Making generative sense of collective learning: Teachers as e-designers of professional development in K-6 Science and Technology

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Communities (including online communities) appear to provide powerful contexts for the professional development of teachers. Yet, despite the apparent educational potency of groups, professional development research has almost exclusively focused on describing and explaining the learning of individuals. In a world now overwhelmingly characterised by collectivity (not singularity), there are compelling reasons for adopting a collective perspective on learning, for exploring the usefulness of new learning technologies in making such a perspective possible and for examining the worth of such an account.

We take up the challenge of developing a preliminary position on group learning in this paper. We describe and analyse aspects of the learning of a group of teachers in the first phase of DESCANT - SciTech, a large ARC-funded e-learning research and development collaboration between the University of Technology, Sydney and the NSW Department of Education and Training (DET). In so doing, we address the strategic challenge of how to gather data and report stories of group (not just individual) learning, and the conceptual one of how to explain and understand the growth of this professional group. In conclusion, we speculate as to the importance of this first step in developing a contemporary approach to professional (self-) renewal.

Introduction

Vygotsky’s (in Cole, John-Steiner, Scribner and Souberman, 1978) central belief in the potency of social contexts for individual learning is now widely accepted in education. Descriptions of craft-based communities of tailors and midwives (Lave and Wenger, 1991) and more recent analytical syntheses (for example, Wenger, McDermott and Snyder, 2002) of what are now called communities of practice have been turned into strategies to serve education broadly - and the professional development of teachers in particular.

So, teacher professional development is increasingly being conceived as a sustained group process in which the learning of participants is (at least partly) a product of their engagement with a professional collective (for example, Yagamgata-Lynch, 2001; Seels, Campbell and Talsma, 2003). The collective has long been regarded as more than the sum of its parts; and this philosophy informs the social interdependence theory that is at the heart of co-operative learning, for example (Johnson and Johnson, 1996). Nevertheless, analyses of co-operative groups typically focus on how individuals benefit educationally from their groups rather than on the learning progress made by the group itself. Eraut (2002) highlights this distinction, “…we have to ask how to define learning by a group, differently from learning by its individual members” (p.4) In essence, he challenges researchers to understand how teachers learn in groups as well as how the group itself learns.

Typically, researchers have used the concept of community of practice to describe a group’s progression in terms of changing patterns of participation or ‘practice’, at the level of the collective. (See, for example, the ‘GlSML Community’ in which a group of teachers undertook a year long program based around professional dialogue and investigation closely coupled to ongoing classroom practice (Palincsar, Magnusson, Marano, Ford and Brown, 1998).) Many researchers of online communities have used the notion of community of practice socio-culturally. For example, Barab, Mackinster and Scheckler (2004) analyse participation, within the online Inquiry Learning Forum (ILF), in terms of a set of dynamic system dualities (after Wenger, 1998).
Recently, however, some researchers are warning against the over application of the concept of community of practice, beyond the data available (Schwen and Hara, 2004; Kling and Courtright, 2004). Based on his own empirical studies of the learning of groups, Eraut (2002) cautions against uncritical use of ‘social relations’ (p.4) as the dominant basis for analyzing the learning of groups. He argues that viewing learning as acculturation risks overemphasising the established commonality of the group and neglecting the diversity newcomers will bring. The following three examples illustrate different ways of resolving this problem. First, Grossman, Wineburg and Woolworth (2001) offer an alternative ‘intellectual’ dimension. These researchers describe a progression from a group of individual learners (high school teachers undertaking professional development) to a learning collective, or community. They "...sketch the developmental trajectory of intellectual community among teachers" (p. 944). Whilst still recognizing the importance of the social dimensions of community, this ‘intellectual’ dimension affords a level of description and analysis of the learning of groups, which seems only implicit in the findings and conclusions of research based solely on socio-cultural analysis. Secondly, Scardamalia and Bereiter’s (1994) focus on knowledge building communities formed the basis of a preservice education course described by Lamont, Reeve and Caswell (1999). Through a collaborative computer network known as the Knowledge Forum, the group of participants (including classroom teachers, student teachers, researchers and primary students) developed their shared knowledge-base in the domain of the physical sciences. In describing the group’s progression with reference to particular scientific concepts, these researchers, like Grossman, Wineburg and Woolworth, articulate an intellectually based progression that seems to extend socio-cultural analysis. Thirdly, Hewitt (2004) has employed activity theory to undertake an analysis of group progression in a knowledge building community of primary students. Whilst not explicitly related to teacher learning, Hewitt provides a strong example of analysis that incorporates the progression of specific scientific knowledge in the group.

The notion of a progression of collective or community knowledge is not new to the corporate or scientific communities. In the former communities, such progression has been described in terms of a transformative dynamic (for example, Senge, Kleiner, Roberts, Ross, and Smith, 1994); in the latter, progression depends on the scientific community’s critique of knowledge (Woolgar, 1988). Now, this notion is gaining momentum as a focus for teacher professional development. For example, Hiebert, Gallimore and Stigler (2002) advocate the development of a knowledge base for teachers that incorporates a dynamic mechanism for verification and improvement. This focus on cumulative professional knowledge that is both public and storable is evident in the development of these researchers’ Lessonlab software, an e-learning mediated professional development system that builds a database of video cases and associated material. A burgeoning literature recognises the utility of new learning technologies for creating, building and sustaining diverse educational communities, with a range of personal and social benefits (Maor, 2003; Brunnvand, Fishman and Marx, 2003; Schlager and Fusco, 2004; Barab, Mackinster and Scheckler, 2004). Such examples illuminate an expanded conception of professional development that is “...both personal and professional, both individual and collective, both inquiry-based and technical” (Lieberman, 1995, p.3). Indeed, it is here, in just such an e-learning mediated community, with the potential for studying a teacher group’s progression of learning over time, that the large ARC-funded Linkage project (DESCANT – SciTech) (of which the present paper is a part) takes place.

In this paper, we present and explore the worth of our new approach to describing and analysing collective learning - an approach that derives from our e-learning research and development group’s (biologically based generative) theory of learning. We preface our presentation first, with an overview of generative learning, next, with a description of the design of the DESCANT – SciTech study and finally, with some brief comments about our research approach.
A biologically based generative theory of learning and its associated model of natural learning

We have described in detail elsewhere our biologically based generative theory of learning and its implications for technology-and-science education (Schaverien and Cosgrove, 1999, 2000) and have reported its worth in making sense of individual students’ and teachers’ learning (for example, Hall and Schaverien, 2001; Schaverien and Cosgrove, 1997; Schaverien, 2003) and in re-conceiving e-learning design (Clendinning, Shepherd and Schaverien, 2002). In this paper, we test the utility of a generative view in describing and analysing the collective learning of a group of teachers.

In essence, according to our biologically based generative view, learning is an adaptive behaviour - one that hedges our chances of survival. In Edelman’s (1993) words, “To survive in its econiche, an organism must either inherit or create criteria that enable it to partition the world into perceptual categories according to its adaptive needs” (p. 115). We have previously written of it:

According to Plotkin (1994), individuals procure such knowledge in a nested hierarchy of ways: through their genetic code, by their own actions and from the culture. That is, such a view identifies, as learning, the development of genetic knowledge, within-organ knowledge (in brains and immune systems) and cultural knowledge (such as that of technology-and-science), three processes which have previously appeared unrelated. … [Furthermore, learning at all three of these nested levels can be characterised as a heuristic of] first, generating variants, second, testing them, and third, regenerating and hence propagating those variants that have survived the tests, that is those that have been selected. Plotkin (1994) has termed this the g-t-r [or generate-test-regenerate] heuristic. (Schaverien and Cosgrove, 1999, p. 1227)

This synthesis of biological and cultural learning is evident in the work of a growing number of researchers harnessing ecological and dynamic systems perspectives for the understanding of cognition and learning (for example, Capra, 2002; Maturana and Varela, 1987; Varela, Thompson and Rosch, 1991), and development (Thelen and Smith, 1994). Our group has also proposed a model for technology-and-science education, identifying generative learning with the following six acts: exploring, designing, making, operating, explaining and understanding1. Amplifying this model we have written,

Though these acts occur contiguously, they [can be] teased apart in order to describe them. Learning may ‘begin’ with any of the five [now six] and learners then take an idiosyncratic learning path, following connections [between them]. (Schaverien and Cosgrove, 2000, p. 20)

Clear connections exist between the g-t-r heuristic and this six-act model derived from it. Broadly speaking, we can identify

- Exploring as the generative component,
- Designing, making and operating as testing components and
- Explaining and understanding as regenerating components of the g-t-r heuristic.

It is in this form that we will make use of this biologically based generative view to try to describe and analyse a teacher group’s learning.

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1 This original model appeared in print in Schaverien and Cosgrove (2000) with five acts of natural learning (excluding operating). Cosgrove has since proposed, in conversation, that operating be specifically differentiated from making, thereby constituting a sixth learning act.
The DESCANT - SciTech Project: A context for group learning

DESCANT - SciTech is exploring the worth of an innovative, future-oriented strategy for scaling up teacher professional development in elementary Science and Technology education in a large, operationally diverse and geographically diffuse education system. (The acronym DESCANT – SciTech denotes the full project title: Designing e-learning systems to celebrate and nurture teaching – in Science and Technology. It portrays teacher learning metaphorically, as a decorative line in music, one that harmonises with and thereby embellishes the main melody of student learning.) The project’s research design hinges, initially, on bringing together a small group of teachers, consultants, Departmental officers (in Science and Technology disciplines and IT domains) and University researchers. In this group, in the first phase of the study, teacher-participants are being supported to conceive and prototype their own e-learning mediated environment for teacher professional development in Science and Technology education – an environment able to be extended, in use with subsequent cohorts of teacher-designers/learners. In the second and third phases of this study, the initial prototype will be trialed, modified and evaluated, with larger groups, and its success in providing a systemic, sustainable approach to teacher self-renewal in Science and Technology examined.

Two rural school districts were selected to initiate the DESCANT project, in recognition of DET’s strong interests in remote and rural education and to test the project approach’s potential in this context. The Science and Technology consultant (FL) in these two districts called for expressions of interest from schools known to her. We aimed to establish a network of about five participant schools, with two self-nominated teachers in each school. Ideally, we sought a broad cross-section of teachers, with respect to years of teaching experience and confidence in Science and Technology and their teaching. Two meetings of interested teachers were held. Researchers explained that participation in the first phase of DESCANT would engage teachers with activities (mainly by immersion in a range of e-learning environments and through web-mediated discussion in the DESCANT community) designed to support their conception and subsequent prototyping of an e-learning environment for teacher professional development in Science and Technology education. Eleven teachers volunteered to participate, in six schools – one deputy principal considered the project so interesting that he asked to participate without funding, alongside two funded members of his staff. In all schools, except two, there were at least two participant teachers – and in the remaining two schools, small country schools relatively close together, two teachers agreed to work collaboratively.

Once all teachers had signed up to the project in late July, conversations about Science and Technology learning, teaching and professional development were held – and videotaped - with each pair/trio of teachers - or individually in schools with only one participant teacher, so as to meet teachers and provide baseline data about their views at the beginning of the project. A week later, all teachers met for the first time to attend a preliminary workshop at one of the district offices. They talked informally and then formally about learning and teaching generally and learning, teaching and professional development in Science and Technology in particular. We acquainted them with the DET Webboard, which was to be the mainstay of conversation and communication for the DESCANT community in planned conversations leading up to and beyond the conception of their e-learning environment. As well, we introduced them to the Generative Virtual Classroom (GVC) – an e-learning environment that LS had developed and used in teacher education (see Table 1 for names of participants). The GVC was to occupy a central role in DESCANT’s research design. Through their immersion in the GVC, teachers gained their first, and arguably, most powerful “object-to-think-with” (after Papert, 1980) about e-learning environments and their potential role in professional development. Other objects-to-think-with included teachers’ immersion in the DET Webboard itself and a virtual excursion arranged by LF to another e-learning environment. These planned experiences, about which more will become clear later,
deliberately addressed the risk that without clarity about new paradigms or educational media, teachers might design an e-learning environment that “[filled] in the gray areas based on their existing understandings and practices” (Stein, Smith and Silver, 1999, p. 950).

Table 1: List of DESCANT participants

<table>
<thead>
<tr>
<th>Abbreviation/ Pseudonym</th>
<th>Position</th>
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<tbody>
<tr>
<td>LS</td>
<td>Chief Investigator, UTS</td>
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<tr>
<td>LF</td>
<td>PhD Student , UTS</td>
</tr>
<tr>
<td>FL</td>
<td>DET officer</td>
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<tr>
<td>IR</td>
<td>DET officer</td>
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<td>KE</td>
<td>DET officer</td>
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<tr>
<td>VG</td>
<td>DET officer</td>
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<tr>
<td>FQ</td>
<td>DET officer</td>
</tr>
<tr>
<td>TA</td>
<td>DET officer</td>
</tr>
<tr>
<td>Kirsty</td>
<td>Teacher</td>
</tr>
<tr>
<td>Cynthia</td>
<td>Teacher</td>
</tr>
<tr>
<td>Anna</td>
<td>Teacher</td>
</tr>
<tr>
<td>Vic</td>
<td>Deputy Principal</td>
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<tr>
<td>Roger</td>
<td>Teacher and Technology Coordinator</td>
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<tr>
<td>Kate</td>
<td>Teacher</td>
</tr>
<tr>
<td>Kylie</td>
<td>Teacher</td>
</tr>
<tr>
<td>Sarah</td>
<td>Teacher</td>
</tr>
<tr>
<td>Isobel</td>
<td>Teacher</td>
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A second workshop, the Design Workshop Day, was held two and a half months later. By this time two teachers had failed to contribute at all to the project due to personal circumstances. Neither teacher attended this Workshop. (At the time of writing, both have left the project, one by choice and one as a result of taking a position at another school.) In the morning session, LS led a conversation aimed at deconstructing the theoretical basis of the GVC and a companion e-learning environment, *Where does the cold come from?* In the midmorning session, teachers worked to distil their highest priority purposes for the e-learning environment they were to conceive and some indicators by which they could gauge whether these purposes had been achieved. In the afternoon session, the group conceived, in first draft, the design of their e-learning environment for teacher professional development in Science and Technology education. The day’s work was supported by a folder of materials including summaries LF had prepared of the relevant aspects of the group’s Webboard discussions. Subsequent to this workshop, teachers returned to their schools to put together materials (including video excerpts captured in their classrooms and text files that might support these excerpts in the environment they designed for the professional development of K-6 Science and Technology teachers). They undertook to submit these materials to the UTS members of the DESCANT team by year’s end so that their prototype could be built in good time to begin Phase Two.

**Our design-based research approach**

As will be clear from this outline of DESCANT, our approach sits comfortably within what is now claimed to be an emerging paradigm for educational inquiry: a design experiment or simply, design-based research (after Brown, 1992; Linn and Hsi, 2000; Cobb, Confrey, diSessa, Lehrer and Schauble, 2003; Barab and Squire, 2004). According to the Design-based Research Collective (2003, p. 5), such research “blends empirical educational research with the theory-driven design of learning environments, [thereby fashioning] an important methodology for understanding how, when and why educational innovations work in practice.” Furthermore, this group distinguished design-based research from experimental...
design, studies of designers or trial teaching methods, on the basis of five identifying characteristics:

1. The key goals of designing learning environments and developing theories of learning are intertwined.
2. Development and research take place through cycles of design, enactment, analysis, and redesign.
3. Research on designs leads to sharable theories informing practitioners and designers in relevant ways.
4. Research accounts for how designs function in authentic settings, documenting success and failure and helping to understand the learning issues involved.
5. Development of such accounts uses methods that document and connect implementations to outcomes.

In particular, DESCANT’s research design proceeds directly from those generative learning principles we have already described. We designed a context with opportunities for generative learning for a group of learner-teachers: that is, with the aim of gathering and then using, iteratively, intimate, specific and explicit knowledge of how teachers generate and test ideas together, and of their group’s insights into this process. To this end, we adopted established anthropological research approaches, well-accepted in case study, such as conversations and other participatory techniques (Miller in Whitehead, 1998); and we tapped multiple data sources including face-to-face and telephone conversations with individual teachers, pairs and groups, transcripts of Webboard discussions (including solicited and unsolicited postings and contributions to other self-contained e-learning environments), video and audio recordings of workshop days, individual and group designs and other classroom-related materials (including videos teachers captured in their classrooms and other documents, such as lesson plans and work programs).

In this paper, we have chosen to pilot our approach to describing and analysing the group learning that occurred by choosing two short vignettes.

**Describing and analysing the learning of a group of teachers: Two Vignettes**

The first vignette occurred on the Webboard as the subgroup of teachers contributing at the time debated the relative worth of video, and then of macro and micro video views of classrooms, for teacher-learners such as themselves. The second occurred during a face-to-face workshop day as the whole group (including university researchers and DET officers) discussed features of one of the components (the personal notepad) teachers wished to include in the prototype e-learning environment they were designing together. Many other contexts for the group’s learning could have been chosen for the purposes of this paper. However, we believed these two vignettes could be examined for evidence of collectivity across several of the six acts of natural learning (exploring, designing, making, operating, explaining and understanding) at this early stage of our study. As well, our choice of an asynchronous and a synchronous context remained true to the nature of our blended study.

**Vignette One: Debating the relative worth of macro and micro video views of classrooms**

Early in Phase One, the group familiarised itself with the Generative Virtual Classroom (GVC), an e-learning environment developed by LS for assisting teacher education students to develop their theories of learning. This environment had been deliberately selected as an “object-to-think-with” (after Papert, 1980, p.11) about e-learning mediated environments for professional development, and in particular, environments designed on the basis of a principled approach to learning (in this case, generatively principled, after Schaverien and Cosgrove, 1999, 2000). As expected, as the project progressed, there were many instances of sustained conversations amongst several participant teachers, expressing aspects of collective designing. After all, DESCANT teachers were moving towards designing a prototype e-
learning mediated professional development environment. FL (11/8) provoked just such an early discussion in the group with the following words:

Because [in the GVC videos] we get to see one or two children, not what's going on in the rest of the room and especially not the teacher in action, it doesn't seem to me like watching a colleague at work. What it does do [is] it lets me watch *kids* in a way I can't in my own classes…What do people think are the pros and cons of using video clips?

The discussion of the GVC videos that was to follow allowed the group to develop a shared pool of ideas and a range of values, by which to make design decisions related to their own e-learning environment.

Roger (11/8) expressed both support and caution in relation to the use of video for professional development:

Videos can be valuable for specific purposes- such as the GVC. They can never be a substitute for actually being present in a teaching space. The clinical view of the camera lens screens us from the larger view- that’s appropriate for a focused task…Balance is a consideration. In viewing the GVC clips I get the notion that these children have reasonable to very good verbal communication. What of the child who has difficulty communicating their opinions/understandings verbally? Perhaps images of designs, plans sketches, models? Just rambling on, now. Will post this before I change my mind!

Isobel (12/8) responded by advocating a different function for the videos than was intended through the GVC: she urged the need for a less finely resolved picture, one that let us see a classroom system.

Using video clips to gain an overall impression of class interaction is brilliant though - that appeals a lot and would really let you sit back and see all the little 'incidents' that happen and that you just physically can't take in when you're teaching. Yes FL, seeing one or two kids is great but that overall classroom atmosphere is lacking and how children mesh and integrate in that setting is crucial.

Cynthia (12/8) extended this critique still further:

I think you and Roger have both hit on valuable points. Watching others in action is a very powerful training tool. I can always remember a colleague of mine complaining that many of the [training and development] clips were false and not realistic as they concentrated on a very small group with “perfect” children, which as we all know is not how it really is. We need to show the macro as well as the micro.

And in his characteristically astute synthesis, Vic (12/8) made explicit for the group his view that fine grain might be helpful early and coarser grain later:

At this stage the videos serve their purpose well as we are focusing on the intricacies of how individuals are thinking, and generating ideas. As these are just examples of what we hope is occurring simultaneously in many young minds in our class during a stimulating lesson, they’re very useful … the ‘more realistic’ [video examples] may be of use later when we are better skilled at selecting the trees in the forest.

Such insights no doubt helped to lay the groundwork for the positions that Anna (13/8) and Sarah (18/8) then espoused, respectively:
I agree with Vic (move slowly so we can pick the trees in the forest), but the realism factor of large classrooms, sets in again and challenges how the outcomes of the single child have been achieved in the 30+ classroom. Would the response of a single child be seen as misleading the public?

and

Would it be possible to create a split-screen situation?

Making generative sense of collectivity in this vignette

We can see in this vignette both collective exploring and collective designing. By discussing the GVC videos in relation to their purpose, Roger immediately challenged the group to set their critique in terms of functionality. Through his posting, and FL’s initial stimulus, the group was encouraged to think about the professional development function of the video-cases, whether micro or macro. Underpinning this conversation was therefore a requirement to negotiate, as a group, their professional learning needs, including how these needs may be served through video-cases. By expressing a diversity of values in this regard, the group was developing a repertoire of ideas, values and understanding by which to meet their collective purpose of designing an e-learning environment for professional learning.

Vic’s final comment is particularly noteworthy: “…the ‘more realistic’ [video examples] may be of use later when we are better skilled at selecting the trees in the forest.” Here Vic, perhaps fulfilling the role of an elder, seems to be hinting at a particular learning need in the group. At the time of writing, the group was struggling to describe the learning, in micro, that was occurring in the GVC videos. (It is worth noting, that the group eventually followed Vic’s suggestion. They adopted a micro focus for the videos they were subsequently to capture in their own classrooms for the e-learning environment they were building, in order to better understanding the learning that takes place by fine-grained focus.)

Vignette Two: Discussing aspects of the personal notepad feature within the group’s prototype e-learning environment

A central design issue explored by the group was whether the notepad feature of their environment should be private or public, or integrate both functions. The vignette we now present appears to offer evidence of collective understanding regarding the importance of maintaining the backbone of the teacher collective: the public sharing of emergent ideas. As well, this shared understanding seems fundamental to the process of collective exploring and designing.

Conceiving a notepad for the prototype environment

LS summarized the group’s thinking about the kind of environment that might support and situate videos of student learning, steering the group’s focus towards discussion of their suggested personal notepad.

LS: We need some video of good examples of student learning that we then situate with an audio or a prompt of some sort to engage people, to give them the eyes to look at it, the ears to hear it with. Yeah?

Kirsty: Some sort of focus.

Vic: An identified focus

Kirsty: Because everyone gets different things out of those videos [inaudible]

FL: Some focus questions?

Kirsty: Maybe focus questions, then go off and write our ideas and look at others.

LS: So this sounds a bit like a step on the way of a progression, that now we’re looking at particular things that are quite focused, or we’re suggesting them, for
people to go away and write something about. So are you thinking of a notepad of some sort in the environment?

Kirsty almost inadvertently raised the privacy issue regarding the notepad, but was quickly forced to clarify her position by FQ.

Kirsty: Yes something where you can jot down. If it’s on the computer I suppose then other people can view your ideas like with the GVC.
FQ: Do you want them to be viewable?
Kirsty: Well you could have that choice, I suppose. Just to go back on your own views, I think. Because sometimes I’ve written things and then a week later I’ve thought about it, and thought, “Oh, that sounds stupid [laughing]!” Yeah, just so you can go back and relate to it, it’s a notepad on your table. So I suppose if you wanted to edit things and change things.
FQ: I’m wondering here whether you’re saying it’s a personal experience of how you relate to the stimulus or whether that’s a community experience and is shared or…
Kirsty: The personal experience can be involved in the community views as well if you’re happy for it to go into the community, sort of thing, that’s…[shrugging to indicate “That’s fine”].
FL: Did anyone get put off commenting on the GVC by the fact that, you know, as soon as you entered it, it went into the community view?
Kirsty: Yeah, we thought, “We’re [she and Isobel] not going to type on this yet!” [We’d] have a little look at this and take notes [privately], because it was very early on, and we were like “Errrrr” [feigning fear].

In making the distinction between a personal experience and a community experience, FQ articulated for the group two distinct, yet perhaps complementary, values for engaging with the e-learning environment: one focused around an individual user, the other concerned with a group process. Kirsty’s response to FQ seemed to integrate both personal and community perspectives: she recognised the value of a private notepad for editing purposes, yet also recognised that private ideas might have value for the group. This exchange was to stimulate the group’s collective designing process, by forcing them to distil whether their design decisions would be based on values that reflected individual needs or collective needs, or a combination of the two.

In response to the anxiety described by Kirsty, LS explained why the private notepad in the current version of the GVC had been removed:

The argument that the developers [of the GVC] had was that they could do, that you could do that [private] jotting on your hard drive. You didn’t need a space in the environment to do that.

In the conversation that followed, there was a general consensus that the teachers’ design would be far more appealing and user friendly if the private and public spaces were incorporated into one integrated environment. Vic’s comment clearly articulates this combination of private and public:

So are you implying that the private notepad that you’re talking about, is like the preparation we do for a posting, and having done that and reviewed it, then we decide we are going to post to the archive. And then that’s your view, and then it would then accumulate into the community view. I think that’s great.

Nevertheless, consensus on this issue was soon to be tested. Ensuing conversation raised two potentially competing values underpinning the anticipated prototype: privileging individuals’
choices versus privileging the development of the collective. Just how these positions emerged and how possible conflict between them was resolved is the focus of our next sections.

**A value underpinning the prototype notepad: Privileging individuals’ choices**

A contribution by VG put these issues on the table for discussion:

One of the things you may want to consider is that … not everyone learns in the same way, not everyone is going to want the same tools. So you need to have an environment that’s customizable to suit the way that you want. So some people may want a personal notepad plus a place to share publicly, yet someone else won’t. And you need to have an environment that allows the users to dictate or to determine what they actually want.

This prompted a range of responses from TA, Kate and Kylie;

**TA:** Yes, with the flexibility to go back and change.

**Kate:** They’re [the community or the researchers are] not so in your face; they can be there, but they don’t bother you.

**Kylie:** But it’s interesting, like quite a few times when you put something down, the first time that you’ve actually, your thoughts are running, you put it down. “Yes, I’ll quickly post it”, have a look in a week’s time [you] think, “No, that wasn’t what I meant” - now that I’ve read a few other people, or I’ve thought about it myself, or read a little bit of extra information I can clarify it a little better and make it a little bit more specific. So having a notepad that, say, only you can get into. And then when you’ve polished it, which most people like to do, then you can post it.

VG seemed to be advocating an environment in which users could operate without being encouraged, through the design, to contribute publicly: “So some people may want a personal notepad plus a place to share publicly, yet someone else won’t.” By expressing the need for user flexibility in this way, he seemed to place a heavier value (within design possibilities) on the individual, rather than the group process. TA (another DET officer) also supported this notion of user flexibility. Kate appears equivocal here, acknowledging the presence of the community, but also appearing to want to preserve a private virtual retreat for individual teachers.

Kylie’s desire to ‘polish’ ideas is also telling. Due to the high participation rate in DESCANT’s online discussion, a delay of ‘a week’s time’ in posting was significant. Kylie’s comment, like VG’s, seems to indicate she too placed high value on the individual’s process, as distinct from the collective. This was of particular interest as Kylie had proved to be an infrequent contributor both in the Webboard and the GVC.

However, the importance of supporting the collective process did not escape other DESCANT participants. Several were most unwilling to let the strength of the collective process be threatened in the developing design. In fact, they rigorously defended the need for sharing emergent ideas, apparently valuing the collective process.

**Another value underpinning the prototype notepad: Privileging the development of the collective**

Despite the fact that the topic of conversation threatened to shift to the role of an online facilitator, Vic wanted to make a final point on the former topic before it did:
Vic: Before that question, can I ask you, Roger? You made a comment, you were preparing comments offline and what did you find you did? It was really interesting.

Roger: I’d sit down and I’d look at it, with a view to eventually posting it and I’d sort of, this was usually late at night, and the next day would come and you’d log onto the Webboard and everything had moved on. So you really do need to be encouraged to do it in real time.

Vic: But so what did you do?
Roger: I didn’t post it.
Vic: That’s the point I’m trying to make just counter to [inaudible]. I think that would not facilitate the growth of what’s happening and I think it’s better that’s what we have to have, the honesty in ourselves, that’s what we think at the moment. By all means go back and change it later on, but you think about it, you prepare it, you post it, it’s food for thought, it carries on, it grows. Then you can change it later on. Because often I think, people who’ve done it on the side they, they don’t bother posting. It’s not shared, it’s important to share.

FL(to R): Why didn’t you hit the button? Why didn’t you post?
Roger: I think it was because a lot of times I logged on, it was late at night, and it was the end of the day. And I really didn’t have the will to immerse myself to the depth and absorb everything that was there. And it varied from day to day. Some days there was quite a bit to get through. And I’d say, “Wow, that’s interesting,” you know. And I just had a bit of paper that I wrote some notes, like so. And what I really should have been doing was just thinking out loud, putting something in a post and then, boom! That’s what I should have been doing.

KE: Roger and I have had this conversation because you pointed it out, that we both had the same experience. I don’t know whether it’s the Departmental training but once I put it in writing I want it to be right. I’m happy to blurt things out in meetings orally, but I find, when it’s in a written form, I want it to read right. I can’t talk right [laughter] but, and, you know, so there’s that sense of “I’ll come back to that.” And when you’re busy, when there’s things coming across the top all the time, you can’t just put enough time into it to do it the way you want to do it. For me, it was exactly the same, a real tendency to say, “I’ll get back to it,” and you never do or when you get back to it, you think, “Oh, that’s moved on.” So I think that’s actually a fundamental issue for some personality types.

In this exchange, both Vic and Roger were articulating an understanding, developed through experience in the project, of the value of ‘unpolished’ sharing within the anticipated prototype for the e-learning environment. As Vic notes, “[not sharing immediately] would not facilitate the growth of what’s happening… it’s food for thought, it carries on, it grows… it’s important to share.” This contrasts starkly with the value Kylie puts on ‘polishing’ contributions over time before posting. Interestingly, Kylie’s position was shared by KE, another DET officer, who had not participated strongly in the Webboard or the GVC.

So, our analysis of this vignette seems to reveal two loose groupings. One group appeared explicitly to value the collective process in their conception of an e-learning design, even at the expense of individual user flexibility. Most members of this group were teacher participants and DET officers (for example, FL) who had engaged with the collective experience, or (as in Roger’s case) who now recognized why they had not engaged sufficiently. The second group seemed to be advocating a stronger focus on the individual user, that is, on user-driven design features, and a more user-centred approach in which ideas may be shared after significant time (when ‘polished’), or not at all. This loose grouping consisted mainly of DET officers, who had not participated in the group’s previous online immersion. So perhaps they did not have the advantage of experiencing the group’s collective learning process first hand. Also in this group was Kylie, an infrequent contributor during the online collective process who was apparently more comfortable with this lack of public
engagement than was Roger. (Kylie was later to comment that having another DESCANT participant at her school, Kate, meant she was less inclined to use the online community as a primary learning resource.)

Following this exchange, FL initiated a short discussion of the use of proofreading before posting to the community. She raised the possibility of a button that allowed users to go to the personal notepad or the community space “depending on whether you got cold feet or not.” Roger argued that such a button would “defeat the purpose” by giving users too much of an easy way out, and thus not encouraging them to share their comments. His belief in the importance of the collective appeared to be so strong that he could not even permit users this choice.

However, before the end of the conversation, another functionality of the notepad was to emerge as a focus for discussion: the notepad as a record of learning progression. Here, debate would revolve around whether the notepad should be editable.

To edit or not to edit?

The group began to discuss ways in which a ‘learning progression’ could be built into the e-learning prototype. FL suggested that users could end their work in the environment by writing a ‘learning journey’. This stimulated a new perspective on the purpose of the notepad, initiated by Vic:

Vic: In order to do that, you’ve got to have done something in the first place haven’t you? You’ve got to actually have taken the trouble to set some sort of benchmark or make a statement of some sort. That’s why I thought that [Where does the cold come from? e-learning environment] was good, because [it asked] “What do you know now?” Go through the process, now write your story with the influence of other things. That’s a wonderful sequence.

FL: That’s what I can see as a value of a personal notebook. Because trying to retrieve your individual entries out of the community view in a sort of dated way, to work out what you said when, is quite tricky. Whereas if you have a personal notebook that recorded your thoughts over time and preferably dated them as you went along, you could actually see where you’ve been.

Roger: My comment earlier on, about the inclusion, or the exclusion of that in version 4 of the GVC, was, when I said, “It’s defeating the purpose,” that’s a different purpose to what I had in mind. Rather than a draft area, it’s actually a [taking suggestion from another participant] a journal. Exactly.

This prompted LS to raise the difference between the Where does the cold come from? notepad and the GVC notepad. In contrast to the editable Where does the cold come from? notepad, the GVC (version 3) notepad was not editable. It had been conceived as a research environment both for learners (who had the opportunity to return to previously held beliefs), and for academic researchers. In response to this description, Roger suggested a “for your eyes only” notepad, prompting FL to introduce the idea of a non-editable notepad for their prototype.

FL: I think I’d quite like a “for your eyes only” but not editable.
Roger: Yes definitely,
Sarah: Yes it’d be interesting wouldn’t it.
VG: Why would you, I mean if,
KE: Isn’t it your notepad?
VG: Yes, that’s right. Why would you put a restriction on it? If you choose not to edit it, if you don’t want to edit it, then that’s your choice?
FL: So you preserve…
Roger: It’s like dragging a brush behind to erase your footprints. You don’t do it.
FL: You preserve what you did.
Roger: I concur simply because of the experience I’ve been through where I’ve held back from responding immediately and then felt that that response in 24 hours’ time, is not appropriate…
FL: It doesn’t have to go public, you’re the only person that sees it, but you can’t actually erase it after you’ve been there. You leave your footsteps.

In expressing their support for a non-editable notepad, FL, Roger and Sarah (all of whom had participated in the online DESCANT collective) seem to be displaying a shared understanding that such a feature, although again restricting user flexibility, would still be of value. On the other hand, VG once again articulates a different understanding, in which individual flexibility is of foremost importance, a stance also supported by KE. Roger’s and FL’s subsequent defence of their position makes it clear that there is a common understanding here, related, it seems, to their DESCANT experience. Both place value on preserving the ideas generated by learners, a view reflecting the generative theory of learning increasingly advocated by DESCANT participants. In Roger’s case, it is clear that this value extends beyond the individual, to the collective.

Making generative sense of collectivity in this vignette

There is strong evidence in this vignette that a loose grouping (Vic, Roger, FL, Sarah and others) articulated and defended design choices based on the importance of collectivity, and generative learning principles, to their professional development process. They applied this particular set of values to the collective design process. When the whole group generated ideas within discussion (a process that qualifies as collective exploration), this subgroup tested them in relation to their ability to strengthen both an individual’s generative learning process and the process of the collective. Their shared value position thus balanced both the needs of the individual, for example the need for a private journal section, with the needs of the collective. This collective development of value tests, by which to judge the merit of ideas and suggestions, is fundamental to the generative notion of designing, one of the six acts of natural learning.

This group’s design ideas, based upon a ‘value test’ of maintaining a generatively-based collective process, stand in contrast to more individualistic ‘value tests’ apparently being applied by others during this period. Roger and Vic were quick to discern that VG and Kylie’s design ideas for user flexibility would not meet their own ‘value test’ of supporting the collective process. Without being encouraged through the design to contribute publicly in real time, Vic and Roger believed, based on their experience in DESCANT, that the group would lose the main mechanism for learning through the collective, articulated by Vic in his words, “…You post it, it’s food for thought, it carries on, it grows.”

Implicit in Vic’s words and the convictions of others in this vignette, is the belief that the DESCANT group was operating as a learning collective. Each member played their own part, much in the manner that colonies, swarms, hives or flocks operate interdependently for a larger collective goal. Thus, in collectively arguing their case for the explicit purpose of achieving a satisfactory e-learning design, the group was demonstrating collective operating; another of the six natural learning acts. These participants were using the DESCANT collective itself, that is, its shared knowledge, understanding and values, as an “object to think with” (after Papert, 1980, p.11): a technology, through which to articulate and defend certain design principles. Whilst others continued to question the logic of their ideas and values, this subgroup stood firm as a collective.
Discussion and implications

In these two vignettes, we believe we have been able explicitly to identify and describe instances of collective exploring, designing, operating, explaining and understanding. (As well, perhaps evidence of collective making already exists in the form of the group’s collective prototype, though we did not explicitly deal with that here.) Furthermore, we believe we have been able to show evidence of some ways in which a collective g-t-r heuristic is at work here. Certainly, there is evidence of collective valuing driving learning and of collective generating and testing; and there are some indications of progression, over time, in the learning of the group (though more forceful evidence must await, at the very least, the development of the group’s prototype e-learning environment).

We began our paper by drawing attention to a paradox: there is widespread acceptance of the potency of social contexts for learning, but authentic accounts of group (not simply individual) learning are rare. Clearly, there are significant challenges in producing such accounts, as Eraut (2002) cautioned and as we have discovered from our own efforts. Our analysis here is only a static snapshot of what collective learning might look like. A dynamic account may be far more elusive. By sampling a point in time the decisions we attributed to people and groups were locked in that timeframe. Such decisions and shared understandings may have shifted before or since. Interpreting levels of consensus within the collective has also proved challenging. Whilst we acknowledge that participation within a collective occurs across many dimensions, participants who remained silent in opinion and decision-making may have been less well represented than others in a collective analysis. There are also deep and important stories to tell about teachers’ collective learning in Science and Technology, and in Science and Technology education which we have not even touched upon here. Apart from these challenges there were also challenges for us as analysts and writers of the story. In identifying effective and reliable examples of collective activity, within dynamic and complex systems, continual vigilance was required to maintain the integrity of subtle empirical data in the face of pre-existing theoretically-driven categories and concepts.

Nevertheless, despite these challenges, a few different approaches to describing and analysing collective learning are emerging, and the one we describe here represents, we believe, an important contribution to this field. Reasons given for theory advancement in a field typically include such benefits as the following, proposed by Fletcher (1995, p. 52) - good theories offer:

1. unifying power
2. internal coherence
3. external coherence
4. predictive accuracy
5. fertility
6. simplicity

We are beginning to appreciate the unifying power, internal coherence, fertility and simplicity of a generative account of collective learning such as the one we have presented here. In working towards the analytical synthesis in this paper, we have been able to see important synergies with other kinds of accounts, indicating that this one has some degree of external coherence, too. We are yet to see if the next phases of DESCANT will show that it possesses predictive accuracy, too: if, once the group’s prototype e-learning environment is developed, a new educational collective arises from it; and if such a collective exists, whether we can make generative sense of how that collective learning occurs.

In the final analysis, there are compelling reasons for understanding collectivity. In the words of Grossman, Wineburg and Woolworth (2001, p. 59):
If public schools are indeed the cornerstones of a democracy, charged with instilling in future citizens the skills and sensibilities required to participate in public life, then the struggles of community formation take on a larger meaning. If teachers themselves cannot reclaim a civil discourse and an appreciation and recognition of diverse voices, how can they prepare students to enter a pluralistic world as citizens? If we are unable to broker the differences that divide us, how can we tell students to do otherwise? Of all the habits of mind modelled in schools, the habit of working to understand others, of striving to make sense of differences, of extending to others the assumption of good faith, of working towards the enlarged understanding of the group – in short, the pursuit of community – may be the most important. In an era of narrow academic standards and accountability, it is all too easy to forget that the ultimate accountability of schools is to the sustenance of a thoughtful, engaged, and vigorous democratic society.

For us, the task of progressing towards this democratic ideal in the field of education will itself require a community process. Following the example of our DESCANT participants, all of whom we have come to admire and respect, we offer in these pages, our emergent ideas regarding collectivity in teacher education, in the hope that such ideas may be a voice within a larger collective dialogue.

**References**


