# Using practice architectures theory to compare consecutive offerings of the same subject

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## CONTEXT
Two consecutive offerings (2015 and 2016) of the same subject, Concrete Technology and Practice, prompted opposite reactions from students. The academics involved in 2015 and/or 2016 sought to explore the similarities and differences between these consecutive offerings in reflecting on the learning and teaching practices in their classroom.

## PURPOSE
Practice architectures theory provides a framework for examining and understanding the differences between these consecutive offerings of ostensibly the same subject. This paper also provides an example of how a theoretical framework can be used to examine teaching practices – even our own by practitioners who are also acting as researchers in this context.

## APPROACH
Evidence used in comparing the 2015 and 2016 offerings of this subject is drawn from focus group discussions with students and observations of each of the researcher/practitioners involved. Additional data includes the end of semester Student Feedback Survey results including written responses to open-ended questions.

## RESULTS
Differences in aspects of the cultural-discursive, material-economic and socio-political arrangements of the 2015 and 2016 offerings of Concrete Technology and Practice became apparent from the analysis.

## CONCLUSIONS
Using the theory of practice architectures gave us insights into the inter-relationships between the different arrangements inherent in teaching and learning practices. It also highlighted the resilience of 'taken for granted' practices.

## KEYWORDS
Practice architectures theory, teaching practices, evaluating teaching and learning.

# Introduction

> *Gendering and other discrimination practices…are also very resilient and often difficult to change because,* ***qua*** *practices, they are taken for granted and often considered as part of the 'natural' order of things. The contribution of a practice approach is to uncover that behind all the apparently durable features of our world there is always the work and effort of someone* (Nicolini 2012, p.3).

In the light of Nicolini's comment about practices that are resistant to change, it is fruitful to consider how the practice architectures of the engineering curriculum and university management can constrain certain teaching and learning practices while enabling others.

This paper shows how we used practice architecture theory (PAT) to compare consecutive offerings of the same subject, namely Concrete Technology and Practice. This subject had our attention because in both 2015 and 2016 it was the focus of institutional teaching and learning projects. In 2015, the institutional project involved redesigning the subject in the 'flipped' mode, while in 2016 the project focussed on developing the 'writing skills' expected of postgraduate students at AQF level 9.

PAT provides a framework for examining and understanding the differences between these consecutive offerings of ostensibly the same subject. This paper also provides an example of how a theoretical framework can be used to examine teaching practices – even our own, and hence is an alternative to action research methodologies.

We first provide a brief summary of PAT and the subject Concrete Technology and Practice. We present data collected after each of the 2015 and 2016 offerings of this subject and analyse this data using the theory of practice architectures. We conclude with a discussion of how the practice architectures of the different offerings of this subject enabled and constrained student learning and provided a framework for exploring learning and teaching practices.

# Practice architectures theory (PAT)

The theory of practice architectures has evolved from more general practice theory, so we provide a short summary of practice theory as background to PAT.

The literature on practice theory suggests practices are more than simple activities or actions. Rather, practices are organised and always contextualised (Green, 2009) people engage in "doings and sayings" (Schatzki 2002, p. 81) that bring together combinations of know-how, rules, purposes, personal investments and general understandings and expectations relevant to the nominated purpose (Price et al. 2012). Along with the 'doings and sayings', Kemmis (2009) would also add 'relatings' in recognition of the relational aspects involved in practising. In relation to practices, 'doings' are the actions of participants the physical artefacts they do them with; 'sayings' can be thought of as what participants are thinking and speaking about and the language they use in enacting the practice; and 'relatings' are the relationships between participants in the practice. It is the particular combinations of 'doings', 'sayings' and 'relatings' that define a practice.

Schatzki (2012) suggests that at the base of practices are those 'doings and sayings' that can be described as basic activities, which are often physical activities – such as writing. These basic activities are attached to further activities, such as taking lecture notes and to 'higher level' purposeful activities or teleological action hierarchies, such as developing notes and resources for a subject studied in higher education. Practices are organised by practical rules (explicit instructions or directives), understandings (that is how to do the actions through 'doings and sayings'), teleoaffective structures (including the affective emotions and moods, which are acceptable to the practice), and general understandings of the significance of a practice (abstract worth or value inscribed in the 'doings and sayings') (Schatzki 2012). Moreover, practices are not isolated but bundled with material arrangements so that:

> *...practices effect, use, give meaning to, and are inseparable from arrangements while … arrangements channel, prefigure, facilitate, and are essential to practices* (Schatzki, 2012, p. 16).

Kemmis and colleagues (Kemmis, 2009; Kemmis, 2012; Kemmis et al, 2014; Ronnerman and Kemmis, 2016) developed the concept of arrangements further into 'practice architectures'. Practice architectures are also referred to as ecologies of practice – engineers may see practice architectures more readily as a system in which practices are embedded. The various components of the system, or as Kemmis would say, the arrangements of the architectures, are the cultural–discursive, material–economic and social–political arrangements that prefigure and shape the conduct of practice, i.e. that shape the distinctive 'sayings', 'doings' and 'relatings' characteristic of a particular practice.

One of the attractions of PAT is that it provides a framework for academics to explore their own practice. In this situation the researchers are the practitioners and collect relevant data to evaluate their progress. This is usually their individual and collective (if team-based) reflections, but also the perceptions of other stakeholders such as students. The 'insider' view of educational practice is valued by researchers such as Kemmis who see it as:

> *…meat and drink and earth and air to those teachers who revel in their professionalism and the individual and collective development of their professional practice. It is what gives them joy and pain in their work, and what keeps them thinking deep into the night about how best to respond to tricky practical situations.* (Kemmis, 2012, p.893)

How engineering academics see and define their own discipline is critical in beginning to understand the arrangements that prefigure their teaching practices and that hold these practices in place, while recognising that these practice architectures inhabit the sites where the practices happen (Kemmis et al., 2014, p.14). In this case the site where the practices happen is generally the classroom as well as the LMS space for a particular subject. These academics' views and definitions construct and support the narratives that engineering academics tell about themselves and about their discipline (Pawley, 2009).These narratives can be seen as some of the cultural-discursive arrangements that form the practice architectures of sites of engineering teaching and learning practices.

These cultural-discursive arrangements influence the material-economic arrangements, these include artefacts and processes like timetabling, the arrangement of tables in a classroom as well as what students are required to do in class, what they are required to do out of class, and in their assessment tasks. The narratives also influence the socio-political arrangements, as the dominant transmission mode of teaching practice in engineering means that there is little interaction between students or between students and the academic during lectures, or if there is interaction it follows particular protocols. The socio-political arrangements also include interactions with other engineering academics about learning and teaching practices – who do they talk to, and what's the relationship between them? The cultural discursive arrangements, the material-economic arrangements and the social-political arrangements hold in place the practices of engineering academics in the teaching of their subjects.

# The subject Concrete Technology & Practice

The subject was redesigned in 2015 to be in line with flipped learning models, where individual learning activities precede the face-to-face time, which is used for collaborative problem-solving exercises, as described in more detail in (Gardner and Vessalas, 2016). To allow students to meaningfully participate in the in-class learning activities, resources were created and made available on the institutional learning management system (LMS). These resources included information in the form of slide-packs and videos as well as online quizzes. Students were instructed to access the information and attempt these online questions before the weekly face-to-face sessions. Students were then expected to collaboratively work on problems in class, which was facilitated in a number of different ways such as:

- All student groups worked on the same problem. Students completed questions individually, discussed their answers with the other students in their group and then the instructor would ask the tables to explain their answer to the rest of the class; and
- Groups worked on different problems or different aspects of the same problem, then students from one group would present to the rest of the class, who were expected to listen to the answers and explain why they either agreed or disagreed with the presented solution.

In addition, the types of questions asked in quizzes and the final examination were changed to complement the new subject design by asking students to apply critical thinking skills rather than simply answering purely descriptive questions.

In 2016, a change in the teaching team saw a reversion to the traditional lecture format for the first half of the semester. Other changes included a shortened semester, an increase in the number of students, as the subject was made a core (compulsory) subject in the masters' degree, and a consequent shift in the type of students undertaking the subject – from those who selected to study Concrete Technology and Practice, to those who were obliged to complete the subject as part of their degree requirements.

Evidence used in comparing the 2015 and 2016 offerings of this subject is drawn from the end of semester Student Feedback Survey (SFS) results including written responses to open-ended questions. Additional data includes focus group discussions with students and observations of each of the researcher/practitioners involved. While institutional student feedback surveys of individual subjects do not provide definitive data for individual questions, the trend in responses was interesting. Figure 1 shows the difference in average values recorded for each question in the SFS's between 2014 - 2015 and 2015 - 2016. The survey questions changed between 2014 - 2015 and 2015 - 2016 so there is no directly comparable question for Q2 and Q4. In these surveys, the possible responses are rated 1 - 5 with higher scores representing more positive responses. What is interesting about the trends illustrated in Figure 1 is that between 2014 - 2015 the changes in student responses were all positive while between 2015 - 2016 the changes were all negative and all except Q2 were more than a single unit of change (1/5 = 20%). The general level of engagement of students in the subject is also indicated in the percentage of responding students as this dropped from 63% in 2015 to 35% in 2016. Comments on the student feedback surveys summarised by:

*...this subject exceeded my expectations* [2015],

compared with:

*I would not recommend this subject to future candidates* [2016]

prompted us to compare the 2015 and 2016 subject offerings.

# Findings & discussion

The following section analyses and discusses the data using the lens of PAT. Comments and observations are part of more than one arrangement, and the arrangements themselves are not seen in isolation. The interactions among the arrangements and the elements of practices are dynamic and without clear-cut boundaries. However, to clarify the analysis we consecutively foreground each arrangement under the headings of cultural-discursive arrangements: what people say and think about a practice; material-economic arrangements: what can be done and what is required to be done in a practice, and what is it done with; and socio-political arrangements: how people relate to one another in a practice, including relationships of power and status.

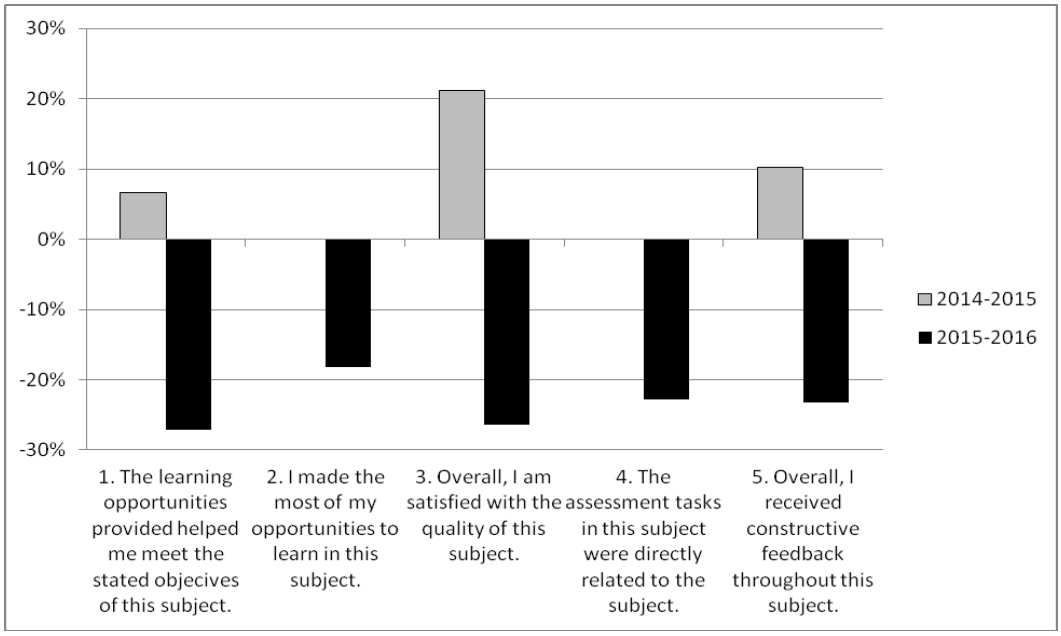


**Figure 1: Changes in averaged responses to the institutional Student Feedback Survey between 2014 - 2015 and 2015 - 2016.**

*Cultural-discursive arrangements*

In 2015, the semester started with a description of how the learning/assessment activities were designed, why they were designed in that format, and how students were expected to learn from them. The two academics involved in teaching the subject were present each week in class and referred back to this description throughout the semester so that students had a language to describe the active and collaborative learning activities they were expected to undertake and the impact these activities had on their learning:

> *...I am being pushed to learn independently which actually helps. Was sceptical of the new process at first, but liking it more and more as I learn.*

Students valued the multiple sources of feedback, one 2015 student commented that feedback in this subject comes from: "*everywhere*", i.e. from the online quizzes, from peers and from the instructor, before the class, during the class and after assessment submission. Other comments described sources of feedback in more detail:

> *Well from here and sitting at the table and suggesting something and someone was saying oh yeah I agree or no, not really. The quizzes, speaking, like when you give that summary and someone had to get up at the end and present the answer to the question.*

Comments from the questionnaire and the focus group reinforced the benefits of the individual work followed by collaborative learning. A key feature of the redesign of the subject in 2015 was the introduction of in-class collaborative problem-solving activities. **All** students who completed the questionnaire (n = 17 of 23 enrolled students) either agreed or strongly agreed that the collaborative problem-solving activities in class helped them learn the subject content because students were expected to apply this content to practical situations. Students commented that these activities helped them understand the content especially because of the opportunity to hear about different students' perspectives:

> *this activity is good, it helps in conveying your knowledge to others in a friendly way, and also we learn from others' point of view and experience - it is good activity;*
>
> *discussion is better way to understand and remember;*
>
> *there is a lot of emphasis on justification which has broadened my understanding;* and,
>
> *I had the opportunity to explain concepts I understood to my peers, and to have concepts explained to me by others.*

Comments from the focus group elaborated further on student perceptions of the usefulness of the collaborative learning activities with benefits coming from their own personal involvement including learning from their own mistakes*:*

> *You retain more information if you're doing it yourself...;*
>
> *You get a chance to learn from your own mistakes...;*
>
> *Your thinking changes...;* and,
>
> *...because you're actually every time involved in the class and you get something extra from the professor. Everywhere else you already know what you're going to get. It's the same module and everything is written, but here you get something else so it's good."*

Some students commented that collaborative learning was **the** aspect of the subject that had the greatest impact on their learning. These student comments show that collaborative learning activities were a valued learning practice in the 2015 class.

The 2016 offering of the subject did not start with a description and justification of the design of the subject, with the result that students approached the subject with expectations based on their prior experiences of learning, including from studies undertaken overseas, as well as previous subjects studied at the University of Technology Sydney:

> *…I am paying you to teach me. I am paying you to provide academics to teach me, I am not paying you to tell me I have to learn this subject outside of face to face interaction….*

In contrast to the 2015 class, feedback was considered to be restricted to the marks and comments provided by the marker on submitted assessment tasks. Quizzes were referred to as a means of scoring marks rather than as preparation for in-class discussion and opportunities for receiving feedback:

> *The online quizzes were graded, contributing to the final mark of this course…I don't think that it is suitable to assess the content knowledge of the subject based upon prior knowledge and self-learning…*

The 2016 institutional learning and teaching project in this subject was focused on trying to improve postgraduate writing skills. This was also not appreciated. The dominant argument from students was that the disciplinary content was far more important to focus on than demonstrating evidence of analytical and evaluative writing skills:

> *I did not undertake a Concrete Technology and Practice subject to be assessed on the way I critically analyse information….*

This discourse aligns with the prevailing engineering narratives in which writing is not seen as a key part of doing engineering (Goldsmith and Willey, 2016; Kranov, 2009; Pawley, 2009).

The way the two academic teams operated had both cultural-discursive and socio-political elements. The cultural-discursive elements relate to the way these academics conceptualise teaching and learning as this affects the way they talk about their teaching and the way they talk about learning to students. In 2015, the two academics involved had similar participatory objectives in the way learning experiences were designed and implemented, i.e. students were expected to collaboratively solve problems in small groups in class, to explain their solutions to the rest of the class and to provide immediate feedback to other groups on their solutions to the problems. In 2016, the two academics involved had different ways of operating in class. The academic responsible for the first 5 weeks of class operated in transmission mode delivering traditional style lectures in contrast to the other academic in this team who was trying to facilitate the collaborative learning activities he had used in 2015. This contrast in how these two academics thought about teaching and learning generated tension between themselves and between students and the academic taking the second half of the semester as many students did not see the collaborative mode of working as "legitimate learning practice" (Beetham and White, 2013). Both the academic responsible for the first 5 weeks of class and the students in 2016 were operating as per the 'taken for

granted' teaching and learning practices in engineering, with some conflict arising when these teaching and learning practices were challenged. The practices of the students and this academic enabled the transmission model of teaching and learning, while constraining more collaborative teaching and learning practices.

*Material-economic arrangements*:

As both Schatzki (2012) and Gherardi (2009) note, practices occur with human and non-human (e.g. tools, technologies, objects) actors in space and time. These material arrangements and non-human actors constitute the practices. For example, in a classroom, practices are constituted by the material arrangements of desks, whiteboards/ smartboards, books, ipads etc. Hence we turn our attention now to these arrangements.

For this subject, class size increased from 23 in 2015 to 77 in 2016, i.e. in 2016 there were over three times as many students as in 2015. This increase in student numbers impacted on the implementation of collaborative learning activities in class and the resourcing needed for marking the two major assignments.

The implementation of collaborative learning activities in class was much more difficult in 2016 than in 2015 because of the room that the subject logistics unit allocated to this subject in 2016. In 2015, the subject was run in a room with moveable tables that provided flexibility in the room set up and easily allowed for small group interaction interspersed with class-wide discussion. In 2016, the room had fixed tables and the large size of the room made it difficult for all students to hear during debriefing activities. Using a microphone helped more students to hear but not all – and this object, the microphone, encouraged one-way communication from the academic to the students so influenced the socio-political arrangement. Furthermore, the number of groups, because of the number of students, made it difficult to facilitate collaborative learning in the same way as was implemented in 2015. The short timeframe between knowing the class size and the start of the semester prevented effective 'scaled up' redesign of these activities.

Another change between 2015 and 2016 was that in 2015 the teaching team involved the subject coordinator (the subject matter expert) and a civil engineer with expertise in the research and scholarship of engineering education. These two academics were both present during class time to interact with students and with each other. This arrangement is in contrast with 2016 where the two academics involved in teaching the subject were both subject matter experts who largely operated asynchronously - one responsible for the first 5 weeks of classes and the other for the remaining 5 weeks. This allocation of academic staff in 2016 was a workload management action initiated by management staff in the School. This can be viewed both as a material-economic arrangement and as a social-political arrangement; see comments in the following sub-section.

Despite the increase in student numbers in 2016, there was not a commensurate increase in resources allocated to the subject. This led to student dissatisfaction in the lack of personalized feedback provided on assignments, and the speed with which they could be marked and returned to students. Finally, another material-economic arrangement that impacted on instructor and student assessment practices was the shortening of the semester – from 14 weeks in 2015 to 11 weeks in 2016. This meant that the teaching and learning activities and related assessment tasks were considerably more compressed over a shorter time, so that the turnaround time between completing/marking one assignment, receiving/giving feedback, and completing/marking the next assignment was uncomfortably tight. Ironically the immediate feedback integrated into collaborative learning activities that was highlighted by students in 2015 would be even more useful in this shortened timeframe.

*Socio-political arrangements:*

It is relevant here to examine the way that the two teaching teams related to each other during class. In 2015, both academics were generally present during classes and modelled the discursive behaviours they were asking students to adopt. This involved one academic

sitting at a student table and participating in the discussion and problem-solving of that group - asking questions of each other, as well as the other academic etc. In this way, the modelling can be seen as both material-economic (the actions carried out in a practice) and socio-political (how people relate to each other in practice).

In 2016, the academics involved worked largely independently and because the learning activities in the first 5 weeks were not designed to be participatory, there was no opportunity for the other academic to participate. This view of teaching as private practice is another dominant paradigm in engineering:

> *Teaching is also regarded by many [engineering academics] as a 'private' activity* (Goodhew 2010, p.93).

The socio-political aspect of the two academic teams is borne out in the relative rank of the individuals involved. The 2015 team consisted of a lecturer and senior lecturer who worked collaboratively with each other. In 2016, the academic operating in transmission mode was a professor who, in view of his rank, did not feel compelled to adopt the blended and collaborative learning and teaching mode of the subject coordinator, a lecturer, and like most research-focused academics, his level of literacy about learning meant that he was not able to and not interested in discussing learning practices. Being a lecturer, the subject coordinator was not in a position to impose his mode of operation on a professor.

The social-political arrangements in terms of the cohort are also relevant. In 2015, students chose to study the subject because they were interested in it and/or they believed it was relevant to their current or future work. In 2016, as the subject became core, a significant number of students were enrolled in the subject because it was a compulsory requirement of their degree. This led to a lack of engagement, which manifested in the teaching sessions when, for example, some students were on Facebook rather than listening during a debriefing session.

Previously mentioned student comments that they are paying to be taught illustrate another element of the 'relatings' between students and academics. This has also been noted by Kemmis:

> *…Australian university students now pay much more substantial fees, and they regard their relationship with university staff as a consumer relationship in which they are entitled not only to tuition and assessment in return for their fees, but rather that they are entitled to success—attaining high grades (with or without assiduous study and excellent performance).* (Kemmis 2012, p.899)

# Conclusions

This analysis has allowed us to view the complex interactions that comprise a site of practice such as an engineering subject. It has also revealed that making changes to one element or arrangement will inevitably impact other elements and arrangements in possibly unforeseen ways. In teaching and learning practices, nothing is fixed; different students and academics will always have their own intended outcomes, no matter how changing or unchanging the 'content' of the subject or the curriculum being taught and learned. What has emerged from this study is the importance of addressing student expectations of learning practices, of making clear to our students and colleagues what we are attempting to do in our practices and why. Perhaps most importantly, we as researchers and educators have gained a deeper understanding of the cumulative effects of changes to seemingly unrelated aspects of our teaching.

Practice architectures theory has given us a framework to systematically explore the differences between the versions of Concrete Technology and Practice experienced in 2015 and 2016. It also allowed us to show how changes in one arrangement, e.g. material-economic can affect other arrangements. To return to the quotation from Nicolini at the beginning of this paper, the insights gained from using practice architectures theory show that we, as engineering educators, need to examine the 'taken for granted' practices that are

embedded in the engineering curriculum, if we wish to effect real and lasting improvements in teaching and learning.

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