A Project to Adopt Technology in Electrical Engineering and Computing Units: Participants Experience

Cesar Ortega-Sanchez and Diana Taylor
Faculty of Science and Engineering, Curtin University
Corresponding Author Email: c.ortega@curtin.edu.au

Structured Abstract

BACKGROUND

The educational landscape in Australia is going through a period of rapid change. National and international imperatives are driving universities to transform both what they teach and how they teach. One aspect of this transformation involves the use of technology to facilitate student learning and engagement. To address this particular challenge, a six-month project to progress the incorporation of technology in teaching was offered in the School of Electrical Engineering and Computing (SEEC), at Curtin University, Western Australia. Nine academics, with different backgrounds and levels of experience, enrolled in the project with the objective of using technology to transform one aspect of a unit. Six academics completed both the pre- and post-surveys.

PURPOSE

A research project was established to investigate the participants' journey from learning new tools to adopting them in their teaching. The objective was to identify the elements of the professional development process that facilitated or impeded their journey.

DESIGN/METHOD

The project used pre- and post-project questionnaires to capture participants' perceptions of how the project met their expectations. Questions were designed to cover various aspects of a typical learning journey; time spent, previous knowledge, learning anxiety, and confidence. Responses were tallied to determine if a shift in perception had occurred.

RESULTS

All participants acknowledged that some degree of learning happened while adopting technology in their teaching. The main obstacle reported was the difficulty in finding time to learn the tools and then applying them to transforming one aspect of their units. However, with timely and personalised support all participants were able to make enough time to learn and apply new technology in their teaching.

CONCLUSIONS

The main findings of this research are presented in this paper as take-home messages that may inform the design of professional development programs. Findings suggest that the most important element is having an environment that is academic-centred, work-integrated, and offers freedom of choice.

KEYWORDS

Transforming learning with technology, professional development, community of practice.

Introduction

The Australian Higher Education landscape is constantly changing. Universities are affected by many internal and external drivers. Internal drivers include: ambitious targets to compete in international rankings, meeting quality assurance reviews, policy compliance, improving student retention and satisfaction; and offering educational opportunities to new national and international markets. External drivers include: compliance with national regulatory bodies, competition from national and international universities, challenges to the status quo from MOOCs and other open education providers, industry expectations of graduates and students expectations of universities.

All these drivers produce changes for which academics are not always fully prepared. Strategic initiatives have an expectation that academics have the ability and knowledge to transform the way they teach (and learn) in a short period of time. However, these expectations often neglect the pedagogical and psychological changes that need to take place before academics embrace new ways of teaching. When facing change academics in the right frame of mind will jump to the opportunity and become early adopters; whereas the less motivated will struggle to reconcile the changing landscape with their pedagogical believes. These behaviours and response to change are influenced by academics past experience and pedagogical beliefs (Ertmer, 2005).

To meet aggressive transformation agendas academics are required to develop an integrated understanding of discipline-specific content, appropriate pedagogy, and knowledge of how technology can be used to enable learning in the 21st century; all with minimal support. Koehler and Mishra (2009) proposed the Technological Pedagogical and Content Knowledge (TPACK) model that explores the idea that an integrated knowledge of content, pedagogy and technology are required in order for academics to successfully integrate technology enabled teaching strategies.

In the context of this study TPACK could be expressed as the following: Academics in the School of Electrical and Computing Engineering are experts in designing and working with technology and this represents the Content Knowledge (CK). Their teaching responsibilities also require them to possess Pedagogical Knowledge (PK) to successfully teach the subject matter. It is important to note that knowledge of technology does not automatically transfer to knowledge of how to integrate technology to enhance teaching and learning; i.e. Technological Pedagogical Knowledge (TPK).

Developing the required knowledge and skills to transform teaching with technology is a challenge for many academics who have to find a balance between time-intensive teaching and research commitments. Furthermore, professional development (PD) offerings are often unable to cater for diverse teaching contexts and specific learning needs.

Based on the drivers for change and the challenging road ahead for academics a project entitled "Transforming Teaching with Technology" was established. The project was a vehicle to provide academics with opportunities and experiences that may influence their behaviour and beliefs (Ertmer, 2005). The aim of the project was to encourage academics to transform one aspect of a unit they taught through the use of educational technologies. The project offered professional learning opportunities, tools and support to assist academics in achieving realistic and manageable transformational goals. The project took place in second semester, 2013, which spanned from mid-July to mid-December (24 weeks). It incorporated the three core features of professional development activities that have significant, positive effects on teachers' learning pointed out by Garet, Porter, Desimone, Birman, and Yoon (2001), namely: focus on content knowledge; opportunities for active learning; and coherence with other learning activities. One distinctive feature of this project is that the PD took place as part of the participant's workload and not as an additional impost.

The objective of this study was to take a close look into the participants' journey from learning to adopting technology in their teaching. Data was gathered to contrast their expectations at the beginning of the project with their actual experience transforming their teaching. Some key aspects that had an impact on the journey have been identified. They could inform future efforts on planning of strategic goals; professional development needs and support initiatives.

Methodology

The *Transforming Teaching with Technology* research project was established to document and analyse each participant's journey from learning to adoption of technology in one aspect of a unit they teach. A call for volunteers was sent to all 25 academics in the School of Electrical Engineering and Computing and nine volunteered to participate in the project. These academics formed a community of practice that provided mutual support to explore strategies, solve common problems and learn from one another. This approach was chosen to create an environment where academics would not feel alone in their endeavours (Keesing-Styles & Ayres, 2012; Roder & Rata-Skudder, 2012). Activities within the community of practice included one-on-one consultation, peer-support, workshops, online collaboration, and a mini symposium. Participants also received an iPad and Camtasia software licenses as tools to enable the transformation.

Central to this project was the notion that academics, not the agendas, had to be at the centre of the decision making process; i.e. a learner centred approach as described by Hirumi (2002). First, facilitators helped academics to identify or clarify one or two particular aspects they wanted to transform in their units. The academics then spent some time learning about educational technologies and selected one or more of these based on their particular student learning needs and personal preferences. During this process academics could engage the support of a consultant and peers.

Support roles

Support was provided by three experienced academics from different levels in the Faculty organisation: The Associate Dean of Teaching and Learning (ADTL), a Learning Engagement Developer (LED) and an Educational Technology Consultant (ETC). Collectively these roles provided expertise in the use of educational technologies for teaching and learning, as well as in the pedagogy.

Data gathering

To monitor the progress of participants in the areas of interest, the following questionnaires were designed and applied at different points of the project:

- Pre-project questionnaire
- Post-project questionnaire
- Profile questionnaire

The pre- and post-project questionnaires were designed to assess the project's impact on participants' perception of what is required to adopt technology in teaching. These questionnaires asked essentially the same questions with slight modifications to capture the before and after experience. The questionnaires had eight Likert scale questions, as shown in Tables 1 to 8. The Likert scale included five categories: Strongly Agree (SA), Agree (A), Neither Agree nor Disagree (N), Disagree (D), and Strongly Disagree (SD).

The profile questionnaire was designed for academics to self-assess their background knowledge on educational tools and techniques before and after the project. Answers to this questionnaire informed the analysis of the pre- and post-project questionnaires.

Analysis of questionnaires

The findings presented in this paper only reflect the cross-analysis of the pre- and post-project questionnaires that were completed by six of the nine participants. Personal observations by the researchers have been incorporated in the analysis that follows.

Question 1: Awareness of educational technologies

Table 2: Answers to question 1

		SA	A	N	D	SD
Pre	Educational technologies are new to me	0	0	0	4	2
Post	Through this project I have become more aware of educational technologies.	4	1	1	0	0

Discussion

All academics indicated that educational technologies were not new to them and yet all but one indicated that through the project, they became aware of additional educational technologies previously not explored. The data seems to indicate that academics may already be aware, informed and even using some educational technologies in their teaching prior to embarking on PD in this area. As part of this project academics were autonomous in choosing how they wished to transform the unit they taught; and workshops and support were tailored in response to their needs. According to survey responses it could be inferred that this approach fostered a worthwhile learning opportunity for the majority of participants.

Take-home message

Professional development initiatives must allow participants to be autonomous and be responsive to their needs to ensure a relevant and worthwhile learning experience. The critique by Dadds (2006) of the British Educational Reform highlights that the academic learner "must lie at the heart of continuous professional development". Learner autonomy and personal relevance are considered to be key factors that develop a participant's engagement and learning confidence in the digital literacy landscape (Jeffrey et al., 2011).

Question 2 – Stepping outside of one's comfort zone

Table 3: Answers to question 2

		SA	A	N	D	SD
Pre	I am prepared to step outside my comfort zone to try a new educational technology	2	4	0	0	0
Post	Participating in this project required me to move out of my comfort zone.	0	2	2	2	0

Discussion

All academics were prepared to step out of their comfort zone, that is, being prepared to face an unfamiliar situation that could potentially be challenging and stressful (M. Brown, 2008). Despite the variation in the post survey responses, two-thirds of the academics did not perceive the project to require them to move out of their comfort zone.

The academics in this project were only required to transform one component of their teaching creating a low stakes and scaffolded transformation goal. Perhaps the goals and structure of the project created a learning environment that was safe and supported those

who challenged themselves. By scaffolding an innovation, academics anxiety level can be reduced (Garcia, Morrison, Tsoi, & H, 2014) and is also a means of achieving larger learning goals (Bonk & Cunningham, 1998).

Comfort zone however, is a measure on a personal level and could be dependent on a number of variables including confidence, experience and attitude (Jeffrey et al., 2011). Therefore further investigation of each academic would be required to better understand the factors that influenced this phenomenon.

Take-home message

Addressing transformation needs in a scaffolded manner can reduce anxiety and make the task more manageable (Garcia et al., 2014). Exploring or adopting a new educational technology may not necessarily be a threatening or painful experience.

Question 3 – Collaborative learning

Table 4. Answers to question 3

		SA	A	N	D	SD
Pre	I will investigate what other lecturers are doing to guide my choice of educational technology.	0	5	1	0	0
Post	Seeing what other lecturers were doing guided my choice of educational technology.	1	4	0	1	0

Discussion

The majority of academics were open and willing to learn from their peers in a community of practice. Through their engagement in this community the same majority of academics acknowledge that their peers influenced their choice of educational technology. This suggests that their engagement in community activities provided them with sufficient opportunities to collaborate and learn from each other (Wenger, 2006). Bandura (1977) proposed the social learning theory that describes learning to occur in social contexts and through observation. The facilitated workshops and mini-symposium were three such opportunities that facilitated this observational learning to occur.

Take-home message

Academics are willing to learn from others, to participate and to share their approaches. A community of practice, with opportunities to demonstrate, is a suitable PD strategy to foster such outcomes (Garet et al., 2001).

Question 4 – Project support

Table 5: Answers to question 4

		SA	A	N	D	SD
Pre	I will need a lot of support to transform my unit with technology.	2	1	2	1	0
Post	The support received influenced my outcomes in this project.	1	4	1	0	0

Discussion

The perceived need for support varied across academics; however the support received did, to some degree, influence their work in this project. The data suggests the participant's perceived level of required support is not a good indicator of whether support is actually required. Academic's perception toward support may vary based on their level of confidence,

skill level and expectation of support. Learning can occur through shared experiences from people with varying skill sets and experience (Jeffrey et al., 2011) making a community based PD initiative a great opportunity for transformation (Kennedy, 2005).

Take-home message

Create community based learning opportunities that include participants with varied skills and experience.

Question 5 – Opportunities to explore educational technologies

Table 6: Answers to question 5

		SA	A	N	D	SD
Pre	I would not have tried a new educational technology if it were not for this project.	0	0	0	3	3
Post	This project provided a good opportunity to try new ways of teaching with technology.	3	2	1	0	0

Discussion

All participants are academics with different levels of experience but they have in common a natural disposition to try new ways to improve the effectiveness of their teaching. Answers to question 5 reflect that the project was not a determining factor in trialling a new technology; however it did facilitate the exploration and learning of new ways of teaching with technology. This may be a confirmation that participants are all self-driven and motivated.

Take-home message

To facilitate the adoption of technology in teaching it is important to create a quality-centred environment that fosters ownership and freedom of choice. This kind of environment has been reported as characteristic of a healthy learning community (Hirumi, 2002).

Question 6 – Time requirements

Table 7: Answers to question 6

		SA	A	N	D	SD
Pre	One hour a week (over 10 weeks) will suffice to explore, re-design and develop a small component of my unit.	0	4	1	1	0
Post	One hour a week (over 10 weeks) was enough for me to explore, re-design and develop a small component of my unit.	0	2	1	3	0

Discussion

In the pre-project questionnaire most participants estimated that one hour a week would be enough to change one aspect of their unit. Answers in the post-project questionnaire show that the opinion was divided; some participants found one hour quite sufficient to implement the change they wanted to achieve, while others acknowledged one hour was not enough. It is important to note that during the project participants were not required to record the time spent in their activities, hence answers can only reflect a subjective perception of time spent. In his study on time perception and attention S. W. Brown (1985) found that "the more difficult or complex the task, the longer its perceived duration". In this project, we found that perception of time passing was in direct correlation with the length of the journey from learning to adoption. One participant implemented a technique that was very familiar to him and he did not consider the task time-consuming. On the other hand, participants who used

technologies new to them found the project time-consuming. The graph in Figure 1 represents this notion.
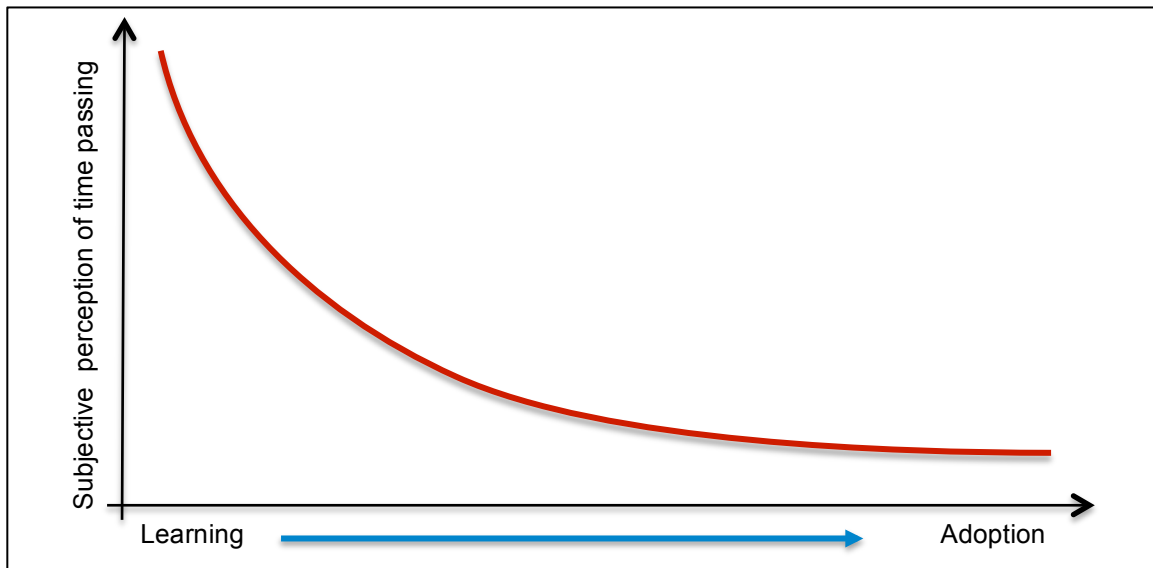

Figure 1: Subjective Perception of time passing VS Learning-Adoption Continuum

The actual shape of the curve in Figure 1 will be different for each individual. Some of the factors that may influence the experience of time passing are: years of experience incorporating technology in teaching activities, clarity of objectives, mastery of the subject, motivation, and match between personal capabilities and the task. In this study, participants who believed that one hour a week was sufficient were the ones who had more experience incorporating technology in their teaching.

Take-home message

People need different periods of time for learning technologies and adopting them in their teaching. Universities driving changes in teaching and learning need to be patient and give academics the time they need to learn. It cannot be assumed that all academics will spend the same amount of time performing the same activity. Support and guidance must be available to make the best use of available time. Again, creating the right environment seems to be an essential element for the success of PD programs.

Question 7 – Learning a new way of teaching

Table 8: Answers to question 7

		SA	A	N	D	SD
Pre	I believe transforming my unit will require me to learn a new way of teaching.	1	2	1	2	0
Post	Transforming my unit required me to learn a new way of teaching.	0	4	1	1	0

Discussion

Before the project, some participants had a sense that a transformation in their teaching could possibly happen; while other participants did not think they would need to change their teaching. However, by the end of the project most participants acknowledged they had learned alternative ways of teaching.

In this question, the exact meaning of "way of teaching" was deliberately left to personal interpretation. The spirit of the question was to determine if participants perceived a change in their way of teaching, regardless of their personal definition of it.

The one participant who could not decide if a change in teaching would take place during the project changed his perception to Agree in the post questionnaire. On the other hand, one of the participants who agreed a change in teaching would take place changed his answer to neither agree nor disagree. Perhaps the learning that took place did not meet expectations.

One of the most experienced participants did not expect, nor acknowledge any changes in his teaching strategies. It may be that for experienced academics, technology is only an enabling tool, while the main driver to change their way of teaching is sound pedagogy. Overall, the majority of participants acknowledged they learned new ways of teaching.

Take-home message

When given a good reason and support, academics are usually open to adapting the way they teach. Leaders of teaching and learning transformation programs need to reiterate that technology is just a tool. Academics who are given the opportunity and support to adapt their teaching practices will select the appropriate tools to meet their students' learning needs.

Question 8 – Impact on teaching

Table 9: Answers to question 8

		SA	A	N	D	SD
Pre	I expect this project will have a long-lasting impact on my teaching.	0	6	0	0	0
Post	What I learnt in this project will have a long-lasting impact on my teaching.	2	4	0	0	0

Discussion

Answers to the questionnaires indicated that every participant experienced the project in a different way; however all expected and agreed that it would have a long-lasting impact on their teaching. Participants were genuinely interested; hence they engaged and were sufficiently self-motivated to take the challenge of transforming their teaching with technology.

Take-home message

Academics have a natural disposition to learn and adopt knowledge and tools they find useful. Hence PD programs could focus more on creating the right environment for participants than on measuring how much they learned. Given a supportive, academic-centred environment, the learning will happen.

Discussion and Future Work

In the current environment academics have little choice but to adapt their teaching by shifting the focus from content delivery to student engagement and active learning. This project enabled participants to reflect on their teaching and showed them some of the opportunities that are readily available to transform it.

Academics looking for ongoing improvement in their teaching usually volunteer in projects and initiatives of this nature. This may lead to situations where PD opportunities are always taken by the same people. In our case only 9 out of 25 academics in the School volunteered to participate, not necessarily those who need it the most. The challenge is to create an environment that motivates and inspires academics who are less engaged in teaching improvement. Explaining why people do not engage in PD programs is beyond the scope of this paper and further research in this area would be needed.

One of the outcomes of this study is a set of take-home messages to inform the design and planning of more inclusive PD programs. The most important element is having an environment that is academic-centred, work-integrated, and offers freedom of choice. Under these conditions participants changed aspects of their teaching that were important to them. These changes should not be compared as they reflect personal priorities and abilities. Some of the technologies that were adopted were: eMarking, web-based polling, screencast tutorials, tablet-enhanced lecturing, and videos to support flipped-classroom.

Future work will analyse the answers provided in the profile questionnaire and interviews. Our future goal would be to investigate how participants' previous knowledge and image of themselves as academics affects their performance in PD programs.

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