THE DEVELOPMENT OF TECHNICAL STAFF COMPETENCIES VIA INTERNATIONAL EXCHANGE

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ABSTRACT

CDIO standards 9 and 10 require institutions within the initiative to work toward systematically supporting and developing the teaching and the more general competency of their faculty. Conventionally this is assumed to be the academic teaching staff responsible for the curriculum, learning outcomes and assessment on a given programme. CDIO by implication from the other standards requires significant involvement by students in practical projects and experiences all of which typically involve the use of technical support staff. While technical staff will generally not be directly involved in designing curricula or setting assessments, they are often a key contact point and enabler of the students learning experience particularly with regard to many practical or problem solving competencies desired within programmes. Despite their importance, the opportunities and support given to technicians to enhance their competence, particularly with regard to the learning process and student engagement, can be quite limited. This paper describes an effort by CDIO partners the University of Twente and Aston University to trial an exchange visits scheme to help encourage and support our technical staff to gain new perspectives, have opportunity to develop, to build a collaborative network and share best practice.

KEYWORDS

Technician, Exchange, Faculty Development, International
Standards: 5, 6, 8, 9, 10

INTRODUCTION

CDIO standards 9 and 10 require institutions to systematically support and develop the teaching and the more general competency of their staff. It perhaps could be argued that these standards are some of the trickier ones to implement thoroughly and attract less attention than they should within the community.

In addition it should be noted that the definition of "faculty" in these standards has tended to be interpreted as academic staff however the nature of CDIO, particularly through the design, build and test approaches embodied directly or indirectly in standards 5, 6 and 8 means that technical and workshop staff are key partners in enabling these activities and ensuring successful outcomes for students.

At many Universities operating the CDIO model, the technical staff are a key contact point with the students helping them in a very practical way to resolve issues in their design implement projects and helping them translate many of the more academic aspects of their learning into tangible outcomes. Despite this critical role there may not always be obvious routes to develop their skills in these areas.

This paper describes a trial between the University of Twente in the Netherlands and Aston University in the UK to develop both specific and more general competencies among technical staff at the two institutions. This involved the technicians reflecting on their skill sets and needs with a view to developing these by sharing best practice with colleagues from the partner institution.

At Twente a particular requirement existed to help support technical staff in gaining confidence in instructing in English and in particular the jargon and specialist language of technical English. This was tied to the Bachelor's curriculum at Twente moving to English as a language of instruction. At Aston there was a desire to encourage staff to gain a wider picture of technical support beyond the specific capabilities and environments of the individual technician.

This paper reports on the initial findings of the initiative and exchange with the hope that it may encourage others to consider the particular support needs of technical staff.

BACKGROUND

CDIO standards 9 and 10 relate to the development of faculty competence in both engineering practice and in teaching and learning methods. In many regards these are particularly key to the long term sustainability of CDIO focussed programmes beyond the initial implementation and the moving on of the initial cohorts of staff.

It could however be argued that standards 9 and 10 may be those which are most difficult to tackle in depth and do not necessarily attract appropriate levels of attention. This can be seen by figure 1 which shows a survey of the papers at the CDIO Summer conference held in Calgary in 2017 which showed a relatively modest proportion of papers self-reporting as featuring standards 9 and/or 10, with a further subset of this having staff development as a key focus of the work.

The reasons for this are not for discussion in this paper but may relate to the more long term and sustained approaches needed to address these issues fully which may require cultural changes within Universities beyond the remit of those typically within active within the CDIO community.

Papers presented recently related to standards 9 and 10 include those involving the development of formal staff training programmes (Bhadani et al. 2017, Cleveland-Innes et. al. 2017)), using networking as a means of developing and enhancing competence (Clark et. al. 2016, Rouvrais et al. 2016, Bennedsen & Schrey-Niemenmaa, 2016.), the establishment of processes and systems to support staff development (Kilstrup et. al. 2011), spells in industry (Kontio et. al. 2015) and case studies (Shankar & Suppiah 2014).

A number of other papers reference standards 9 and 10 though the focus of the paper is more on a mode of teaching or curriculum initiative with some degree of staff development implemented to allow for these. (eg. Wikberg-Nilsson et. al. 2017, Gommer et. al. 2016)

In all cases however there is generally no explicit reference to the development of technical staff with the focus of the work very much centred on traditional academic teaching staff.
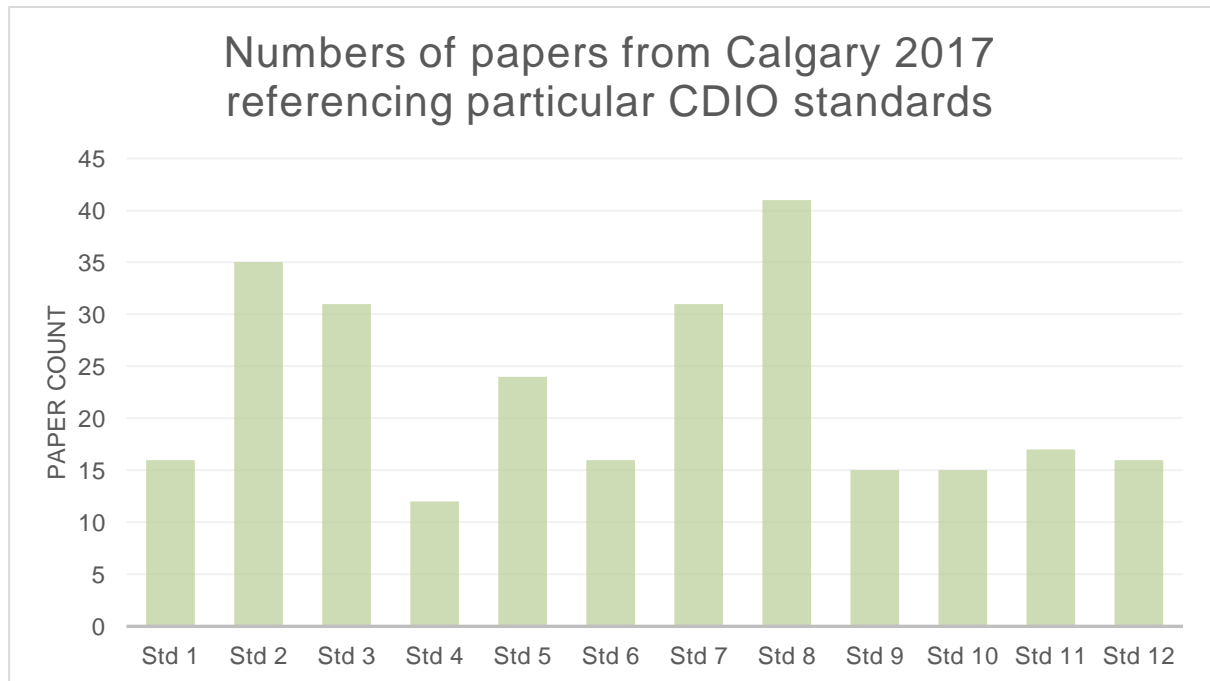

Figure 1. Papers at the CDIO Conference 2017 in Calgary, self-reporting as featuring particular CDIO standards.

The definition of faculty can have different interpretations but is perhaps generally assumed to be the academic teaching staff responsible for the curriculum design, syllabus, delivery and assessment of programmes of study. The CDIO standards however also require the delivery of an integrated curriculum (std. 3), an introduction to engineering (std. 4), integrated learning experiences (std. 7) and active learning (std. 8), much of which will take place in suitable engineering workspaces (std. 6). For many institutions it is likely that much of this activity will be embodied within design, build and test exercises or similar practical activity and to achieve this a high level of technical support is likely to be needed. This group of individuals often has a very direct role in helping students develop their competences particularly in regard to the practical and problem solving skills at the heart of much of CDIO.

Despite this importance to the success of CDIO programmes, the development of technician competence may often be quite limited and haphazard with few opportunities to share best practice or to grow skill sets to allow them to better support students.

The role of technicians supporting CDIO type learning typically may include:

- Advising students on production of parts
- Helping students resolve practical issues on design, build and test work
- Running practicals on the tools and techniques needed for building prototypes/
- Operation, maintenance and preparation of specialist test rigs
- Manufacture of parts to student drawings, files or specifications
- Manufacture and/or design of test rigs to support teaching
- Issuing, ordering and stock management of tools and consumables
- Health and safety of workshops
- Input into planning of modules and learning activities
- Planning of workshop redevelopment

It can be seen that most of these activities are likely to involve direct engagement with individual students in their learning and the remainder will factor in the learning environment experienced by the students. This sets a distinction between technicians in the academic sector who have to blend technical skills with and learning support attributes against those in the industrial arena where pure technical competence is the key metric of value.

There is limited academic work in place looking at the role and development of technicians supporting engineering programmes. In their 2015 paper "Technicians under the microscope: the training and skills of university laboratory and engineering workshop technicians", Lewis and Gospel highlighted many of the issues around the recruitment and training of technicians to support engineering and science activities within the UK sector. Within engineering it was found that most technicians came to the profession having gained vocational qualifications in technical skills. Ongoing training and development was often reported as being ad-hoc relying on the passing on of knowledge and skills by more experienced technician or academic colleagues or by localised spot training such as might be provided tied into the acquisition of new equipment.

The paper also described obstacles related to training of technicians, in particular referencing the release of time to undertake training, financial constraints and in certain cases motive and incentive of individuals. The latter case of incentive and motivation may also relate to the flat technical grades limiting progression beyond certain points and the stable workforce precluding promotion to senior posts while an incumbent is in position.

An earlier, large piece of work, "Highly Skilled Technicians in Higher Education: A Report to HEFCE", (Evidence Ltd, 2004) was focussed around 12 case studies over a range of institutions and a range of science and engineering subject areas. While published well over a decade ago it highlighted similar issues to those of Lewis and Gospel though clear distinctions were made between the life sciences and medicine which had quite different technician demographics and also between contract research technicians and the permanent and primarily teaching support technicians within engineering departments.

It was however notable that the focus in both papers for both initial and ongoing training related to the development and currency of the technical staff in their engineering or scientific skills competency almost entirely to the exclusion of their wider role in supporting and engaging in direct student learning as highlighted earlier.

THE PARTNERS

The partner institutions involved in this exchange are two science and technology focused institutions of comparable size based in the UK and the Netherlands respectively (Figure 2).

Aston University

Aston University came into being as a University in 1966 from a much older College of Advanced Technology and is situated in a city centre campus in Birmingham, UK. It is home to around 15,000 students with studies primarily focused on engineering, applied science, life sciences, business and medicine.

The participants in this exchange came from the Mechanical Engineering & Design subject group. This runs undergraduate and postgraduate degrees in both mechanical engineering and product design with an annual intake of around 180 students at undergraduate level.

Aston has been a CDIO member for around 8 years and has a curriculum which features significant levels of project based learning.

Figure 2 : Aston University and the University of Twente

University of Twente

The University of Twente was formed as a University in 1975 and is based in Enschede, the Netherlands. It is home to around 9500 students taking degrees in the fields of engineering, technology, science, behavioural science and business management.

The participants in the exchange were drawn from the Faculty of Engineering Technology, which runs undergraduate degrees in mechanical, civil and industrial design engineering together with specialist MSc and PhD programmes.

Twente became an official member of the CDIO initiative in 2017 but has been running project based education since 2000.

The Technicians

A total of nine technicians took part in the formal exchange, though other technicians and academic staff were also involved as hosts during the visits to the respective institutions.

Six technicians from Twente travelled to Birmingham in December of 2017, while three technicians from Aston travelled to Twente in January 2018.

In general the technicians directly involved in the exchange had been at their respective institutions a significant period of time with a mean period of service at their current employer of over 15 years and time in post varying from a little over a year to over 37 years. It is felt this was probably fairly representative of the wider demographics of the engineering technician pools at the two Universities and perhaps more widely.

It was also noted that none of the nine technicians who took part in the exchange had previously worked at another institution in a similar role with most either coming into post following a technical apprenticeship or following a period in a technical role within industry.

This tends to suggest a highly stable workforce however it also poses questions regarding career development and the potential isolation of technical teams, from new ideas and practices. With limited turnover of staff, any new ideas or processes must be self-generated or mechanisms need to be brought into place to allow transfer of ideas between institutions and the technicians within them.

As part of the process, the technicians were also asked to note any formal or informal training they have undertaken in the previous two years related to technical issues (operation of machinery or equipment, engineering software etc.) or student support (learning assistance, problem solving, pastoral care etc,).

In all cases the technicians reported having taken part in technical training. Often this was informal or self-directed, while in most cases there were also more formal elements of training related to having been instructed on the use of various engineering software packages or specialist equipment.

In most cases there had however been little formal or informal training in teaching or learning support over the previous two years. The Twente technicians had however taken part in a tutor training activity to help support project activity. The Aston technician's had just embarked on a post graduate certificate in teaching and learning. This is a qualification traditionally expected to be obtained by new academic and teaching staff but which is now being trialed at Aston to help develop technician competences in the learning and teaching area.

THE EXCHANGE

Set Up

Following an agreement in principal to set-up the exchange, a series of steps were then taken to bring about the exchange. An over-arching goal for both Universities was to give their technicians a wider picture of their professions and open a network to channel best practice between the technical teams of the two Universities. Over and above this each institution had general areas of interest, for Twente this was helping their technicians converse more easily

in English while for Aston there are particular issues regarding efficiency of process when dealing with large groups of students.

Scheduling was set to enable the Twente technicians to visit Aston in December 2017 with the reciprocal visit a month later. The key factors relating to the timing was to ensure that the host University would be at a suitably active phase in its calendar to make engagement with live student and learning activities possible, while pragmatism dictated that the visiting technicians could be spared and were not at peak demand in their own institution.

Each visit was scheduled to last a Monday to Friday working week, though this amounted to around three days on the host site after allowing for travel and for a cultural visit day mid-week. The visits to the host institution included opportunities to view and meet with opposite numbers to discuss processes and best practice together with chances to participate in and observe live classes.

Questionnaires

Prior to the visit, the technicians were asked to complete a questionnaire. The role of this was multi-fold.

- To gather basic demographic data about the technicians, length of service, career background, recent training history etc.
- To ask the technicians to reflect on their current position and identify both technical and learning support areas they would like to develop via the exchange.
- To use this data to help tailor the visits to suit.
- To capture this data for this current and future research.

Following the visit, a reflective questionnaire was also sent out to ask the technicians if the experience helped them develop the areas they wished to develop, the experience more generally and how they would hope to use any resultant learning or colleagues at the partner institution to support their current role.

OUTCOMES AND REFLECTIONS

The initiative was very much welcomed by the technicians and appears to have proved successful.

Following the visits a follow up questionnaire was issued to review the experiences of the technicians over the course of the exchange. This survey used a number of Likert type appraisals of their time on the exchange together with some more open ended type questions to help justify and clarify the wider experience.

As can be seen by the summary appraisals in figure 3, the exchange was seen as a highly positive one by the technicians. The technicians all saw merit in developing an network of technicians, see their role in a wider context and try activities and practices carried out in the partner institution at their own.
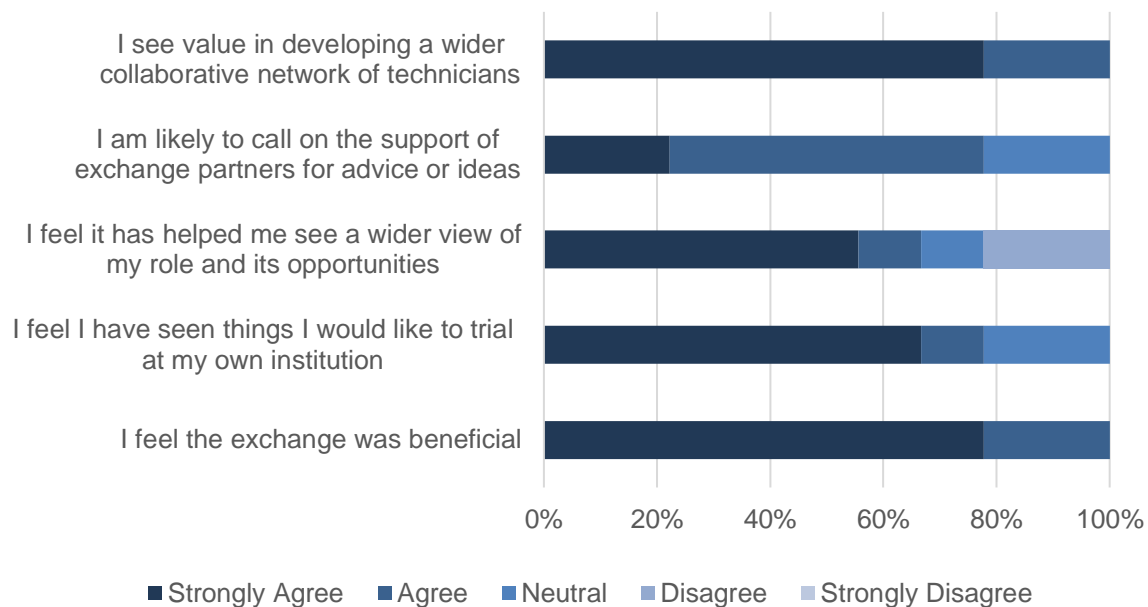
Figure 3 : Summary of technicians reflections following exchange

In the more open sections of the review questionnaire the technicians were able to expand upon their experiences.

Very often these were related to highlighting the differences between the two institutions and there approaches and environments :

Of Twente on Aston - *"I actually learned the most from the difference in education in terms of modelling practical's. The modelling program is much more strict and is much longer 12 weeks in total."*

Of Aston on Twente - *"The University of Twente students spend more time being taught traditional model making skill such as Sculpting, Foam Modelling ,Generating Concept Models, Clay Modelling"*

In addition some particular positives to take back to their own institutions :

For example in relation to tool organisation :

"…a follow up to my finding will be to analyse the cost of implementing the Twente method for our machines to have shadow board style inserts and see if the cost is appropriate for the gains involved."

For the Twente technicians the opportunity to converse with English as a native language staff and students was a key goal and was at least partly developed by the exchange :

"Yes, the visiting of some project meetings was an opportunity to train my speaking skills. The conversations with students and teachers taught me that I was able to do these discussions on a, for me, sufficient level."

"Yes it gave me a better vocabulary of English technical terms."

While more closely allied to the Twente technician's goals, a perhaps unexpected learning experience for the Aston technicians related to them taking a step back and consider the support of their own international students in English where this is not their native language.

"I feel this (working with the Twente students and technicians) allowed me to gain an insight and therefore a greater understanding of the language barriers they encounter when involved with a technical degree ….and gave me the forethought to now simplify some language at the beginning (for Astons own international students) and build up to the technical vocabulary to allow for their learning to continue to develop at a steady rate."

CONCLUSIONS

While very much a pilot study, the exchange has been very positive. The technicians from both institutions valued the visits greatly and took home a number of learning and development experiences.

For successful implementation, CDIO requires students to engage in a number of practical activities to allow them to apply and embed much of the theoretical knowledge required of a modern engineer. Technicians are key to enabling this learning and will often be engaging with students in a very practical way. Ensuring they have the opportunity to develop their technical and teaching support skills is therefore essential for the sustainability and effectiveness of CDIO programmes.

In general CDIO standards 9 and 10 are perhaps not as systematically addressed as they could be and the opportunities for technicians in particular to develop their competencies can be limited and overlooked. Demographics associated with historically low job mobility between institutions and limited progression opportunity within institutions do little to change this.

This pilot is seen as a way to encourage others to think about the importance of technicians to the learning experience, to encourage discussion about how they can be best supported to help the students learning, to consider exchanges as a possible means to achieve this and to propose a much wider community of practice among technicians to share best practice.

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BIOGRAPHICAL INFORMATION

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