

Using the 'Most Significant Change' Methodology to Study Innovations in Pre-Service Science Education

Paul Chandler

Australian Catholic
University

chandler.paul.d@gmail.com

Nicholas Reynolds

The University of
Melbourne

nreyn@unimelb.edu.au

Christine Redman

The University of
Melbourne

edmanc@unimelb.edu.au

The Most Significant Change (MSC) approach, widely used in the recent 'Teaching Teachers for the Future' project, develops qualitative accounts of the experiences of participants in a project. These accounts are thick descriptions of events from the participant's own perspective and are used to identify, amongst other things, values and unexpected changes. The methodology is participatory and iterative in nature and requires participants and interviewers to work together to describe significant change. In this presentation, we outline how we have used MSC to learn from attempted innovations in teaching and learning in teacher education programs, particularly in pre-service Science education.

Introduction

This paper reports on a collaboration that arose from a shared vision that a major contribution of information technology is its potential to support knowledge creation and sharing (Dede, 2009). Notions of collaboration have been increasingly embraced as core to science learning (Harlen, 1993) and in teacher's professional learning experiences (Skamp, 2012). Previously (Chandler & Redman, 2012) we have reported in more detail on the particular initiatives to redesign a pre-service primary science education program to embrace these perspectives. In this paper, we focus on the methodology to both study the impact of that redesign and provoke further cycles of iterative development.

The redesign has emerged from the educational perspective of the second author (the program co-ordinator in this study): if one believes that good learning arises from discursive spaces and self-initiated personal learning networks, then we should endeavor to have teaching reflect this. In addition, improving both collaborative thinking and ICT competence is an imperative for soon-to-be teachers whose work will be with students whose lives are increasingly digital (Stevenson, 2008). This paper is situated in the stories of one academic (co-ordinating a 'primary science method' program for 135 teachers-in-training) together with the stories of her students.. Please make sure you do not change margin settings etc etc throughout.

Teaching Teachers for the Future

A desire to ‘try more things’ to embrace this perspective on education has conveniently coincided with the institution's participation in the Teaching Teachers for the Future (TTF) project. TTF has been a nationally funded project that included all 39 Australian Teacher Education Institutes. Its main aim was to increase the capacity of graduate teachers in their use of ICT to support and enhance learning. It endeavored to achieve this by supporting university academics in their ICT practice. The project has identified the Australian Institute for Teaching and School Leadership (AITSL) Standards for Australian Teachers as a measure of graduate capacity in their use of ICT. In order to accommodate the introduction of an Australian Curriculum, TTF focused on the four key learning areas that had been identified as the first phase of the Australian Curriculum introductory process: Science, Maths, English and History; at the institution described in this paper, the principal focus has been on Science education. The project is made up of three components, as shown in Figure 1.

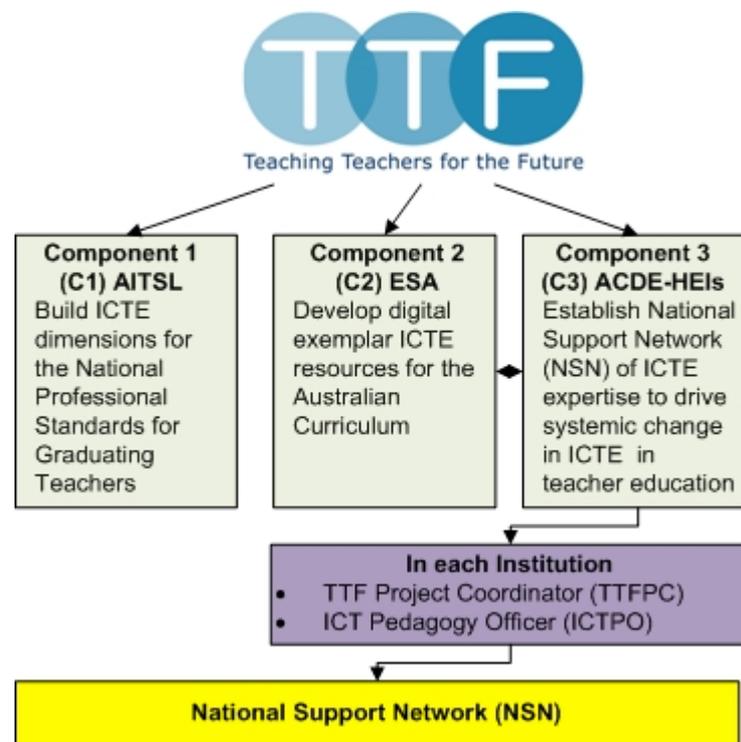


Figure 1: The three TTF components (TTF, 2011)

The national project provided funding for each institution for an ICT Pedagogy Officer (ICTPO) and for a TTF Project Coordinator (TTFPC). The TTFPC position was typically a university academic who received workload ‘buy out’ to allow them to coordinate the project, and in this instance has had a minimal, background facilitation role in relation to the work described. At the University of Melbourne, the ICTPO was an external person brought into the institution to work with and support academic ICT practice (the first author of this paper). The lecturer receiving support through the TTF project (the second author of this paper) was an experienced Science educator, with a track-record for innovation, who was seeking to further develop her pedagogy.

'Most Significant Change' Methodology

The Most Significant Change (MSC) technique is a form of participatory monitoring and evaluation. It is principally the invention of Rick Davies, and described thoroughly by Davies and Dart (2005). The process involves the collection of significant change (SC) stories from the field, and the systematic selection of the most significant of these stories by stakeholders. Those involved in selection initially apply themselves to 'searching' for project impact. Once changes have been captured, various people sit down together, read the stories and participate in in-depth discussions about the value of these reported changes. A successful outcome is where whole teams of people begin to focus their attention on program impact.

In the years of its genesis, MSC had been referred to by several names, each of which emphasise a different aspect. Two of these are as follows, which clarify the "flavour" of the research. "The story approach" indicates that the central data gathering is in the collection of stories which are themselves a response to a central question about change, and describe who did what, when and why and the reasons why the event was important. "The evolutionary approach to organisational learning" reflects the epistemology and reflects 'who' the research is fundamentally 'for'. Davies and Dart (2005) use several metaphors to describe MSC, one of which is 'holiday memories':

What do you remember from an overseas holiday? Do you remember the average things or the wonderful and terrible things? MSC helps teams of people focus on the memorable events and uses these events to help realign effort towards achieving more of the wonderful things and less of the terrible things (p. 16).

MSC arose not in relation to educational research or change. Rather, it was an attempt to meet some of the challenges associated with monitoring and evaluating a complex participatory rural development program in Bangladesh, which had diversity in both implementation and outcomes, and very large numbers of people involved (some 500 staff and more than 46,000 people). MSC was adopted as one of the research methodologies for the TTF project. It is a methodology which can operate at a suitable scale and can embrace the diversity of implementation and outcomes which would be present, and is designed to focus attention on program impact. The TTF is almost certainly the largest educational application of MSC to date.

Davies and Dart (2005, p. 11) describe 10 phases for the implementation of MSC.

1. **How to start and raise interest.** The focus here is really on stimulating a large organisation to engage in organisational learning firstly, and then on MSC as an approach. For us, we were already 'caught up' in the wider TTF project, and individually committed to the merits of writing and sharing practitioner stories and of an evolutionary, person-centred to practitioner learning.
2. **Defining the domains of change.** 'Domains of change' are deliberately fuzzy and allow people to have different interpretations of what constitutes change, and stand in contrast to 'good indicators' which are supposed to be specific, measurable, achievable, relevant and time-bound. However, it is important to understand the broad reference points to which participants might respond, which might, in rural development programs, be 'quality of people's lives' to 'environmental sustainability'. In our case the domain of change was a given, and encapsulated in the prompt "Think about the list of changes in your thinking about ICT and the activities

you participated in. Identify the most significant one from your point of view? Can you describe why this activity changed your thinking?

3. **Defining the reporting period.** Within the TTF, stories were collected from around Australia either just before or just after the first twelve months. In our case, the project was somewhat slow to take root, and the innovations were commenced in late February, and the stories collected between early June and late November.
4. **Collecting stories.** In our case, stories associated with the above prompt were collected by verbal discussion/interview, which were subsequently transcribed, and the participants given the opportunity for correction, elaboration or other editing. Stories were collected from the teacher educator and volunteer pre-service teachers. For the pre-service teachers, the conversation which took place was that of a “group discussion”, deliberately fostering the cross-fertilization and validation of ideas.
5. **Selecting the most significant of the stories.** This is presumably still “in progress” for the TTF on a nation-wide basis. In our case, it is the point where we are up to. As monitoring and evaluation of large-scale efforts, MSC explicitly involves an iterative process of selecting and pooling the change stories. At each level, the participants are well versed in the ‘domain of change’, and the effort is to identify stories which describe project impact and align future efforts to focus on the ‘positive’ outcomes. The participation of teams in the story selection process is itself valued as a way of facilitating personal or organisational change.

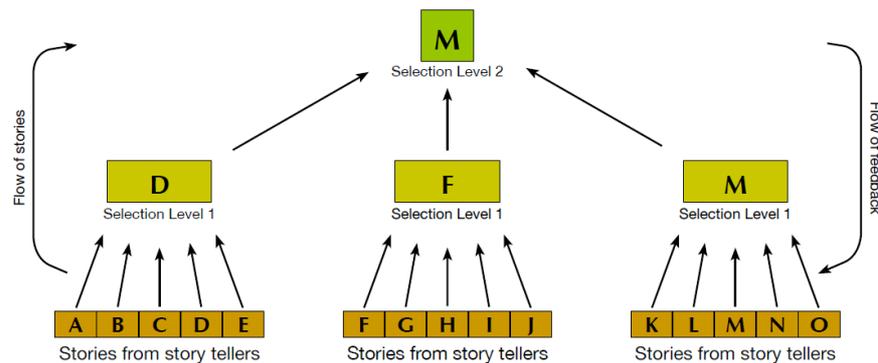


Figure 2: Flow of stories and feedback in MSC (Davies and Dart, 2005, p. 29)

The process is not hard to see for a large organisation (though implementation may not be easy). In our case there are relatively few stories, and relatively few levels. So being “up to” this point involves a range of philosophical and epistemological decisions about ‘who are the learners?’, ‘how many levels?’ and ‘what is the feedback process?’.

6. **Feeding back the results of the selection process.** Clear means of providing feedback to participants is a key feature of the approach.
7. **Verification of stories.** This is the process of developing confidence that the stories shed light on what actually happen. It involves such things operating protocol for each of the ‘selection groups’ and the extent to which feedback (possibly multiple cycles thereof) are crucial before ‘settling’ on various accounts.
8. **Quantification.** This is recognition that MSC is not the only methodology for reporting on change or monitoring impact, and in large-scale organisations and

- projects, it fits very well within a mixed method approach. In the TTF, both quantitative methods and MSC was used.
9. Secondary analysis and meta-monitoring. Secondary analysis may involve the identification of themes across a set of stories and meta-monitoring will focus more on the attributes of the stories, (e.g. the origins of each of the stories, including who identified them, who selected them, etc.) This adds to the legitimacy and rigour of the MSC methodology.
 10. Revising the system. Revisions are made to the approach for subsequent iterations.

Learning from, and with, the stories

Elsewhere (Chandler & Redman, 2012), we have described the technologies which we experimented with (edmodo, ipads and todaymeet) and the associated pedagogical principles (flipped classroom and back channel). Here we start to make headway into selection of stories which describe project impact and align future efforts (stage 5 of the MSC process in particular) and articulate some of the issues.

In order to get a reasonably quick ‘foothold’ onto the themes which might be present in the various stories, the words of the discussion from the lecturer and teachers-in-training were analysed using Leximancer text mining software. This type of software can be used to analyse the content textual documents and to provide a thematic overview of the material, representing the main concepts contained within the text and how they are related (c.f. Stockwell, Colomb, Smith & Wiles, 2009; Smith & Humphreys, 2006).

Using this approach, the stories share in discussion with lecturer can be seen to identify two sets of linked concepts: ‘teaching’, ‘people’ and ‘edmodo’; and ‘talk’ and ‘think’. Both sets embrace the notion of knowledge creation and sharing identified which was identified as a goal. Edmodo was employed as particular technology to support discursive approaches, and that is reflected in the first set. Therefore, we see in the transcript from the lecturer consistency between the goals articulated at the start and the stories which were told towards the end of the process.

Thus far, stories from two teachers-in-training have been collected. Content analysis of the stories shared by these students suggests two sets of linked concepts. The first includes is primarily centred on the ideas of ‘classroom’ and ‘students’, and emphasises their work in classrooms and with students in the months following their engagement in the ‘primary science education’ subject, and includes ideas of schools, teachers and technologies. The second set emphasises the work of the lecturer in introducing them to edmodo, and also connects with ideas of ‘people’ and ‘science’. This suggests that the discursive approach is present in their thinking, but more retrospectively than a feature of current work in classrooms.

Whilst we have some stories, and some apparent commonality between them, the task of selecting stories which describe project impact and align future work is the one we are endeavouring to progress. Use of MSC in a relatively small scale effort in Science education has some important differences with a large-scale rural development program. Certainly, there are fewer stories to collect. Moreover, the teachers-in-training may not have the same long-term vested interest in the effectiveness or nature of a particular course of study (and also may be harder to track down) than do villagers in Bangladesh. This raises the issues of “who participates in the selection process”, “how many levels of selection are there” and “how extensive is the feedback loop”.

Two lines of work are presently being explored. The first is for the ICTPO, TTFPC and teacher educator to work independently to identify salient stories from the interview/discussion data, for these to be then fed back to the teacher educator for review, and in discussion make a final identification of 'representative' stories and identify areas for future action. The second approach is to revisit the teachers-in-training some time later, after a substantial experience in the classroom as teachers in their own right. Certainly, the intention is to create a second round of stories, reflecting on the impact of the particular program/approach on their professional journey, but it also opens up the possibilities for widening the participation in the selection process.

We have found Most Significant Change to be a helpful participatory and reflective process, and are progressively considering the methodological issues so that we might more clearly grasp the 'real' impact when ICT intersects with Science education.

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