this point in time, but it will be investigated in future.

It is recognized from the data that the system is used by all types of faculty categories (e.g. by assistant, associate, and full professors) including faculty serving in the top management of the university, by teachers in a training or learning position, as well as by educational administrators. It has been observed that the introduction of this system indeed has increased the frequency of spontaneous pedagogical discussions among faculty.

In figure 2, the number of course offerings using the system are shown for the 10 units, for the first three years of operation. It's notable that the system is not spread equally over the whole university. Again, a unit is defined as an organization level formed by clusters of departments. Some units does nearly not use the system at all (J), while other units use the system to a large extent, see figure 2. As the statistical data for unit J is so small, we henceforth omit it in the analysis and discussion.

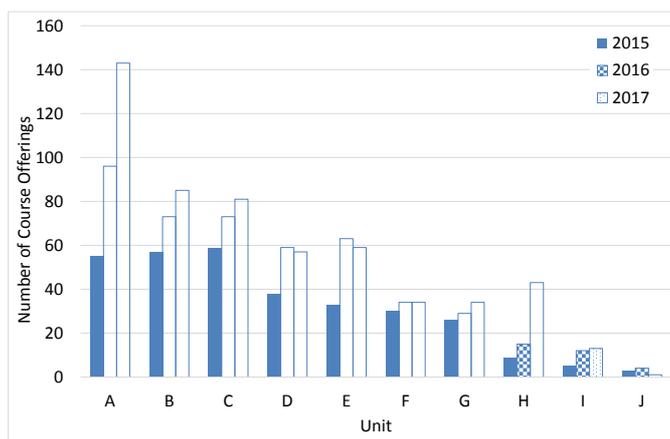


Figure 2: Number of course offerings using the system per unit and year.

From figure 2 it can be seen that all units have increased their use of the system since it was introduced in 2015, even though some units (D and E) experienced a small decrease between 2016 and 2017.

It should however be noted that the units are not equally sized. If we normalize the usage by dividing the number of course offerings using the system with the total number of course offerings for each unit, we get a quite different view of the usage, see Figure 3.

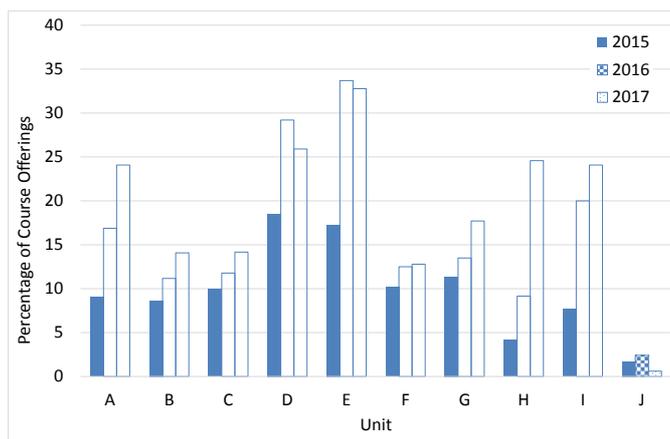


Figure 3: Percentage of course offerings using the system per unit and year.

It should be noted that the number of course offerings varies slightly between years, most often as a result of minor reorganisations within educational programs, or that some courses are only offered biannually. The difference in number of course offerings can be as large as  $\pm 10\%$  between years.

It is interesting to see that the units analysing the largest number of course offerings using the system (units A, B, and C) are not the units having the largest penetration in terms of usage. From figure 3, we see that units D and E have the largest penetration. In these units, there is a deep-rooted engagement in educational development and quality issues that has been present for a long time, and this may explain this finding.

The total number of course offerings at the respective units does not seem to play an important role. In fact, unit I, which by far is the smallest unit at the university, evaluate the same or larger percentage of their courses as the largest units (A, B and C). At this point in time, we can only speculate on the reasons why this is. We believe that a combination of educational leadership, as well as devoted teachers interested in course development can be possible explanations. Another reason may be that it is easier to convince a smaller number of teachers to use a newly developed evaluation system.

Another unit that has had a large increase in both number and percentage of course offerings analysed with the system is unit H, see figure 3. One major reason for this is that a large portion of the courses at the unit has undergone a major revision when it comes to both learning activities, as well as assessment during 2015. It has therefore been important to evaluate these changes, which in turn has led to this increase.

Finally, from the data we can see that the system is utilized differently depending on unit. In some units, one person could be responsible for initiating a large number of questionnaires while for other units, individual teachers are responsible for starting their own questionnaires. From the data we see that for units A, and B, many questionnaires are started by very few persons which are assigned administrative roles at the respective unit. For units C – I, the questionnaires are initiated by course-responsible teachers.

### III. FUTURE STEPS

This work-in-progress report of the on-going development and system integration project is at an early state regarding the analysis of how it is used. The intentions with the introduction of the system were to facilitate opportunities for well-functioning microcultures called [7], [11] and the initial analysis shows an increasing use of the system. With a common and well-grounded approach to course development one can assume the university has a capability to construct microcultures and environments for informal learning with focus on the common task; to deliver, design and develop courses based in deep content knowledge and on factors we know increase students' deep learning. The outcome of the use, and the result of the integration of it, in terms of increased collegiality and actual course development need to be examined more deeply. The data present in this paper enable us to identify cluster of teachers using (and not using) the system in different ways. A qualitative approach in investigation of the use should give us more insight about difficulties and opportunities in adopting the system in the local context. A deeper understanding to the teachers approaches to eth different part of the system enables identification of improvement. Furthermore, we also need to, with a qualitative approach, investigate how it is used and what kind of approaches the teachers have and their understanding of research-based development

From present data one can ask why is the system used in some units but not in others and what approaches to research based development can be identified in the different context..

We do also need to look deeper in to how the teachers take use of all the steps supported by the system. For example, does teachers share their course development work with others, as is suggested in the system, or is it done as an isolated development? And does teachers also take use of the support given to analyse the collected data and what kind of knowledge-enhancing activities are being conducted to enable a change in teaching practice? Another important aspect to investigate is if the course development actually is based on knowledge on factors promoting learning and how other teachers and students perceive these changes. Of interest is also to look deeper in to the student perspective. Does the student role in course development change and what approaches to learning and development does the student bring in to the discussion? The work reported in this paper gives a possibility to identify different categories of environments in which teachers has adopted different approaches of using the system. Next step in the work is a more detailed analyse of the user data and to add user data from the part regarding to make the analysis. A more qualitative approach needs to be used to investigate the results of the integrated system.

### IV. REFERENSES

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