# Towards a self-report methodology for STEM research when developing and implementing a blended learning faculty-wide curriculum design framework

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*The purpose of this paper is to describe briefly my "methodology" decision when developing and implementing a faculty-wide blended learning framework for STEM at an Australian university.*

## *Introduction*

The writing of this paper takes place during a time when I was employed as a Lecturer in Blended Learning at Deakin University in the Faculty of Science, Engineering and Built Environment (SEBE). During this period, I was also undergoing a post-graduate research program in blended learning for STEM. As part of my employment outcomes, which were also aligned to my post-graduate studies, I was engaged in the systematic study of my educational practice in an effort to deepen my understanding of the complexities around the role of being a "specialist practitioner" in blended learning for STEM. My primary task was to improve practice and promote instructional change by encouraging teaching staff to consider the benefits for a blended learning curriculum framework for the teaching of STEM subjects.

## *Background*

The requirement for systematic curriculum renewal at Australian universities in the teaching of STEM subjects is not uncommon. For instance, the *University Experience Survey National Report* (2013) highlights the need for improving practice and instructional change due to low percentage "satisfied" rates (45% to 69%) such as "learner engagement" and "student support" (see Figure 1).

*Figure 1:* An excerpt from the *University Experience Survey National Report* (2013): Table 13. Percentage satisfied results by subject area.

**Table 13. Percentage satisfied results by subject area**

| Broad field of education | Subject area | Skills Development | Learner Engagement | Teaching Quality | Student Support | Learning Resources |
|---|---|---|---|---|---|---|
| Natural and Physical Sciences | Natural & Physical Sciences | 77 | 58 | 83 | 54 | 87 |
| | Mathematics | 73 | 53 | 80 | 58 | 87 |
| | Biological Sciences | 82 | 62 | 84 | 57 | 87 |
| | Medical Science & Technology | 80 | 63 | 82 | 57 | 87 |
| IT | Computing & Information Systems | 72 | 58 | 74 | 54 | 81 |
| Engineering and Related Technologies | Engineering – Other | 76 | 63 | 71 | 51 | 81 |
| | Engineering – Process & Resources | 79 | 69 | 73 | 53 | 82 |
| | Engineering – Mechanical | 76 | 61 | 70 | 49 | 78 |
| | Engineering – Civil | 78 | 66 | 71 | 48 | 81 |
| | Engineering – Electrical & Electronic | 73 | 63 | 72 | 51 | 80 |
| | Engineering – Aerospace | 77 | 63 | 71 | 50 | 82 |
| Architecture and Building | Architecture & Urban Environments | 77 | 61 | 75 | 45 | 71 |
| | Building & Construction | 72 | 53 | 70 | 47 | 81 |
| Agriculture and Environmental Studies | Agriculture & Forestry | 73 | 56 | 77 | 54 | 85 |
| | Environmental Studies | 79 | 61 | 84 | 58 | 84 |

Similarly, at Deakin University the *Student Evaluation of Teaching and Units* (SETU) for Trimester 3 (2013) Summary Report for the Teaching and Learning Committee had "good agreement levels (≥70%) for the Science, Engineering and Built Environment (SEBE) faculty with a view to mark improvement in the areas of "manageable workload", "helpful feedback", "library resources", "online technologies" and students being "challenged" (p. 4). As a result, the priority areas for blended learning in the faculty of SEBE were:

- Provide and support a faculty-wide blended learning framework to improve practice;
- Support teaching staff to implement "best" practice models in blended learning for lectures, laboratories and practicals; and
- Provide "best" practice examples for student-centred learning activities such as online and face-to-face collaborations.

During my time as a specialist practitioner, I functioned within a top-down management decision making model (Slade, Murfin, & Readman, 2013) where senior management were mindful of the student evaluation data regarding the University's teaching and learning arena (see Figure 1). As a consequence, I was often advised and directed on the "best" way to engage course directors, unit chairs and teaching staff to consider curriculum changes that would support and implement "best" practice for blended learning, and that were student-centred. Simultaneously, I was expected to operate independently as a specialist practitioner in blended learning for STEM. However, I did not participate in the teaching of STEM subjects in our faculty, and as a consequence, I often felt that I was being viewed by teaching staff as an "outsider" to the "naturalistic setting", especially around the teaching of STEM subjects (Barab & Squire, 2004, p. 2). Therefore, potential pedagogical uncertainties that I felt I would face while developing a faculty-wide blended learning framework afforded an avenue worth exploring. As part of this process it was important to decide on an effective methodology that would suit the faculty's blended learning focus as well as my researcher's identity.

## *Design experiment*

The commitment to examine and understand the messiness of real-world practice, and working with my post-graduate supervisor, mentor and colleagues when designing a blended learning framework for STEM led me to consider "design experiment" as a suitable methodology. First, I required a methodology that allowed for a series of approaches with the intent of producing new theories, artifacts, and practices that accounted for and potentially impacted learning and teaching for STEM (Barab & Squire, 2004). Second, I needed a data collection process that would allow me to analyse the outcomes of the intervention and refinement of the design experiment. Third, the theorization of the operation of practice and product was important, because ultimately it would lead towards improving the "design" and influencing practice (Cobb, Confrey, diSessa, Lehrer, & Schauble, 2004; Ruthven, 2005). Finally, I required the opportunity to deepen my understanding of the project as it was being planned, created and implemented (and while it was continually being used). I therefore chose "design experiment" (Barab & Squire, 2004) because it allowed for the collection of a variety of records that are from multiple levels (for retrospective analysis), which were imperative for drawing rigorous conclusions. In addition, self-report (qualitative) data collection was encouraged in the literature for design experiments. This aligned nicely to my researcher's identity as I had already published modestly using qualitative methods (see for example http://www.deakin.edu.au/profiles/rachael-hains-wesson). Essentially, I knew that this type of data gathering would be something that I could easily access and maintain over a long period. Self report methods that rely on the collection of multiple qualitative data points was an important element of a design experiment methodology (Cobb et al, 2004; Confrey, Bell & Carrejo, 2001).

Despite the usefulness of such a methodology, it is worth noting as Zeichner and Noffke (2001) comment, that researchers might become limited by their preconceptions, because it is often difficult to avoid bias towards self-validation. This point is important, but other researchers have also suggested otherwise. For example, they have expressed that such a methodology strengthens educational discourse, supports change in curriculum and pedagogy, and improves the quality of students' learning experiences (Barab & Squire, 2004; Gorard, Roberts & Taylor, 2004; Ruthven, 2005).

## *Observations*

The purpose of using a design experiment methodology that relied on self reporting was twofold. First, to effectively describe, interpret and analyse my experiences pre-, during and post-design of a faculty-wide blended learning framework for STEM. Second, to impact local practice around blended learning in STEM while advancing blended learning theory that will be of use to others. The following research questions guided the inquiry:

- In what ways does a design experiment methodology for developing a faculty-wide blended learning framework for STEM contribute to and/or detract from improved practice and instructional change?
- In what ways does a self-report method contribute to an understanding of the use of the blended learning framework for STEM?

It is important to note, that design experiments are messier than customary experiments and often do not have a prescribed procedure for dealing with the difficulties presented by its untidier type (Gorard et al, 2004; Sloane & Gorard, 2003; Shaverlson & Towne, 2003). With this in mind, I still feel confident undertaking such a research project using a design experiment methodology, because not only will it aid in meeting the faculty's urgencies for blended learning, this method is suitably affiliated to my researcher's identity.

## *Conclusion*

This paper is a brief account of the methodology I have chosen when undergoing a research project that investigates the planning and implementation of a blended learning framework for STEM. I plan to produce a series of future papers, which are forthcoming, in order to highlight the specific phases of the design experiment via self-report to aid in refining and evaluating the faculty-wide blended learning framework for STEM in terms of its success or otherwise.

## *References*

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