Investigating the effects of academic development on novice teachers' conceptions of teaching in HE

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Conference Key Areas: Curriculum development, Education concepts specific for engineering education, Engineering education research

Keywords: Engineering, Teacher training, Academic development

INTRODUCTION

To be effective engineering professionals in today's global world students need to be equipped with a range of skills. These skills should not be confined to just a good understanding of their field of study, but require students to also developing critical thinking, problem solving and digital literacy skills. These skills are necessary so they can apply their knowledge appropriately, undertake work ethically and responsibly, and be effective in communicating their expertise [2]. Helping students

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to develop these skills challenges some of the more prevalent teaching paradigms in engineering education. As has been observed, students tend to be taught in more passive lecture environments, were teaching material is delivered in a pre-determined manner [7]. This entails the transmission of information where students are typically taught in lecture rooms. This leaves little room for developing many of the skills that 21st century engineering students will require as they leave university.

This brings into sharp focus how, as universities, we are teaching our students and how that teaching is preparing our students for their future careers in a fast-moving digitally connected world. In order to improve student learning and help students' develop the required skills we need to consider how we teach and how we design our teaching to best achieve this. In this paper we report on an approach to improving engineering student education through an academic development programme in a Swedish research-intensive university. We examine whether the introductory course for novice engineering teachers brings about meaningful changes in teaching that can help students attain the skills required as future engineering professionals.

1 UNIVERSITY TEACHING AND ACADEMIC DEVELOPMENT

University teacher training is a relatively new concern. The usual practice is to hire new lecturing staff on the basis of their research achievements. That is, they are expected to have a PhD and have demonstrated some degree of competence in their given field in conducting research. Typically there are limited expectations of new lecturing staff in terms of their training in teaching. PhD students are often employed as graduate teaching assistants (TA). They often develop their teaching approaches on-the-job and typically limited training is required before TAs are allowed to teach. Their teaching practices are often modelled on their experiences of teaching as students and hence the lecture-model is often perpetuated by default. Hence training of graduate TAs is often overlooked.

In historical terms this model worked reasonably well. Students could attend university and gain the knowledge they needed as they would only have limited access to it outside a university structure. Within a university, they would have access to knowledge through the university teachers and through the university library. However, this model is no longer sufficient for educating tomorrow's engineers. Students attending university now already have access to a considerable body of knowledge through Internet so they no longer 'need' to attend a university just to gain access. Employer expectations too have changed. University graduates entering the workplace are no longer expected just to be knowledgeable, but to know how to access knowledge they don't currently have and how to use that new knowledge to solve new problems. This also requires future professionals to be able to acquire new information, discern its validity in informing their work, and be able to use it appropriately to solve new problems and formulate appropriate solutions. This requires future engineers to work across countries and boundaries and across professional disciplines. This changes the role of university teaching.

Universities are aware of these changing roles. This is evident in the increasing emphasis on academic development programmes and university teaching quality [3]. Unfortunately some academic development programmes are framed around a model where the goal is to 'rectify' the skills-gap of academics [5,9]. However by grounding academic development programmes on conceptual change as opposed to skills and tactics, improvements can be observed [4]. Hence basing academic development programmes upon conceptual change appears to improve students' perceptions of the quality of teaching.

Trigwell and Prosser [13] have already demonstrated links between higher education teachers' approaches to teaching and students' approaches to learning. They have also shown links between teachers' conceptions of teaching and teachers approaches to teaching [12]. Price and Kirkwood [10] have shown that fundamental to any tangible employment of digital technologies in teaching and learning requires a good underpinning of pedagogical knowledge. Where pedagogical approaches in teaching with digital technologies does not lead, a technologically deterministic approach to teaching is adopted, that is, it is assumed that the introduction of technology in and of itself with lead to an improvement in learning. This typically leads to an information transmission approach which is ill suited to developing the needs of learners in the 21st century [6].

Hence in order to improve the knowledge and skills development of future engineering professionals we need to address the quality of our teacher training. Adopting a deficit model focused on teaching skills development is less likely to lead addressing underlying conceptions of teaching, which in turn underpins good teaching practices with technology. Conceptual change as a model of development has been shown to improve students' perceptions of the quality of teaching [4]. Providing this kind of academic development and training in conjunction with PhD programmes can support progressive teaching and learning, as TAs can develop their conceptions of teaching before their views, predicated on models of teaching that they have experienced, become entrenched.

In this study we examine whether our introductory course to teaching and learning in higher education, as part of our academic development programme, is bringing about the important conceptual development in our novice engineering teachers. This we believe is fundamental to engendering the development of appropriate skills, imperative for future engineering professionals.

2 COURSE PHILOSOPHY AND STRUCTURE

The philosophy of the whole academic development programme at our institution is founded firmly in developing student-centred approaches to teaching and learning aimed at developing students with the necessary engineering skills for today's world, using the principles of Scholarship of Teaching and Learning (SoTL) as guidance. The programme is a vital part of the institution's ambition for a cultural shift concerning teaching and learning, and pedagogical courses is the backbone of the programme. [1,8]

The introductory course comprised a week-long module with a requirement to complete an additional project, presented for scrutiny by their peers and the course coordinators. In total the introductory course represents two weeks' worth of teacher training out of a required five weeks at the institution. This is also a requirement before doctoral students or novice teachers are allowed to participate in any formal teaching at the university.

The purpose of the course project is to let all participants deepen their understanding of teaching and learning by investigating and writing a small scholarly group report about student learning, curriculum design or any other important pedagogical matter in a relevant context – relevant in the sense that the report adds to the understanding of the education at the institution. This writing then continues in more advanced courses, first in groups then individually making the academic development programme a coherent programme.

3 METHODS AND PROCEDURES

Participants were novice engineering teachers who were also doctoral students in a Swedish research-intensive university. In total there were 4 cohorts of participants: in this paper we report initial findings on the first of these cohorts to determine whether any conceptual change has taken place as a result of undertaking the course. In total there were 26 participants who were predominately international where the course was conducted in English.

Before the beginning of the course each participant was asked to complete a written reflection of their views of teaching. At the end of the course, after the participants had presented their projects, they were asked to repeat the reflective writing activity. This was to facilitate a pre and post examination of their views about teaching.

The data from the reflections of participants before and after the course were scrutinised and categorised into conceptions of teaching using Prosser, Trigwell and Taylor's model [11]. Figure 1 illustrates Prosser, Trigwell and Taylor's model [11, pp223-225] which contains six conceptions of teaching ranging in sophistication from conception A to conception E, which we coded these from 1 – 6.

Conception	Title	Code
A	Teaching as transmitting concepts of the syllabus	1
B	Teaching as transmitting the teacher's knowledge	2
C	Teaching as helping the students acquire concepts of the syllabus	3
D	Teaching as helping students acquire the teachers' knowledge	4
E	Teaching as helping students develop their conceptions	5
F	Teaching as helping students changes conceptions	6

Fig. 1. Prosser, Trigwell and Taylor's model of conceptions of teaching [11, pp223-225]

Each participant's pre and post conception of teaching were examined and coded in relation to how they mapped onto Prosser, Trigwell and Taylor's model. This was in order to determine whether any conceptual changes in their views of teaching had occurred as a result of taking the course.

Table 1 illustrates the gender, age, coded pre and post conceptions of teaching and the difference between the pre and post conceptions for each of the participants. The average conception on beginning the course was 2.2: conception 2 focuses on teaching as transmitting the teacher's knowledge. This conception focuses on the transmission of the teacher's knowledge and does not incorporate any prior knowledge that the students might have or how it contributes to their learning. The

pre conceptions range from 1 to 4: (six 1s; eleven 2s; seven 3s and two 4s) thus the majority of the participants had conceptions that were more teacher-centred.

Table 1. Changes in conceptual development before and after the course

Participant number	Gender	Age	T1 conception	T2 conception	T2-T1
1	1	38	1	3	2
2	2	40	3	3	0
3	2	33	1	5	4
4	1	37	2	3	3
5	2	26	4	3	-1
6	2	29	2	5	3
7	2	33	2	4	2
8	1	29	4	5	1
9	2	29	2	4	2
10	2	35	2	2	0
11	2	34	3	4	1
12	2	25	2	5	3
13	2	28	1	3	2
14	2	29	2	4	2
15	1	30	3	4	1
16	1	30	1	3	2
17	2	30	1	2	1
18	1	29	3	5	2
19	2	26	2	2	0
20	1	38	3	5	2
21	1	29	2	5	3
22	2	26	2	5	3
23	2	31	1	3	2
24	2	33	3	3	0
25	1	30	3	4	1
26	1	27	2	2	1
		30.9	2.2	3.7	1.62

In comparison the post course average conception was 3.7. This shows an average improvement of 1.62 – that is, at least one step change in their conceptual development. The post conceptions ranged from 2 to 5 indicating a shift toward more student-centred approaches to teaching.

There were four participants that did not appear to exhibit any changes in their conceptions. However there were also some notable step changes, for example participant 3 had four step changes in their conceptual development. It is not clear why some participants had more changes in their development and some had none. However individual differences in participants may be a factor or perhaps their career aspirations may influence their motivation as some many not wish to pursue an academic career.

Age was not a factor per se in influencing students' initial conceptions of teaching, their conceptions after the course, or any differences between the pre and post conceptions: although age per se cannot of course be taken as a proxy for teaching

experience or knowledge. Similarly gender was also not a factor in influencing either the pre or post conceptions or any changes in conceptual development. All correlations between these variables were insignificant.

4 SUMMARY

The findings showed that most participants had relatively teacher-centred conceptions of teaching before the course and that these developed towards more student-centred conceptions after completing of the course. This suggests that modelling an introductory course on conceptual change is valuable in supporting teachers in developing their teaching perspectives. This is significant, as research has already shown that conceptions of teaching influence conceptions of learning [12] which influence teachers' approaches to teaching. It is also significant as student-centred conceptions of teaching underpin effective use of digital technologies in teaching and learning [6]. Further research needs to provide a more comprehensive picture of these changes through the analysis of the other three cohorts of data in order to examine the generalizability of these findings. Additionally we also need to examine other factors might influence conceptual change in perspectives of teaching.

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