THE PEDAGOGICAL DEVELOPERS INITIATIVE -

CHANGING EDUCATIONAL PRACTICES AND STRENGTHENING CDIO SKILLS

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ABSTRACT

This paper outlines a recently launched initiative with pedagogical developers (PD) acting as local agents of educational change at a major technical university. Traditional educational development are often emphasized either from individual passionate teachers 'on the floor', or from top-down reforms where the university directly, or working through a centralized group of full-time educational developers, seeks to bring about change. This PD initiative strives to educationally empower and enthusiast teachers through the creation of local 'communities of practice', working primarily with pedagogical questions emerging from these communities and their experienced needs. The idea as well as the funding for the initiative, was decided at university top management level, but the PDs receive their legitimacy from their double identity both as teaching faculty as well as educational developers. The PDs also have a strong mandate to cater locally emerging issues, and the outcome has so far been a wide variety of constructive pedagogical projects and plans, largely executed by the teaching faculty. This paper will both describe the initiative in some detail, as well as briefly presenting work and preliminary results from different parts of the university. The paper will also emphasize a more thorough presentation of the Learning Experience Questionnaire (LEQ), a tool for learning environment analysis and a starting point for the pedagogical programme at KTH. The work is also mapped against the CDIO standards and syllabus, and even as the project as a whole was primarily aimed at Standard 10, Enhancement of Faculty Teaching Competence, this mapping shows that the emerging projects fit a whole range of CDIO standards and syllabus. This indicates that the potential strength in pedagogical programme development that allows for by definition unpredictable bottom-up initiatives, while strengthening also cross-disciplinarian understanding within the community of practice created by the pedagogical developers themselves.

KEYWORDS

Faculty development, change agents, pedagogical developer, community of practice

INTRODUCTION

Educational development and methods to enhance increased learning for the students based on scholarly research are areas that have attracted increased attention over the past years (see, e.g., Borrego and Bernhard, 2011; Berglund, 2013; Berglund, Ritzén and Bernhard, 2014). To implement and strengthen the teaching and learning practices among fellow faculty and students, KTH Royal Institute of Technology launched a dedicated pedagogical initiative in early 2014. This initiative has received both national and international attention from peers as it provides an array of different functional ways to enable an inspiring and favorable learning environment, at the same time as it ensures that KTH will continue to offer educational programmes of high pedagogical quality.

One of the first steps initiated within the framework of KTHs pedagogical initiative was the formation of a group of 24 'pedagogical developers' (PDs) with representatives from all of KTH's 10 engineering schools. All of the pedagogical developers are practicing teachers at the university largely engaged in teaching various courses at undergraduate and graduate levels. Some of the pedagogical developers also have roles as programme directors or directors of studies and most have many years' experience in course and programme development. For the single faculty member being an PD means devote between 30-50 % (of full time work) to pedagogical development. Funding for this time is provided mainly by the university centrally, however, some schools also contribute with funding for school-specific projects.

As has been noted in past research (e.g. Lattuca, Terenzini, Volkwein and Peterson, 2006) a set of change agents (e.g., pedagogical developers) at the basic assessment level strengthens possibilities to attain a sustained impact on a programme level. While the aim of the pedagogical programme at KTH is to promote an increase in faculty teaching competence, the pedagogical developers do not have any formal authority to revise or make immediate changes on either programme or course level. However the indirect influence can be substantial if the methods they help develop or introduce can be applied in a way that strengthens a time-efficient work practice. To ensure this the PDs as a group are centrally positioned, but the legitimacy of the the group stem from their institutional and disciplinarian identities; they are in a very concrete sense the faculty's own developers.

The main focus for the pedagogical developers is to facilitate cooperation and knowledge exchange between teachers by establishing communities of practice among KTH's faculty, aligned with CDIO standard 10, Enhancement of Faculty Teaching Competence, (CDIO Standards, 2015). At the same time the pedagogical developers themselves are creating their own community of practice when they meet regularly to discuss issues of common interest and to support each other in the practical work at department level. Through this practice, it is easy to identify potential problems from a bottom-up perspective and to initiate discussions within the group of pedagogical developers about best practices to handle these challenges. This work is supported by the unit for Teaching and Learning in Higher Education at KTH. Each pedagogical developer is also responsible for building up communities of practice at the school level. At most schools, this effort has started by the creation a small group of dedicated teachers focusing on specific projects. Another activity has been to create seminars and workshops around central issues for learning and to both disseminate this to the faculty and actively involve the faculty in discussions about teaching and learning. All these activities support CDIO standard 10.

Initiating pedagogical development with a bottom-up approach several issues relating to other important CDIO aspects (outlined in the CDIO standards) have naturally emerged. This has shown that the activities emerging from the pedagogical developers' initiative are aligned with several other important CDIO aspects outlined in e.g., standards 2 (Learning Outcomes), 8 (Active Learning), 11 (Learning Assessment), and 12 (Programme Evaluation).

COMMUNITIES OF PRACTICE AND LEQ
One of the explicit aims for the pedagogical programme at the university is to create communities of practice among the teachers, focused around pedagogical development of courses and programmes. According to Wenger (2015), communities of practice are "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly". As a basis for discussions among the teachers, the pedagogical developers, together with the unit for Teaching and Learning in Higher Education at KTH, have developed a method to assess the learning environment in the courses. Below the method, abbreviated LEQ is described.

What is LEQ?
LEQ - Learning Experience Questionnaire - is a tool for course evaluation and course development that has been developed by teachers and pedagogical developers at the university inspired by course questionnaires at other universities, e.g. the Course Experience Questionnaire (McInnis et al., 2001). 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 is to create a process among teachers that continuously stimulates experience transfer and contribute to enhance the quality of students' learning.

The process is based on a questionnaire, LEQ, which investigates the students' perception of the learning environment in a course. It is based on factors that according to evidence-based research e.g. Bain (2004), Biggs and Tang (2011), Elmgren and Henriksson (2014), Kember and McNaught (2007), Ramsden (2003), show that we learn more efficiently if we:

- are trying to answer questions, solve problems or acquire skills that we find interesting, intriguing, or important
- are able to do so in a challenging yet supportive environment
- can work collaboratively with other learners struggling with the same problems
- believe that our work will be considered fairly and honestly
- can experiment and explore subjects and receive feedback in advance of, and separate from, any summative judgment of our efforts
- have knowledge of what the learning objectives are, how the environment is organized, and what we are expected to deliver
- believe that the work we are expected to do will help us reach the learning objectives
- believe that we are in control of our own learning process

The questionnaire consists of 22 statements and 4 open questions. The students' responses are averaged and put in a diagram, the LEQ footprint. Using the LEQ footprint, it is possible to map and analyze different aspects of the learning environment. This data can be used as a basis for discussions with other teachers. Comparing the LEQ footprint between courses, it is possible to identify common needs for educational development within a department or a school.

The LEQ process usually involves a group of 4-5 courses where each teacher are responsible for one course. Associated to the group is a pedagogical developer who assists in setting up the LEQ questionnaire and collecting the responses given by the students. The pedagogical developer also plays a key role in the course development meeting held later in the process.

The LEQ process consists of four steps as described below.

Step 1 – Questionnaire
The questionnaire is distributed electronically to the students and consists of 22 statements, and 4 open questions added to probe the general aspects of the course. The questionnaire is opened up in the LMS during the last week of the course and is typically closed two or three

weeks after the final examination. During the time the questionnaire is open, the pedagogical developer or the teacher reminds students to participate in the evaluation through emails.

Step 2 – Questionnaire Report and Teacher's Course Analysis
After the questionnaire has been closed, the pedagogical developer or the teacher will assemble a report containing a graphical representation of the students' responses, a compilation of comments as well as the statistical data from the questionnaire. This report, if assembled by the pedagogical developer is sent to the respective teacher who spends some time analyzing the outcome of the evaluation with a focus on course evaluation for next time. Using the graphical representation of the students' responses, the teacher can identify strengths and possible areas of development in the learning environment of the course. If the report, e.g., identifies a lack of collaboration between students, this means that students' learning may be improved by introducing activities in the course where the students can collaborate. The questionnaire data will hence not answer the question *how* the teacher should develop their course; this is something the teacher need to develop by him or herself based on teaching preferences.

Step 3 – Course Development Meeting
The LEQ process also enables to cooperation with other teachers regarding course development. This is primarily done during a course development meeting where the course evaluations from approximately four courses are discussed. The formation of the group at the course development meeting is done by the pedagogical developer who seeks to select teachers who has courses of the same type, e.g. large undergraduate basic courses, intermediate courses, graduate project based courses. The idea is to gather teachers with similar courses in a group to enhance knowledge exchange.

By focusing on the strengths and development areas in the learning environments the teachers can share experience and exchange ideas on how to develop their courses to increase the students learning, and the course evaluation meetings usually gives rise to ideas for course development for each participating teacher.

Step 4 – Workshops for Teachers
During a course development meeting it may happen that the group identifies common areas of development where there is a common lack of ideas and knowledge among the participating teachers. So in the last phase of the LEQ process it is possible to arrange activities to enhance the knowledge for a group of faculty members by for instance seminars and/or workshops addressing a selected theme. At the university the group of pedagogical developers currently is developing workshops on specific areas of interest identified by the use of LEQs e.g. Formative Feedback, Assessment and Examination Methods, E-learning, Flipped Classroom, Constructive Alignment, Scalable Learning.

Lessons learned
Within the group of authors that has experimented by testing LEQ as a course evaluation tool so far could be summarized as follow:

- Most of the invited teachers participate
- Many appreciate the assistance with setting up the LEQ the first time
- Many participants say they have gained a lot of valuable and unexpected information through the students answers
- There is a great exchange of ideas during the course evaluation meeting
- Many teachers claim they will implement changes

THE WORK OF THE PDs AT KTH's DIFFERENT ENGINEERING SCHOOLS
As mentioned earlier, all pedagogical developers at KTH have three explicit objectives within their specific department:

- To create communities of practice to stimulate dialogues around learning and development of KTH's education.
- To facilitate continuous development of KTH's learning environments to increase the quality of student learning as well as student performance.
- To continuously document the pedagogical development, and the dissemination of the results internally and externally through publications in pedagogical conferences and journals.

In the next section intended activities and some preliminary results of each school at KTH are presented.

The School of Industrial Engineering and Management (ITM)
The School of Industrial Engineering and Management (ITM) involves almost a third of all KTH students in their courses that are provided. The goals set up by the ITM pedagogical developers are:

- Implementation of method and practice on how to improve course and programme analysis
- Review and support revision of course plans
- Develop assessment methods and teaching practices to decrease teacher workload and to create a more efficient learning environment for the students
- Strengthen the use of continuous assessment and formative feedback

To attain these objectives, three main levels are targeted: course, department, and programme. Given that all three levels are connected to each other and by that have both direct and indirect effect on the result at each level. As stated above, one of the key activities has been to establish communities of practice among teaching faculty on department level, with the ambition to also expand influence beyond the department or school. The goals set up from school level is to establish and expand clusters of dedicated teacher practices that connect to the stated focus areas, e.g. course plans and formative feedback.

The group of PDs at ITM-school executed a study trip to Worcester Polytechnical Institute, Stanford University, and MIT (including the MIT-Skolkovo initiative) during the fall of 2014. This study trip was undertaken to gain impressions of best practices in the engineering education field. This study trip also allowed the pedagogical initiatives taken by KTH and the ITM-school to be presented and discussed from an international perspective which meant hands on feedback on ongoing activities.

The LEQ has been implemented and tested on different level in several courses at ITM. In detail, it has been found that certain questionnaire statements work differently at different course levels and in different courses, thus the generic statements have been exposed to numerous iterative improvements.

The PDs at the ITM-school has also arranged workshops on formative feedback with invited guests that opened up a practice oriented approach to change teaching practices at different levels (e.g. student-student and teacher-student) and formats (e.g. classroom, seminar and projects). A matrix has been developed and used to screen present internal practices of how different formats of formative feedback is applied among faculty from a range of background and teaching settings, e.g. classroom, projects or seminars. Revision of course plans has established better correspondence in-between Swedish and English language.

E-learning is also a theme of interest, with the possibility to open up and enable increased efficiency by e.g. teaching time spent (in class and out of class) and re-use of knowledge. As new opportunities gradually expands the number of possibilities, the work is more of a process of continuous improvements than of reaching a specific goal. The goal is rather to

establish a process and set up groups of teachers to work with e-learning improvements. A concretization, for now, is to point out some directions which could be of interest:

- Decrease the time spent on one-way communication and prioritize time spent on two-way communication and improvements.
- Decrease teacher time spent on marking tests.
- Decrease the dependency of time and location.
- Increase the possibilities for students to make diagnostic tests automatically.

Exactly what direction and focus to aim at is not predetermined, rather the degree of engagement, self-interest and genuine passion work as guidance for those that decide to take active part in e-learning. Various aspects of e-learning are practiced in different courses. This also means that there exist certain needs for further development. Without being experts, each areas of sub interest provide a basis for investigation that have the potential to develop strong knowledge coherence in existing sub groups that can be of value for others outside this group. This group also serves as a resource for KTH in implementing changes in its Learning Management Environment system – both in terms of purchasing the right equipment or services, and for in-house development. The expertise in other areas, such as technical platforms or legal issues is still needed.

For the PDs at the ITM-school it is important to ensure that, the time spent on pedagogical development must be saved in the long run by a decreased operating time, in order to achieve a sustainable development process. However there is an Achilles heel, a critical point for the possibilities for success. If the members of the teacher team spend more time than they save it is difficult to motivate participation, even though the potential operating time saved across the entire school could be enormous.

The School of Information and Communication Technology (ICT)
The School of Information and Communication Technology started its first BSc and MSc programmes rather late, in year 2000. Historically, there is still a strong research-oriented culture within the faculty and the two PD at the School of ICT were given quite large freedom to design their own projects and to choose how they would like to work with the faculty regarding pedagogical development.

The fundamental strategy that emerged in the work process for the PDs was to begin by increasing their knowledge on pedagogic research and to ensure that the start-up projects are close to pedagogic research projects involving a small number of motivated colleagues. By this working process the aim has been to create a natural environment for discussing pedagogic and didactic issues as inspired by the Carl Wieman Science Education Initiative (CWSEI, 2015). All projects were designed to either have investigative goals from the beginning or to inspire colleagues to take an investigative approach to educational and pedagogic issues of strategic importance for the School. By this approach, the aim was to use research based methods to obtain sufficient knowledge of both the present status at the School level and about pedagogic research to focus on the major problems that were identified. The findings from these investigations should also be transmitted to the rest of the faculty to serve as a basis for well-grounded peer discussions about how to improve teaching and learning both in specific courses and on programme level. Simultaneously, the School management has been working on setting up an administrative structure that facilitates meaningful discussions for all faculty members.

The projects driven by one of the PDs have so far resulted in the following:

- A research investigation about a peer review module in a course that had worked well as a second step in a writing progression module during engineering studies (relates to several issues in the 3.2 Communication part of the CDIO syllabus). In

collaboration with a pedagogic researcher, a scientific article has been written and the results of this investigation will be presented elsewhere.

- A comparative research-like investigation of student learning in two courses with a similar context (basic physics courses for engineers not having physics as their major subject). The teachers were introduced to important publication within the field (Hestenes 1992, Hake 1998) and were actively involved in the investigation themselves. The LEQ was also introduced as a tool to obtain supplementary information about the learning environment in the courses. The first experience from this work is that it led to very constructive dialogues about the didactics within the field, which seems to be an interesting way to enhance teaching competence within the faculty (CDIO standard 10).
- Find background material and initiate a peer discussion about the first math courses in the BSc programmes at the School. The outcome of this initiative is a collegial development of a relevant questionnaire to learn more about how students change their view about mathematics during their education. This is a small step towards working coherently with programme evaluation (CDIO standard 12).

The School of Education and Communication in Engineering Science (ECE)

KTH's School of Education and Communication in Engineering Science, ECE, is responsible for coordinating the KTH pedagogical programme through its unit for Teaching and Learning in Higher Education, but the school's largest educational branch is the unit for Language and Communication, and this is where the school's PD came from. The PD – an associate professor of Chinese – was set two tasks for the first year. The first was to help his colleagues with a thorough revision and redesigning of the language unit's courses to better fit new and harsher economic control. The second task was to explore ways to systematically encourage students' acquiring of 'global competence' and also to encourage and help enable research into this field of study. Both tasks primarily related to CDIO Standard 2 and CDIO Syllabus Section 3, but also to standards 3, 8, 9, 10 and 11.

The first task took the form of a pedagogical project, Project Lax, involving all teachers at the department. The project, which was executed throughout 2014, included an analysis of KTH's students' learning needs and the learning outcomes of the unit's courses, the adaption of a non-standard grading system with more focus on formative feedback, more active learning activities designed for engineers-to be, alternative ways of assessment and examinations, and increased use of e-learning and computer assisted language technologies, and was characterized by intensive collaborations between the unit's teachers within and across disciplinary lines. Contacts were also made with language units at other technical universities, e.g., Cambridge School of Engineering and TUM in Munich, for exchanges of experiences and ideas.

As creative offshoots from the Lax project, different plans to help enhance the University faculty's competence in language and communicative skills were drafted, as were plans about how to make these skills better integrated in the syllabus of KTHs different programmes.

A challenge for a technical university such as KTH, where undergraduate education is conducted in the country's native language (Swedish in this case) and in English on the postgraduate and doctoral levels, is finding ways to encourage and enable students to acquire also other language skills, as well as the competencies and understanding they will need to be able to work efficiently in a globalised world. In 2015, to help develop a university Certificate of Global Competence, with matching courses and a uniform but flexible design, will be the major task for the PD at the ECE-school.

The School of Electrical Engineering (EES)

At the school of Electrical Engineering (EES), teaching activities represent only 20% of the school's budget. Therefore, most faculties have a strong research focus. Courses are administrated by research units called departments (11 within the school), each unit having specific conditions (number of students) and ways to motivate themselves to different teaching activities. The master and bachelor programmes at the school also orders courses from different departments within and outside the school, with the director of studies of each department being the contact person.

The first task for the schools PD was to interview the 11 directors of studies (1 joint director for 2 departments). The one-hour interview was conducted at each department (PD visiting) with the aim to shortly describe the PD function, and explore how each department organizes their educational efforts, as well as their successes and challenges when doing so. The interviews revealed a large scope of educational challenges at department level, from extremely reduced teaching activities with small courses (10-20 students) to a couple of departments with courses for 100 to 200 students. Many good examples of teaching activities were also listed, together with well-functioning informal teaching teams. A clear weakness was that most directors of studies only had an administrative role, and had rather reduced influence on their colleagues' courses and teaching skills.

From the beginning of the interviews it became quite clear there was a great potential for faculty teaching competence development by stimulating diverse "forums for sharing ideas and best practices" (CDIO #10). For example, the PD engaged in corridor discussions about teaching whenever the occasion rose. The school's yearly convention also dedicated a full day focusing on teaching and learning, and LEQ implementation was started in a small scale under 2014 (basically with the teachers from the "best practice" list). From the autumn, the school also arranges a monthly "Teaching Seminar" to share experiences and meet teaching support wishes expressed by the teachers at the yearly convention. The first two seminars were dedicated to "clicker usage experience at EES" and "flipped classroom" as fitted with the dedicated projects driven at the school by the PD and her support team (GA and e-learning guru of the school Gunnar Karlsson) during the Spring focused on spreading knowledge on active learning to the faculty (CDIO Standard 8).

The school had purchased 100+ clickers a few years ago, these clickers being used by only two courses. Two new compatible sets of clickers were purchased so that teachers willing to try would be able to. Clickers were experienced by the faculty twice (as students would use them), once at the monthly meeting of the directors of study and at the school's yearly convention. 6 new teachers (including the PD) showed interest and received support by the PD in introducing the usage of clickers in their courses. Three mostly positive experiences were reported in short presentations at the first EES teaching seminar followed by a discussion about the challenges. The clickers were also borrowed by the EE student association to organize their yearly election, with a quick "how to do" introduction.

The EES School has had a leading role in e-learning introduction at KTH thanks to Professor Gunnar Karlsson's dedication to the subject. A well-attended seminar had been organized in 2013 and the school has since then had an e-learning open group for interested teachers led by Gunnar. A faculty meeting was dedicated to "scalable learning" in the spring with David Black-Scheffer as a guest. As a next step, at the school convention, the faculty followed a hands-on workshop on how to make videos with the latest acquired tool by KTH, with the task to produce one video per department, corresponding to an elevator pitch to attract students to a chosen course. The second EES teaching seminar was dedicated to the experience of the first EES teacher who totally flipped his course in two development steps.

During 2015, the focus of the PD activities at the EES-school will continue to stimulate forums for sharing ideas and best practices through intensified spreading of LEQ, as well as supporting different teacher groups or individuals when focusing on programme and course development.

The School of Computer Science and Communication (CSC)
At the CSC school the focus has been on CDIO standard 10 - Enhancement of Faculty Teaching Competence. The two major parts has been individual coaching of teachers, and group coaching for master thesis supervisors.

The individual coaching for teachers has been implemented by an pedagogical developer in an informal way. This means that teachers has been offered to discuss problems and solutions in their courses, and also offered limited help in implementing possible solutions. The PD has also many times emphasized that this is not a formal intervention where the university wanted to change the way the courses was implemented, but a voluntary activity for those interested in pedagogical development. In all cases where teachers were approached, the teachers had problems they wished to discuss, and all coaching sessions have resulted in changes in the courses. One example was a teacher who felt students procrastinated too much, and waited until the last moment in studying the content of the course. After a discussion a solution was agreed upon that digital auto-corrected tests would serve this purpose without adding much extra work, something the teacher had thought about for years but not had come around to try to implement. Help was offered in how to construct suitable questions and to get started in implementing the test in KTHs learning management system, and the teacher was happy with the result and would continue to implement the same solution in other courses. Another example was that peer feedback was used in an introductory course in academic writing, but the teacher felt the peer feedback was generally too shallow. After discussions, pointers were given to articles about good feedback and guidelines for the students for how to give feedback were jointly developed and implemented in the course. The intervention resulted in generally better feedback.

The development of group coaching for master thesis supervision was initiated based on two different needs. Partly there was a need identified by the programme management for developing better practices on how to supervise master theses students, and partly there was a need identified by the supervisors themselves, who felt they had too vague ideas for how to supervise students in the best way. The solution was to organize regular coaching meetings for supervisors who stared their supervision at the same time. The structure of the meetings were that supervisors brought possible problems or issues that had emerged since the last meeting and these were discussed with the other supervisors and the pedagogical developer leading the meeting. Resolved issues were documented for future reference, thus building on a documented community of practice. Some issues that could not be resolved in the group were instead discussed with the examiners of the course where the matters were settled and documented. The supervisors also described their personal practice for handling the supervision, thereby spreading ideas to other supervisors.

The School of Architecture and the Built Environment
Apart from the general aims with the pedagogical developer initiative, the School of Architecture and the Built Environment also has strived to provide a more clear structure of the Built Environment programme as well as to ensure progression of CDIO and other skills within the programme. Another focus has been to ensure that the guest lecturers in the Architecture programme are more involved with the educational programme. A third focus area is to refine assessment methods, thereby creating a better learning environment for the students.

Communities of practice have been formed by the pedagogical developers of the school and the LEQ is used to advance pedagogical development in the school's courses. Also the PDs has arranged a workshop in course development and course plans and teaching methods have been revised. Finally E-learning has been incorporated to a greater extent in different courses.

The School of Biotechnology

Apart from the general aims with the pedagogical developer initiative, the School of Biotechnology also strives to ensure progression of CDIO and other skills within its programmes. Another aim is to investigate alternative assessment methods. In particular, continuous assessments as well as formative feedback are being implemented in a few select courses and an investigation on how e-learning can be introduced in the programmes has started. Communities of practice have been formed and the LEQ is used to advance pedagogical development in different courses at the school.

The School of Chemical Science and Engineering

The aims of the pedagogical developers of the school of Chemical Engineering and Science, apart from the general aims with the pedagogical developer initiative, are to implement formative feedback and flipped classroom as teaching methods. Other aims include exploration of E-learning, and to ensure progression in sustainable development as well as mathematics in the courses and programmes in the school. Furthermore, methods of improving students' communication skills are implemented.

Communities of practice have been formed and the LEQ is used to advance pedagogical development in the school's courses. Sustainable development has been implemented in a few courses and progression of sustainable development skills is being monitored.

The School of Engineering Sciences (SCI)

Apart from the general aim with the pedagogical developer initiative, the pedagogic developers have had a focus on improving the quality of education and the teachers' working environment. Another focus has been to involve as many teachers as possible in the course development meetings based on LEQ and thereby quickly build up the communities of practice at the school.

The methodology has been used at almost all courses within one of the MSc programmes at the school during 2014 and has been included in several other teacher teams at the school. The process also includes starting up half-day seminars (twice a year) where subjects of pedagogic interest are discussed among teachers and where external speakers are invited to give their view on pedagogic issues. A workshop about formative feedback has been developed and given for some of the teachers.

The School of Technology and Health (STH)

Apart from the general aim with the pedagogical developer initiative, specific goals has been to create a forum for pedagogic reflection, to create an atmosphere that encourage teachers at the school to explore new pedagogic methods and to increase the quality of all bachelor and master thesis at the school. All courses given during 2015 will use LEQ as a tool for course development and teachers, who are interested to use scalable learning or peer instructions, have been supported to do so by the PDs. Pedagogic seminars have been started up and are given twice a year and a blog for documentation and dissemination of the pedagogic activities has been created.

DISCUSSION

Changing educational practices has been presented with past success on local levels, e.g. Berglund, Ritzén and Bernhard (2014), and from greater program levels by Graham (2012). However, more evidence is needed to assure that University-encompassing initiatives are able to strengthen faculty learning and by so increase the indirect effects on student learning. As described earlier, the overall focus for the pedagogical developer initiative at KTH is to facilitate faculty teaching competence, especially aligned to CDIO standard 10. The activities of the pedagogical developers have been summarized in table 1 below. The activities have been mapped to the CDIO Standards and/or CDIO syllabus where applicable.

Table 1: Pedagogical developers' activities mapped to the CDIO Standards and/or Syllabus.

CDIO STD	CDIO Syllabus		ABE	BIO	CSC	CHE	EES	ECE	ICT	ITM	SCI	STH
8		Active Learning	x	x			x	x		x	x	x
2		Assessment Criteria	x		x			x				
8		Deep Learning		x	x							x
		E-Learning	x			x	x	x		x		x
11		Assessment Methods	x	x				x		x	x	
		Research in Education			x			x	x			
	2.3	Sustain. Development				x						
		Intercult. Communic.						x				
		Course Plans	x					x		x		
11		LEQ	x	x		x	x	x		x	x	x
		Flipped classroom					x	x				x
		New Course Designs			x		x	x				x
12		Prog. of CDIO skills	x			x				x		
	3.2	Report Writing			x	x		x	x			
		Study Skills			x			x				x
8		Formative Feedback		x	x	x		x	x	x	x	x
		Terminology			x							

As can be seen from table 1, the 24 pedagogical developers are, apart from creating communities of practice (not covered in the table), involved in a wide variety of pedagogic development projects. Most of these projects are initiated by the PDs themselves, and hence there is a level of personal commitment in each project that would probably be lacking if the projects were initiated on top management level. It is observed within the communities of practice, that the engagement and commitment of the PDs is inspiring teacher peers to be actively involved as well.

CONCLUSIONS

This paper describes an initiative with pedagogical developers (PD) working as local agents of educational change at a major technical university. The PD initiative strives to educationally empower and enthuse teachers through the creation of local 'communities of practice', working primarily with pedagogical questions emerging from these communities and their felt needs. The discussions within the communities of practice are based on the outcomes from the results of a course evaluation. The tool for the course evaluation, LEQ, has been developed continuously during the pedagogical programme and described in this text. The work is mapped against the CDIO standards and syllabus, and even as the project as a whole was primarily aimed at Standard 10, Enhancement of Faculty Teaching Competence, this mapping shows that the emerging projects fit a whole range of CDIO standards and syllabus. This indicates that the potential strength in pedagogical programme development allows for by definition unpredictable bottom-up initiatives, while strengthening also cross-disciplinarian understanding within the community of practice created by the pedagogical developers themselves.

Although, the pedagogical developers is a new local initiative with a mere 12 months history several important findings have shown direct impact on a range of CDIO standards. By empowering pedagogical developers their actions have increased the level of pedagogical awareness and interest if workshops and LEQ implementation efforts is to be explored further. In short, the embedded effects that a change initiative of this character may face have allowed a myriad of new internal links and interconnectedness. This over time, provides a promising backbone in order to tackle upcoming challenges and as a resourceful source/force to continue to implement new practices.

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