TRANSFORMATIVE AGENCY FOR THE COLLABORATIVE AND FUTURE-ORIENTED REDESIGN OF ACTIVITY IN MILITARY HIGHER EDUCATION; EMPOWERING PARTICIPANTS TO CHANGE THEIR BOUNDARY-CROSSING TECHNOLOGY ENHANCED LEARNING

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This thesis was completed as part of the Doctoral Programme in e-Research & Technology Enhanced Learning.

This thesis results entirely from my own work and has not been offered previously for any other degree or diploma.

I declare that the word-length of this thesis (54,434 words) conforms to the permitted maximum.

Signature …….

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ABBREVIATIONS

ANOVA	Analysis of variance
ARTD	Army Recruiting and Training Division
AV	Audio-visual
CAE	Computer aided engineering
CAQDAS	Computer aided qualitative data analysis software
CHAT	Cultural and Historical Activity Theory
CIS	Computer information systems
Clk Wks (E)	Clerk of Works (Electrical)
Clk Wks (M)	Clerk of Works (Mechanical)
COC	Chain of command
CPD	Continuing Professional Development
DII	Defence information infrastructure
ELE	Enhanced learning environment
ERP	Enterprise resource planning
HE	Higher education
HEI	Higher education institution
HTS	Holdfast Training Services
ICS	Information and computer sciences
ICT	Information and communication technologies
ID	Identification or identify
IP	Internet protocol
IT	Information technology
JSP	Joint service publication
kV	Kilo-Volt
LEC	Locally employed civilian
MOD	Ministry of Defence
MODNet	Ministry of Defence Network
MODREC	Ministry of Defence Research Ethics Committee
MOSS	Microsoft Office SharePoint Server
NATO	North Atlantic Treaty Organisation
OGD	Other government department
PEW	Professional Engineering Wing
QCA	Qualitative content analysis
RE	Royal Engineers
RSME	Royal School of Military Engineering
SCADA	Supervisory control and data acquisition
SME	Subject matter expert
STRE	Specialist Team Royal Engineers
SWOT	Strengths, weaknesses, opportunities and threats
TBC	To be confirmed
TEL	Technology enhanced learning
UK	United Kingdom
VLE	Virtual learning environment
VOIP	Voice over internet protocol
WATSAN (MOB)	Water and sanitation (main operating base)
X-ing	Crossing
ZPD	Zone of proximal development

ACKNOWLEDGEMENTS

My thanks go firstly to my supervisor, Dr Brett Bligh, for sharing his judgement, counsel and inspirational guidance in the meaningful change of work and learning. As a resolute Activity Theorist, his supervision has helped to emancipate people who he is unlikely to ever meet.

My second thanks are for my best friend Eleanor for her unwavering patience, sensitivity and companionship throughout my career. She has liberated me to enjoy the work and learning endeavours of military engineering, and I am grateful for her support in undertaking this study of the liberation of others.

Lastly, my sincere appreciation goes to my colleagues at the Royal School of Military Engineering, who comprised the participants of this formative intervention. I appreciate them permitting me to share their experiences as they enacted social and cultural change to their daily reality of work and learning.

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ABSTRACT

The Royal School of Military Engineering (RSME) trains and educates the United Kingdom's military engineers. The Professional Engineering Wing in Kent is responsible for the RSME's higher education (HE) programmes. In recent years, boundary-crossing technology enhanced learning (TEL) has been practised on these programmes in response to increasingly contingent and unforeseen work and learning challenges which face the military engineering community. The prevalent situation is that boundary-crossing TEL has been constrained to isolated, transient and non-compliant outbreaks; they have lacked endorsement by defence strategists, compromised behaviourist military pedagogies, and violated policy directives that military personnel learn only with sponsored experts and only with defence's information and communication technologies. Boundary-crossing TEL has thus been inadequately resourced and sub-optimal, in addition to contravening policy.

In response, this thesis summarises an 18-month Change Laboratory intervention, where I have set out to empower participants to redesign boundary-crossing TEL. Guided by a theoretical framework of Cultural and Historical Activity Theory, a Marxist epistemology to take ownership of changing the social conditions of learning, and a Change Laboratory methodology, I designed and orchestrated a research-intervention with ten military learners, six civilian lecturers and three military managers. As a lecturer at the RSME's Professional Engineering Wing, I was an insider-researcher. In fourteen sessions and two follow-up workshops the participants progressively undertook, redesigned and led double-stimulation tasks to collaboratively and sustainably change their own activity, first critiquing its historical evolution and then negotiating, enacting and testing proposals for change.

Empowering participants of military TEL to change their own activity entailed three notable contributions to the extant corpus of literature. Firstly, the intervention exposed prevalent deterministic approaches to military TEL; defence's indiscriminate implementations of technologies and policies for behaviourist *training* were found to impede critical military *learning*. Secondly, diverse perspectives for development were a lucrative source of critique yet challenged convention; very few related studies had examined the epistemic potential of contradictory and troublesome voices. Thirdly, examining cultural mediation challenged the

dominant foci of TEL's change endeavours on digital technologies; the mediating effects of rules and division of labour were considered in this intervention to be of higher importance than artefacts, particularly in concretizing and sustaining change.

As participants negotiated, enacted and tested change to their activity my analytical focus was on their future-oriented and collaborative expressions, theorised as transformative agency. Six types of expressions were apparent. These have been documented in seminal works and were identified deductively: resisting; criticizing; explicating; envisioning; committing and taking action. Subsequent inductive analyses identified four or five different sub-expressions within each main expression; these sub-expressions are described in the thesis and are claimed to be original. A further claim of originality relates to the Marxist and Vygotskian orientations; the intervention described in this thesis is claimed to the first in UK defence to examine transformative agency. With the bounded context my claims are clearly modest, yet locally the Change Laboratory intervention has had significant qualitative impact which may be of moderate interest to other researchers.

Keywords:

Change Laboratory; transformative agency; double stimulation; activity theory; technology enhanced learning; TEL; military; boundary-crossing.

CHAPTER ONE - INTRODUCTION

1.0 INTRODUCTION

The Royal School of Military Engineering (RSME) is one of forty Ministry of Defence (MOD) schools in the UK, with its largest campus and School headquarters in Kent described as Europe's largest residential construction college (MOD, 2017). Typical activities are shown at Figure 1.1; its mission is to deliver "appropriately trained highly motivated personnel, and military working animals, in order to meet the operational requirements of Defence" (Commandant RSME, 2015: 5). Since 1812 the RSME has educated and trained Royal Engineers in construction and engineering, from short packages of mission-specific training to two-year programmes at master's level. The Professional Engineering Wing (PEW) is the RSME's Higher Education Institution (HEI), responsible for academic programmes in the design and management of built infrastructure. Its vocational syllabi are steered by government, and it delivers defence's vocational programmes without degree awarding powers. Two partnered UK universities accredit the RSME's longer HE programmes, award its students with their degrees, and award affiliate lectureships to academic staff.

Figure 1.1. Typical learning activities for Royal Engineers, the RSME Headquarters in Kent, and the 2017 visit of the Colonel-in-Chief HM the Queen (under UK MOD Consent License)

I have lectured at the RSME since 2012, as a civilian with a teaching-focused role in engineering management. This was preceded by a full career as a military engineer; I retired in 2012 from an appointment as the Sergeant Major Instructor, which was a relatively senior role in the custodianship of knowledge management and organisational learning. My prior experience as a military engineering practitioner had apparently imbued in me some expertise in these fields, leading to my appointment as a manager of learning. My encounters in working and learning at the PEW, particularly in my latter role as a civilian lecturer, cultivated a personal impetus for me to intervene in problematic tensions for technology enhanced learning (TEL). In fact the very notion of TEL at the RSME presents important tensions for the project, which will be described below. Over time these tensions manifested themselves as contradictions between TEL's policies and practices which, without aggravation and resolution, I felt would continue to inhibit the development of TEL.

The research intervention described in this thesis, oriented towards empowering the RSME's HE participants to change their own TEL activity, has led to deep and qualitative changes to both TEL activity and to participants themselves. Whilst the intervention was orchestrated by me, its outcomes were the results of participants' endeavours. The intervention's motives were embedded in the shared experiences of many people, with my own shaped by participation in Lancaster University's doctoral programme in *E-Research and Technology Enhanced Learning*. I had previously subscribed to over-simplified and local definitions of TEL. I was influenced during the doctoral programme, through undertaking pilot projects, to operationalise and theorise what I had observed as problematic conditions for learning. The doctoral programme thus enabled me to facilitate the intervention in ways which were theoretically grounded, and which appear to have positively impacted on the daily lived reality of learners, lecturers and managers at the RSME. It led me to the intervention summarised in this thesis, which has empowered participants to collaboratively examine, critique and influence their own TEL activity in ways which conventional forms of managerial implementations have not previously achieved.

The emancipating and empowering outcomes of the intervention can thus be described in terms of transformative agency (Virkkunen, 2006: 43); this is a characteristic ascribed to a collaborative group of people who feel that they can question their status quo, propose ways to overcome their problems and reflexively develop their own activity. It is important because military engineers' emerging work and learning challenges are increasingly uncertain and unpredictable, whilst their organisation of work and learning remains staid

and fixed. My aspiration for the project summarised in this thesis is to propose forms of mitigation which may empower participants of the RSME's HE programmes, emancipating them to devise and test their own work and learning processes with which to meet their uncertainty. Transformative agency will, I hope, enable them to identify and enact ways of work and learning with decentralised authority, negotiated rules, and flexible team membership based on expertise rather than rank. The project is believed to be the first empirical study to promote and sustain transformative agency in UK defence.

1.1 The research setting, practice and policy

The RSME's and the PEW's strategists are senior officers and civil servants. Warrant officers, who are defence's highest non-commissioned ranks, are the RSME's and PEW's middle managers. Serving military managers, commissioned and non-commissioned, are alumni of the PEW who are appointed as departmental managers on two- to three-year tour cycles of military duty. The PEW's teaching staff are civilian chartered engineers and infrastructure managers, generally contracted from industry or academia (as an ex-soldier who is a lecturer, I am an exception at the PEW). Lecturing contracts include attaining affiliate lectureships with partnered HEIs and becoming registered as UK defence trainers. The PEW's learner community comprises an annual cohort totalling around 24 non-commissioned officers (corporals and sergeants). Groups of around six learners attend one of four two-year residential HE programmes: electrical; mechanical; civil; and construction engineering. They are selected to attend these HE programmes by a board of senior commissioned officers, convening annually to assess around 200 applicants from the Corps of Royal Engineers and the Queen's Gurkha Engineers.

The PEW's remit for HE is subtly yet profoundly different from behaviourist military training. As a military HEI, the PEW aspires to develop learners' criticality, challenging their habits of conformism and enculturation which have likely formed during former experiences of military training. Examples of previous training include operating and maintaining weapons and equipment, drill and conducting tactics. Their success during such training is likely to rely on enculturation and relatively uncritical forms of 'stimulus-response' behaviourism (Gagne, 1962: 85). Importantly for the project described in this thesis, behaviourist principles and conformist expectations are encoded in defence's TEL policies, which pragmatically focus on training regiments, since HEIs represent a small minority of defence schools. Standardised TEL policies are applied indiscriminately across the spectrum of military teaching and learning, irrespective of the particular School's educational context.

Local policies in defence HEIs such as the PEW attempt to circumvent some MOD directives, aspiring to accommodate critical and adaptable forms of learning. Yet the backwash effects of differences between strategic and localised policies can paradoxically contribute to tensions in the daily reality of TEL's practice and resourcing. The extracts below exemplify political misalignment in attempting to adapt TEL to suit the PEW's unpredictable forms of work and learning, termed by the military community as preparing for contingency (Latawski, 2013):

- Firstly, policy for the RSME (which politically sits between the MOD and the PEW) directs the PEW that to "… train for contingency will require a different mindset and approach. Operational deployments are likely to be characterised by greater uncertainty and we may no longer have the luxury of bespoke Mission Specific Training to prepare fully for such tasks ..." (Commandant RSME, 2015: 6).

- Secondly, and in contrast, MOD policy directs that "When new or changed equipment, technology, tactics, techniques or procedures are developed, or when new or changed policy or legislation is brought in, the requirement for new or amended training must be examined … too much training costs money that will likely be taken from elsewhere in the training budget …" (Defence Authority for People, 2015: 11).

Whilst it is pragmatic that "the requirement for new or adapted training must be examined" (ibid.), the procedural bureaucracy and time for that examination consistently and significantly lags behind the recognition of changing vocational requirements and the dynamic needs of learners. To illustrate, the most recent changes to the PEW's undergraduate programmes took seven years to complete, with MOD policy dictating that every learning event and associated artefact was formally justified. This MOD-wide policy has primacy over local directives, governing "… all training, education, learning and development activity, where Government resource is being spent …" (Defence Authority for People, 2015: ii-iii). Justification is relatively straightforward in behaviourist training regiments, for which the policies were originally designed, yet the daily reality for HEIs is of dynamic learning needs, which are difficult to stabilise for long enough to formally justify and encode. On one hand we are compelled in military HE to undertake TEL based on learner needs and constructive alignment (Biggs, 2003; Houghton, 2004), whilst on the other hand we have perplexingly slow and complex political controls, constraining us to "preparing for past wars" (Mälkki & Mälkki, 2013: 29).

In response to such conflicting circumstances the PEW's learners and lecturers, myself included, have habitually conducted learning in ways which knowingly contravene MOD policies. Defence controls are considered at a local level to be disproportionately restrictive and outdated. If followed uncritically, they are perceived as resulting in learning which is detrimental to the needs of learners and the organisation. Contingent TEL needs have been met by bending rules and circumventing policies on learning and security, which are pragmatically designed to restrict who we learn with and which technologies we use. We have frequently interacted with non-sponsored experts using non-sanctioned technologies, contravening policy to rebalance our daily reality of a status quo between compliance and relevance. Regular rule-bending has been increasingly tolerated, and informally encouraged, by military managers; they have recognised the need for the RSME to respond to vocational requirements, similar to the trends in Higher Education / Work Relations described by Saunders and Machell (2000: 292). This misalignment between policy and practice, and apparent relationships with learning and technology at the School, are described below.

1.2 Challenges for TEL at the RSME

The term "technology" is used in this thesis in two epistemically related forms: firstly, as a mass noun for material tools and signs, which shape and are shaped by human activity in learning; secondly, as a term to describe the functional application of that human activity. Examples of the former are technological artefacts such as computers, pens and textbooks, whilst examples of the latter are technology as a field of study, an economic driver, and a career path (for further comparison see Dafoe, 2015: 1051). In either epistemic form, technology has often been perceived as self-evidently improving HE, with a-priori benefits of individualised, efficient and relevant education such as those described by Bates (2010: 15) and Vargas and Tian (2013: 277). In critically responding to these claims (for which c.f. Selwyn, 2011: 21 and Oliver, 2015: 365) the term TEL itself has been described as rhetorical and over-simplistic, and is critiqued by Bayne (2015: 18) as "… black-boxed, under-defined and generally described in instrumental or essentialist terms which either subordinate social practice to technology or subordinate technology to social practice …".

Empirical studies of TEL commonly supplant and quantitatively compare digital artefacts, rarely considering how technology can transform social and cultural practices. This is ascribed by Kirkwood and Price (2014: 26) to the underestimation of TEL's social and cultural complexity. To compound these challenges for this project, TEL has localised institutional conceptions at the RSME which are described in subsequent sections. In wider literature,

the socially transformative possibilities of TEL for HE have been nascent for decades, with HEIs proving resilient to the organisational changes needed to move beyond deterministic claims of technology (Bates & Sangrà, 2011: 213). A decade prior to this research, Laurillard (2008: 7) called for TEL interventions to foreground the dynamic needs of learners, stating that "education is on the brink of being transformed through learning technologies; however, it has been on that brink for some decades". In considering the dynamism of learner needs, this intervention sees participants collaboratively making future-oriented innovations in their own sustainable ways; this field of agency seems to be rarely foregrounded in TEL studies (Goodyear & Ellis, 2008: 142).

The intervention summarised in this thesis was founded in previous, unpublished, pilot projects undertaken during preparatory modules of my Doctoral training. In these smaller interventions, participants changed isolated elements of their TEL activity. These in turn exposed the problematic aspects driving this intervention, where participants have examined relationships between activity's power, regulation, time-boundedness and interdisciplinarity. The intervention has empowered participants to collectively access epistemic resources (as described by Luckin, 2010a: 33), many of which lay outside the RSME's boundaries and which made the intervention seem important, justifiable and feasible:

- Firstly, epistemic and vocational endeavours of military engineering are increasing in their contingency, with unpredictable requirements for diverse work and learning teams including non-military experts (Farrell, 2008: 777; Bowhers, 2012: 26). In response, calls are being made for military HE to reconsider traditional pedagogies (e.g. Paile, 2010: 79; Sookermany, 2016: 326) adapting TEL to reflect vocational challenges, technologies and stakeholders beyond defence (Remy, 2017: 115). However, the military's locked-down technologies and inflexible policies proscribe such practices, which have been achieved through non-compliant acts.

- Secondly, the educational expectations of military learners are changing at a rate which outpaces defence's undifferentiated policies. Soldiers' educational experiences before armed service include innovative schooling (McInnis, 2005: 88), societal diversity (Goodyear & Ellis, 2008: 146) and distributed technologies (Wilson & Gerber, 2008: 29). Their need for differentiated TEL (Starr-Glass, 2013: 359) sits in contrast to defence's TEL conventions of being "left to get on with it" (Kent et al., 2015: 6) whilst individually consuming standardised audio-visual (AV) media (see e.g. Vogel-Walcutt, Carper, Bowers and Nicholson, 2010: 311; Buck, 2006: 9).

- Thirdly, hegemonic enculturation through behaviourism persists in military work and learning. Criticality can threaten defence's normative expectations of soldiers' education, with Juhary (2015: 1260) implying that critique is the preserve of officers (c.f. Strachan, 2008: 40). That stated, authors such as Catignani (2013: 30); Raviv (2013: 109); and Cornell-d'Echert (2012: 17) present the need for differentiation of learner needs irrespective of rank, described by Fletcher (2006: 26) as contingent work and learning where "… non-commissioned leaders everywhere will be at the strategic point of action … they will have neither time nor opportunity to consult with senior officers, yet their actions will have strategic consequences".

In response, the participants of this intervention have redesigned their boundary-crossing TEL activity, in ways deemed relatively sustainable to lecturers, acceptable to managers and sensitive to the evolving sociocultural and collaborative endeavours of learners. The subsequent section introduces and defines some of the related theoretical notions.

1.3 Boundary-crossing TEL and organisational change

Three notions deserve early definition and relation to the project: boundary-crossing learning; TEL; and organisational change. Firstly, boundary-crossing is defined as learning across different institutions, professions, disciplines and cultures (Akkerman & Bakker, 2011: 182). Boundary-crossing is thus conceived as accessing culturally diverse expertise from outside organisational boundaries (Engeström, Engeström & Kärkkäinen, 1995: 319; Mueller, 2014: 191; Bebeau & Monson, 2012: 245). Secondly, TEL prioritises learning over technology, in ways determined by technological artefacts and the cultural mediation of social processes (Kirkwood & Price, 2014: 11; Dafoe, 2015: 1051). This definition of TEL is not confined to digital artefacts, since many non-digital artefacts are significant for TEL. Nor can TEL be divorced from social practice (c.f. Bayne, 2015: 10 for the potential conservatism of my perspective). Thirdly, organisational change is conceived as originating in contradictory socio-historical conditions (Blackler, 1995: 1037), which drive multiple tensions in human activity and the rejection of a social group's current circumstances and conditions.

The boundary-crossing TEL examined in this project originated in lecturers' introductions of industrial and academic experts from outside the PEW, to provide expertise which was anticipated to improve TEL in some way. Anecdotal evidence indicated that lecturers' historical motives for such boundary-crossing included:

- Remediating local shortfalls such as unavailability of physical resources or knowledge.

- Promoting authenticity to manage learners' expectations of future vocational tasks.
- Enhancing lecturers' and learners' support networks with subject-matter expertise.

Pedagogical drivers such as these are notably different from when boundary-crossing is strategically directed from a top-down perspective (Kidron & Kali, 2015). Top-down motives are beyond the scope of this thesis, but are theorised by Rule (2015: 57) and empirically examined by Forstorp and Nissen (2011: 19). This intervention's drivers are bottom-up, and are associated with local attempts to improve learning rather than organisational efficiency or competitive positioning of the institution. Non-compliant boundary-crossing TEL practices have historically involved a social collaboration of lecturers, learners and external experts becoming temporarily oriented to specific problems of engineering infrastructure. Examples are illustrated in Figure 1.2, mediated by technological artefacts including:

- Physical engineering systems at infrastructure sites, used for learner familiarisation and operational analyses under expert guidance.
- Online AV media and platforms, used for jointly discussing experimental trials and modelling solutions.
- Digital media, for sharing and exploring relevant case studies.
- Specialised productive and communicative technology, such as computer-aided engineering (CAE) applications.

Figure 1.2. Boundary-crossing via face-to-face and online interactions, using non-defence infrastructure and social engagements with non-defence experts (images author's own)

In the first frame of Figure 1.2, learners engage face-to-face with an industrial refrigeration expert. They are discussing technological developments in refrigerated mortuary installations, analysing challenges for operational deployments. These initial face-to-face engagements typically precede further online interactions, using AV and voice over internet protocol (VOIP) platforms. The subsequent frames show remote interaction. In these

frames, the expert interacts with remote learners, discussing infrastructure systems for surgical hospitals on operational deployments, with learners interacting with both the expert and the physical plant over IP. These exhibits show typical artefacts being illicitly used to mediate boundary-crossing TEL: communicative platforms; physical plant and installations; digital representations of physical installations; and CAE systems. These practices contravene MOD policy on at least three counts:

- Firstly, MOD policy conflates the term TEL with the consumption of procured packages of digital content, hampering its development for higher-order learning. Policy states that "existing TEL is to be used if it has been previously procured" (Defence Authority for People, 2015: 40) disclosing TEL's conception by civil service and military strategists as delimited collections of commoditised content, rather than TEL being considered a developmental and social activity (see Engeström & Sannino, 2012: 46 for a related critique of process and content theories).

- Secondly, MOD policy directs that learning only takes place between military personnel and in-house experts "selected and deemed suitable by [the] Chain of Command" (Defence Authority for People, 2015: 72). This politically vetoes experts outside defence, who are not formally endorsed by MOD sponsors. Whilst pragmatic in military training contexts, for military HEIs this presents political barriers to solving problems with diverse stakeholders inhibiting adaptable and contingent TEL (see Redding and Fletcher, 1993: 85).

- Thirdly, TEL is mandated by policy to only take place on defence's own secure information and communications technology (ICT) platforms and architectures (Neal, 2013). These stove-piped[1] and locked down systems hamper social engagement across boundaries, because they block access to non-defence platforms and media. Its indiscriminate application is perplexing, and its withdrawal is frequently mooted in

[1] Stove-piping refers to the centralised management of information within clear military organizational structures based on rank. Communication is limited to one's formal and hierarchical organization, and is controlled by the restriction of direct liaison authority (DIRLAUTH) to contain information within organizational boundaries.

defence, with Arancibia (2016: 348) introducing case studies where defence ICT has obstructed routine military collaborations with other stakeholders.

Despite these contraventions of policy, engaging with non-sanctioned experts using non-defence technologies has been increasingly tolerated and encouraged (at least informally) by the PEW's managers. In my own experience, such rule-bending has stultified the organisational change required for genuine development, and the locus of control for tolerating or sanctioning non-compliance has been unclear. The RSME is mandated to prepare learners for "civilian and military cooperation with UK and international experts, non-governmental organisations and local nationals" (House of Commons Defence Committee, 2010: 38) and to deliver "… not only the training required today but the training required for tomorrow …" (Holdfast Training Services, 2017b). Yet these directives directly contradict others which proscribe the acts to achieve them. The inference in empowering learners for contingency is that lecturers and managers face either compliant paralysis or non-compliant development of social conditions. The RSME's boundary-crossing TEL is increasingly diverse and unconventional, hence vocationally useful (Ripley, 2015: 7; Latawski, 2013: 24) but is practised in direct contravention of policy. Over time, conflicts between de jure and de facto practices have destabilised the daily realities of people's lives. This intervention exposed and aggravated these contradictions, with participants rejecting social and cultural conditions to nurture their collective impetus for change.

1.4 My intent and insiderness

As the researcher-interventionist, I feel motivated to understand how participants can become empowered agents of sustainable change. Military engineering as a vocational or epistemic concern demands increasingly diverse knowledge and social negotiation of its meaning, yet my experiences of military TEL have led me to conclude that the potential to address these demands is constrained by politically-driven cultural reproduction. This is evident in the military's pervasive, historically embedded and normative expectations: higher ranks are educated and lower ranks are trained (Kime & Anderson, 1997: 14; Paile, 2013: 279); expertise and aspiration relate to socio-economic status and rank (Beach, 2008: 37); and modes of division of labour are based on hierarchy, irrespective of expertise. These may be expedient for military training (Fletcher, 2004: 6) yet not for HE's evolving and contingent learning (Nuciari, 2007: 26). By entrenching TEL in defence bureaucracies, indiscriminate policies and black boxed ICTs, the military benefits from stability, predictability and discipline (Kirke, 2009: 745). Yet at a local level, these universalist policies

and hegemonic barriers to knowledge flow have resulted in epistemic sub-cultures. These sub-cultures have formed through isolated and bottom-up adaptations, circumventing policy and hampering genuine organisational change (similar examples are Haaland, 2016: 1001; Catignani, 2013: 34).

The routinisation of local rule-bending, and the ambiguity of unsanctioned change endeavours, risk long-term reliance on un-resourced, non-compliant and localised outbreaks of boundary-crossing TEL. I now offer three short accounts of related concrete experiences from my recent past. I hope that they illustrate the local impact of the status quo, and exemplify my proposal that transformative agency is important:

- In 2010, on appointment as a military manager at the PEW, I had intended to redesign elements of HE programmes to reflect vocational practices which I had encountered on military operations. I proposed using technologies beyond those used in defence, and introducing learners to non-military experts, in particular water treatment consultants and medical specialists who I had collaborated with on humanitarian operations in the Middle East and North Africa. I was informed by a senior civil servant, who held responsibility for the RSME's quality assurance, that I could make any changes that I wished to at a local level, providing that I did not publicise those changes. He considered that completing the formal change procedures was too lengthy and bureaucratic, informing me that programmes were reviewed only on a ten-year cycle. I was directed to make changes as I saw fit, and to assume the undocumented risks of non-compliance. To me this represented a lost developmental opportunity; I had effectively been directed to capriciously mask my personal conflicting motives, between HE's social conditions and my personal role in managing them.

- In 2012, on retirement from military service and on appointment as a civilian lecturer, I enrolled on a post-graduate certificate in higher education at a partnered regional university, which assists with professional development of the PEW's lecturers. During a reflexive exercise we were encouraged to openly and critically reflect on challenges in our own academic practice, in the company of peers from other HEIs and with more senior mentors from the wider academic community. One of my frustrations to share with these colleagues was the extent to which managerialist ideology – at least in applied subjects such as engineering - seemed to influence HE at least as much as the field's vocational settings, and perhaps more so. I shared with colleagues my irritation

with the institutional rejection of internal critique, and the restriction of decision-making to strategists. My subsequent enquiries with colleagues from the RSME exposed similar frustrations; their epistemic critique could be engendered in private, but criticism was neither spontaneous nor shared with strategists. This pursuit of local consensus represented a further lost developmental opportunity; discouraging epistemic critique was, I felt, masking lucrative opportunities for change.

- In 2015, I became involved in the redesign of the HE programmes that I lectured on. This was part of the formal ten-year process alluded to in the first bullet above. It involved a collaboration of managers, lecturers, training designers and learning technologists following a defence top-down process which was pre-ordained and communicated through policy. I had naively assumed that we would discuss prior experiences, propose improvements, negotiate intentions, and consult learners with our proposed content and pedagogical strategies to trial. What actually followed was our enrolment in an orchestrated procedure which claimed that we could achieve our requirements using the technologies, spaces and resources that were already available. I found this deeply frustrating, particularly since in a previous role I had inherited the previous iteration of such a ten-year cycle. All voiced the flaws of the procedure, though we could not identify a strategist willing to risk a more appropriate (though non-compliant) approach or to commit to amending policy. We were all in agreement that policy was inappropriate for HE. At the same time we were locked in to following those policies for compliance, then locally adapting our practices to suit our daily realities. These adaptations represented a lost opportunity to undertake genuine organisational change endeavours; instead, coping with the status quo was limited to un-resourced and local undertakings.

When this intervention was first considered in early 2017, neither further discussion of these local problems nor ongoing contemplation of their effects was deemed likely to improve social conditions. When such epistemic barriers exist "explication or codification does not solve the problem" (Duguid, 2012: 155). Instead, formative acts were deemed necessary to change social reality. Importantly, my participation in Doctoral training empowered me to express a desire for change through a Marxist epistemology (from the 11th Thesis on Feuerbach, Marx & Engels, 1998: 569), enabling me to move towards transforming social conditions in a theoretically grounded way (Roth, 2004: 7; Somekh & Nissen, 2011: 95). A particular challenge for my insiderness was designing a relatively ordered intervention which

empowered agency, for the promotion of expansive learning in the participants' own ways; in other words, how to intervene yet avoid replacing one form of hegemonic practice with another (examined by Engeström & Sannino, 2012: 53). To mitigate these challenges, an understanding of participant motives was required, as summarised below.

1.5 Participant motives for the research

Motives for participation evolved through time during the intervention and will be discussed in later chapters; the participants' motives *at the outset* are described below. They were extracted from early anecdotal evidence provided by the three groups: ten learners; six lecturers; and three managers. Participants in this resistive and critical intervention deserved sensitivity, since the RSME's senior military and civil service strategists (those staffing the Headquarters, rather than participating middle managers) were likely to perceive criticality as subversive (Palm, 2013: 10). Individual participants were diverse, and common motives were difficult to uncover, however they had important shared interests in questioning the misalignment between policy and practice in boundary-crossing TEL. The intervention allowed them to jointly confront and aggravate contradictory conditions to change the lived reality of their activity, which can be termed expansive learning (Engeström, 2001: 137). Expansive learning is differentiated from defensive learning, the latter being a reaction to some threat of a less favourable alternative (Grotlüschen, 2010: 16). The motives of each sub-group varied as the intervention unfolded; the motives considered below were those which related to initial participation, and were thus limited to the outset.

1.5.1 Learners' motives

Learners' initial motives to participate seemed related to developing their vocational capability. This may in the short term politically jeopardise relationships with strategists, yet may benefit their reputations as practitioners in the medium term, enhancing operational effectiveness and competence beyond their immediate circumstances. This contextual transferability is described by Paile (2013: 279) as the difference between military training and military HE. Learners also speculated that there were potential career opportunities in interacting with non-military experts, presenting tensions in their identities. These contradictory opportunities relate to Leontiev's and Vygotsky's "leading activities" (Cole & Engeström, 2007: 484) and the "leading identities" discussed by Black et al., (2010: 52), with contradictions between the use-value of their TEL (military engineering to defend the nation as a force for good) and the exchange-value of its material success (appraisal, promotion,

and earnings including beyond armed service). At the outset, learners thus appeared to be motivated to participate through evolving professional identities and material gain, rather than developing agency per se (also explored by Edwards & Kinti, 2010: 126).

1.5.2 Military managers' motives

Military managers were initially interested in maintaining awareness of changes to cultural and social conditions, particularly on their political control of outcomes such as the developing agency of learners and lecturers. Awareness of the progress and pace of the intervention was deemed to affect their own regulation of the time, cost and quality of TEL within the departments that they managed, impacting on their own regulatory activity and their own promotion prospects. Additionally, they had expected to act as interlocuters for strategists, informing them of likely risks, benefits and political impacts of the intervention. In these duties, managers faced personal dilemmas, such as those analysed by Raviv (2013: 101); participation exposed dualistic tensions between organisational values and their personal values, and temporal dilemmas in short-term and long-term motives. On one hand they were motivated to exhibit participation and commitment to learner agency, and on the other hand they were cognisant of their managers' intentions, and of being reassigned from the RSME before benefitting from investing their own effort and time. Motives at the outset corresponded with managers' rational choices for committing to changes in HE discussed by March (1991: 71).

1.5.3 Lecturers' motives

Civilian lecturers appeared to be initially motivated by expanding their awareness of TEL activity, particularly: opportunities to engage with professional and academic communities; developing awareness of pedagogic practice; and sharing experiences of tensions and dilemmas in their work. Research in HEIs described by Shattock (2009: 44) indicates that the pressures to conduct research tend to be driven bottom-up, yet the pressures to commercially exploit the same research are top-down, providing lecturers with motives to be pre-warned of potential outcomes of any local research. Lecturers were also keen to understand emancipation from pedagogic domination, some claiming that the military's control of its people and technologies suppressed dissent, for the convenience of managerial deference. At the outset, the intervention thus appealed to lecturers in its relatively novel "post-bureaucratic" format (Daniels & Johnson, 2014: 144). As described by Klaus Holzkamp in Haug (2009: 246), learning is inevitable when obstacles are presented to participants,

which the intervention purposefully examined and which appealed to their criticality. The next section builds on these participant motives to describe the aims.

1.6 The aims of the research

The project aimed to provoke collective transformative agency for the sustainable redesign of TEL activity, requiring clarification of three key terms: collective; transformative; and agency. These notions are relevant for the PEW's boundary-crossing TEL because the exact requirement is unknown and unpredictable, theorised by Engeström (2015: xxiii) as calling for expansive learning. The notion of expansive learning being 'collective' relates to a Marxist epistemology (Marx & Engels, 1945/1998: 41) where interactions between people and artefacts are inherently social. This activity becomes transformative when it involves future-oriented change to overcome strong personal demands or crises (Ohlsson, 2012: 618) with agency conceived as the capability and intentional choice to shape activity (Eteläpelto, Vähäsantanen, Hökkä, & Paloniemi, 2013: 49-50). Combining these notions, transformative agency describes how participants collaboratively, practically and intentionally challenge their own activity by rejecting current conditions, embracing social instability and undertaking purposeful change (Sannino, 2015b). This project intervened to actively influence learners, lecturers and managers in redesigning activity, empowering them to access diverse knowledge and meaning (Engeström, Engeström, & Kärkkäinen, 1995: 319).

The intervention deliberately exposed, aggravated and resolved contradictions rather than seeking consensus (see also Engeström & Sannino, 2011b: 371). This approach is considered to be of burgeoning importance to prepare military learners for their increasingly uncertain vocational roles (Johnson-Freese, 2012: 151; Scoppio & Covell, 2016: 127), aiming through its design to promote transformative agency in ways which are sustainable through time and changing social circumstances (e.g. Sutherland, Lindström, & Lahn, 2009: 48; Mor, Craft, & Hernández-Leo, 2013: 9). My approach used some relatively esoteric theoretical principles, warranting their early introduction. They are placed in the next section for explanatory and interpretive power before presenting my research questions, with the aspiration that the questions will then be more meaningful. The concepts aim to balance Halverson's (2002: 243) attributes of theory: descriptive; rhetorical; inferential; and applicable.

1.7 Theoretical concepts for interpreting the research questions

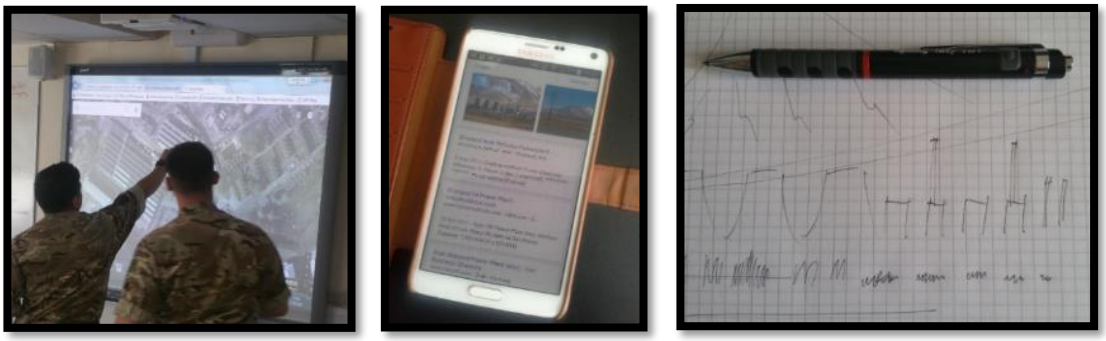
Key theoretical concepts are described in brief below, to inform subsequent interpretation of my research questions. The themes of expansive learning and transformative agency are

grounded in Marxist and Vygotskian theories of development and change (Junior, Ostermann, & Rezende, 2014: 557), which are introduced in order of increasing methodological and theoretical consequence:

- Culture is described in relation to context by Cole (1996d: 331). In this project, culture describes a shared pool of artefacts, accumulated as social groups experience historical adaptation to their circumstances (Cole, 1996b: 110). Culture is thus an inherently complex and ambiguous idea, which may not be clear. To casual outside observers it may not be evident, or it may have implications which seem apparent but difficult to define. To those within a culture it may be so permeating that its implications are undetected during interactions with each other (Cole, 1996a: 302). In this project, culture was considered to be relatively local, more at the level of a 'microculture' or 'idioculture' (ibid.) than larger scale conceptions such as a national or a military culture.

- Artefacts are technological and conceptual tools, which mediate between people and the object of their activity (object here refers to the purpose of activity, with disambiguation in later chapters). Artefacts are products of cultural and contextual requirements (Kaptelinin & Nardi, 2009: 248) shaping external (in the world) and internal (in the mind) activity, carrying their own cultural and historical development which influence their use. Some examples which were typically in use at the PEW for TEL are at Figure 1.3.

Figure 1.3. Examples of TEL artefacts in use at the PEW: an interactive whiteboard, a smartphone and a pencil sketch on paper



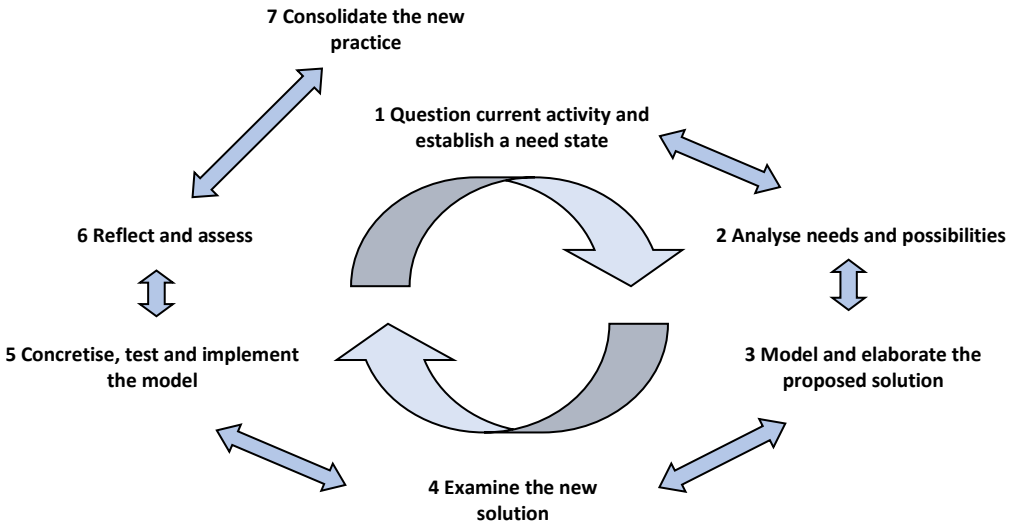
- Activity describes collaborative and sustained human endeavour, culturally mediated by artefacts and regulated by rules, with peoples' social roles differentiated by specialisation and authority (Blunden, 2012b: 99). Activity is motivated toward and defined by its object, which is the driving force of that collective and sustained activity;

the object gives activity its meaning. This object-oriented activity is mediated by artefacts and social structures, with the relationships between elements commonly the focus of studies of activity in educational settings (Bligh & Flood, 2017: 131).

- Contradictions are historically emergent systemic problems, originating in tensions between the use-value of activity's production (for direct application) versus its exchange-value (for trade with another commodity) (Engeström & Sannino, 2011b: 371). Contradictions are not merely more-or-less attractive dilemmas; they are mutually oppositional, interdependently defining, and potentially negating of each other. Their resolution will drive further contradictions, in ascending from the abstract to the concrete (Putnam, Fairhurst and Banghart, 2016: 74).

- Ascension from the abstract to the concrete (Postholm, 2015: 48; Bligh & Flood, 2015: 141) is a Marxist concept describing progression from theorizing and observing activity, towards exhibiting evidence of its transformation and change. An abstract notion is undeveloped and "thin in content" (Blunden, 2010a: 62), whilst a concrete notion has developed connections and is "rich in content" (ibid.); the terms do not necessarily delineate mental and material differences. Also of note, the term ascension may imply a vertical datum, although it also refers to both horizontal and relational expansion (Engeström & Sannino, 2016: 411). Ascension from the abstract to the concrete informs the sequence of expansive learning illustrated at Figure 1.4.

Figure 1.4. Actions in expansive learning, adapted from Engeström (1994)



- Expansive learning is the process of cyclically reconceptualizing a developing activity to reconsider and expand the object, overcoming contradictions to reach "wider horizons

of possibilities" (Engeström, 2001: 137). It has a recognised, relatively stable and iterative cycle illustrated at Figure 1.4. The stages have empirical and theoretical validity for interventions as both a predictive tool (Sannino, Engeström, & Lemos, 2016: 599) and as a guide for design (Engeström, Sannino and Virkkunen (2014: 118). Whilst not the primary focus of my research questions, expansive learning is intrinsically related to the intervention's provocation and study of transformative agency.

- Transformative agency is a collective characteristic of groups as they undertake expansive learning, and is the aim and primary analytical focus of this project. It builds on individual agency, which is the capacity for wilful and voluntary change to one's circumstances, to describe a level of shared subjectivity where a group can negotiate and make collaborative and future-oriented decisions and socially enact them. It is defined by Virkkunen (2006: 43) as collaboratively "breaking away from the given frame of action and taking the initiative to transform it" as participants change their own activity. It requires the destabilisation of social, cultural and structural norms. There are typically six exhibited expressions which reveal how people take purposeful action to change their own activity (Haapasaari, Engeström, & Kerosuo, 2016: 242): resisting; criticizing; explicating; envisioning; committing; and taking action. These are referred to from this point as 'expressions', to be explored through Cultural and Historical Activity Theory (CHAT) and the Change Laboratory methodology.

- Cultural and Historical Activity Theory (CHAT) is a theoretical perspective which takes human activity (as discrete from stimulus-response associations) and represents it as an activity system where a human subject, as an individual or group, is oriented to an object (Yamagata-Lynch, 2010: 140). This subject-object relationship is mediated by artefacts, and an activity system represents this with activity's social rules, community and division of labour, making it useful for studies of collaborative TEL (Kaptelinin & Nardi, 2009: 85). CHAT examines internal and external relationships of these elements, including those through time, as contradictions; an approach which can be advantageous in complex situational dynamics such as changes to TEL activity (Bligh & Flood, 2017: 149). CHAT is a specific form of Activity Theory which foregrounds temporal context and cultural mediation; we cannot understand or intervene in activity until we understand its historical evolution and the culture in which it occurs (Roth, Radford, & Lacroix, 2012: 3.1).

- The Change Laboratory methodology for formative interventions is theoretically aligned with CHAT, having been developed by activity theorists for collaborative interventions (Engeström, Virkkunen, Helle, Pihlaja, & Poikela, 1996). Contemporary studies which share my methodological interests and a Marxist epistemology include: questioning communication in HE (Trotter et al., 2014: 25); resisting the politicisation of learning (Gutierrez & Vossoughi, 2010: 100); mediating curricular-based learning (Toiviainen & Kerosuo, 2013: 8); and collaborative knowledge domains at boundaries (Virkkunen & Tenhunen, 2010: 13). The methodology takes as its developmental starting point the contradictions felt by participants in their daily lived reality, such as those in the outlined experiences of the RSME's HE in Section 1.4. Through multi-voiced negotiation participants take charge of the process to change their activity (Sannino, Sutter, & Engeström, 2011: 606). In collaboratively exposing, aggravating and developing solutions to contradictions, they develop new concepts and build their transformative agency (Virkkunen & Newnham, 2013c: 12).

1.8 Research questions

There is one over-arching research question, related to the transformative agency of participants, and there are six sub-questions. The sub-questions refer to the six expressions of transformative agency described by Haapasaari et al. (2016: 242): resisting; criticizing; explicating; envisioning; committing; and taking action.

> **RQ 1.0**: How can a Change Laboratory research intervention foster the empowerment and emancipation of a military HEI's learners, lecturers and managers to collaboratively reshape their TEL activity, enabling them to better engage with expertise outside their organisational boundaries?

The six sub-questions ask how do participants of the intervention:

> **RQ 1.1**. Resist the proposed change?
>
> **RQ 1.2**. Criticise current activity and suggest tasks and objects for discussion?
>
> **RQ 1.3**. Explicate new potential for developing the activity?
>
> **RQ 1.4**. Envision new patterns or models for their future activity?
>
> **RQ 1.5**. Commit to concrete actions to support change to activity?
>
> **RQ 1.6**. Take consequential actions to change activity?

1.9 Drivers and contributions of the intervention

This introductory chapter has described how, prior to the intervention summarised in this thesis, participants were practising boundary-crossing TEL in ways which were unsustainable, illicit and sub-optimal in addition to contravening policy. Related calls for change in military HE and TEL from other researchers have included: Sookermany's (2017: 310) plea for a postmodern turn; Remy's (2017: 114) appeals to move beyond dualism; and Mälkki and Mälkki's (2013: 29) calls for epistemic emancipation of soldiers. Informed by such philosophical recognition of problems, a Marxist epistemology led me to informed social acts to take ownership of change, to develop boundary-crossing TEL and to engender transformative agency in participants.

The remainder of this thesis can be summarised in three notable contributions. Firstly, it will highlight limitations of prevalent deterministic approaches to military TEL; defence's indiscriminate implementations of technologies and policies for behaviourist *training* were found to impede *learning*, until participants were empowered to change their activity. Secondly, examining top-down and bottom-up perspectives for change was lucrative yet challenged convention; few studies had exploited the epistemic potential of diverse, contradictory and troublesome voices as this study did. Thirdly, examining TEL's cultural mediation countered the dominant foci on digital technologies; this led participants to consider the mediating effects of rules and division of labour to be of higher importance than artefacts, particularly when concretizing and sustaining change.

1.10 Structural overview of the thesis

The thesis is presented as seven chapters:

Chapter one; introduction. The current chapter describes the setting for my project and its historical, cultural and social context, relating the aims of the project to my own motives and those of the participants. It closes with this structure.

Chapter two; theoretical framework. The theoretical framework precedes my literature review, to allow the reader to understand how I subsequently draw theory-driven interpretations of the current literature. Transformative agency and its antecedent theoretical principles are thus described in this early chapter.

Chapter three; literature review. The literature review analyses empirical works in existing bodies of knowledge, reviewing cognate studies of change, TEL and military HE. It identifies a gap in knowledge and situates the project within it.

Chapter four; research design and methodology. The fourth chapter describes the methodological design of the intervention. It critically discusses the methodological alignment between the project's theories and the methods for collecting and analysing data.

Chapter five; data presentation. The data is presented in the fifth chapter. Empirical findings are presented in relatively unmediated forms, to allow the readership to form personal judgements of the data's implications prior to critiquing my own analyses.

Chapter six; data analyses. The analyses of data are summarised in the sixth chapter, which highlights notable examples of expressions and sub-expressions of transformative agency, closing with potential implications and consequences.

Chapter seven; conclusions and further opportunities. The thesis concludes by revisiting the research questions, to describe the benefits and limitations of the project and my claims of original contributions.

CHAPTER TWO – THEORETICAL FRAMEWORK

2.0 THEORETICAL FRAMEWORK

In its placement here, my theoretical framework unconventionally precedes the literature review. My intent is to use these theoretical matters to allow the reader to understand how I subsequently discuss and interpret the corpus of literature, identifying a gap and situating my contributions within it. In this chapter I develop theoretical principles for the literature's interpretation, many of which for me are ontologically and epistemologically antecedent to transformative agency. It comprises successive descriptions of:

- Activity Theory, specifically Cultural and Historical Activity Theory (CHAT). This provides a dialectical framework for the theorisation of participants changing their own activity, by purposefully and collaboratively intervening in social reality (Langemeyer & Roth, 2006: 21).

- CHAT's key principles for work and learning. CHAT theoretically grounds the transformation of mediated activity in ways which are historically and culturally sensitive for participants, allowing research in the cultural context of work and learning (Engeström, 2013: 90).

- Expansive learning, a process theory where learning is authored by participants. In reconceptualising and redesigning the object of activity, and therefore the reason for its existence, participants support changes to social reality (Engeström, 2016: 40).

- Transformative agency, which theorises participants' rejection of current conditions. Their capacity for collaborative change evolves as they *jointly* expose and aggravate contradictions in their activity (Haapasaari, Engeström, & Kerosuo, 2016: 233).

- Double stimulation, a theoretical concept and process for the emergence of transformative agency where participants reframe or reconceptualise a problem situation to break out of conflicting motives in activity (Sannino & Laitinen, 2015: 6).

- Boundary-crossing, which theorises evolving forms of work and learning between people of different backgrounds, different organisations and horizontal levels of expertise, rather than solely vertical rank and status (Fuller & Unwin, 2013: 56).

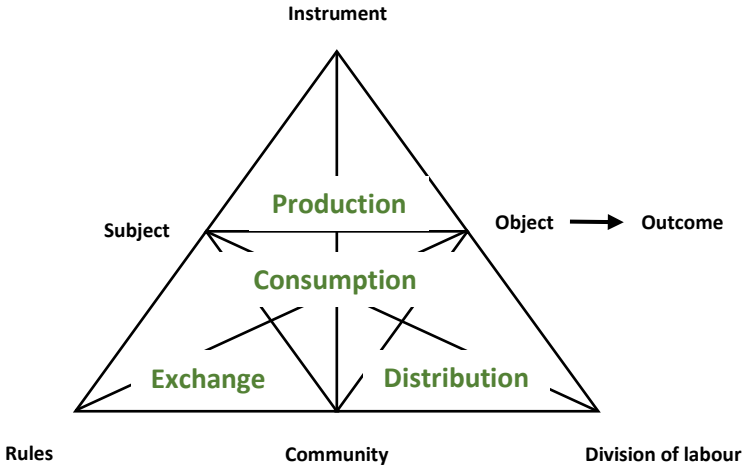
- The Change Laboratory methodology, an interventionist methodology to promote and sustain transformative agency (Virkkunen, 2006: 43) by exposing and aggravating contradictions in activity (Haapasaari et al., 2016: 232). My principal reason for introducing the methodology in my theoretical framework is that it is very theoretically derived, and warrants association with the principles above.

The chapter then closes with a short critique and the limitations of my project's theoretical framework, leading into the literature review.

2.1 Activity Theory and CHAT

The origins of many of Activity Theory's concepts originated in Russia in the 1920s, receiving attention from western scholars during the post-cold war 'social awakening' (Daniels, Cole & Wertsch, 2007: 13). Successive adaptations of Activity Theory have been proposed, often discontinuously and antagonistically (Lompscher, 2006: 35; Kaptelinin & Nardi, 2009: 173). CHAT originates in the works of Russian psychologists including Lev Vygotsky, Alexander Luria and Alexei Leontiev who challenged dominant theories of behaviourism, intending to develop a non-deterministic theory of consciousness to improve the human condition. Their original insight was in emphasising the mediation of social activity, through sharing internal and external artefacts including: material tools and instruments; signs, speech and illustrations; and cognitive concepts and problem-solving devices. These artefacts, and their influence on the world and mind, led to CHAT's theorisation of human-world interaction (Cole & Gajdamaschko, 2007: 193) which can be represented as a triangular activity system attributed to Engeström (1987: 94) as shown at Figure 2.1.

Figure 2.1. Engeström's (1987: 78) triangular activity system describing the structure of human activity



The starting point of activity in CHAT is production, shown as the top triangle in Figure 2.1: the subject (person or people) interacts with the object (the purpose of the activity) and is mediated by artefacts (tools and signs) to reach the outcome (the activity's intended and unintended consequences). The outcome is the interactional, societally meaningful and relatively lasting abstraction of the completed object (Engeström, 1999a: 31) also described as the "exhibition of value in a way not previously evident" (Taylor, 2009: 231). This project uses the collective term 'nodes' to describe all of these outer connections from this point forward. The nodes at the base of the activity system represent activity's less visible social mediators (Engeström, 2008: 27). They are:

- Rules, which are the implicit and explicit regulators of social activity.
- Community, representing the social formation with interest in the object whose membership is outside the subject.
- Division of labour, describing the horizontal and vertical allocation of roles and responsibilities.

The four assembled sub-triangles comprise CHAT's representation of meaningful human activity (Sannino, 2011: 577; and c.f. Blunden, 2010d: 229 for a critique of representational simplicity). These sub-triangles are referred to as 'functions' from this point in the thesis, and they can be analysed either as mediated by, or mediating, their enveloping activity (ibid.). Their triangular representations of mediation challenge duality and directness (Sannino et al., 2009: 13). The representation of collaborative, durable and culturally-mediated activity, defined by the object, is termed "object-oriented activity" (Karakus, 2014: 13) and activity systems can be used as theoretical bases for interventions with CHAT as explained in subsequent chapters for the RSME's boundary-crossing TEL in HE (see also Ellis, 2008: 56; Sannino, 2010: 843; Laferrire, Hamel, & Searson, 2013: 463). The functions are (see also Engeström, 1987: 95; Bligh & Flood, 2015: 147):

- Production, where the collaborative subject re-creates an object to satisfy social need.
- Distribution, which is allocating and reallocating through social demand.
- Exchange, which is allocating and reallocating based on individuals' demands.
- Consumption, which is finally satisfying social need.

CHAT's activity system foregrounds mediation and activity's evolving, dialectical and dynamic nature (Engeström, 1987: 77). This is illustrated by the three nodes in any function's triadic

relationship. The origins of contradictions and dialectics can be traced through these nodes and functions, with mediational relationships aggravated for development, rather than represented as closed (Langemeyer & Roth, 2006: 20). Contradictions are mutually defining and interdependent tensions; they are examined in some detail below in Sub-section 2.2.4. CHAT's activity system can represent how activity iteratively and continuously changes, and is changed by, its own elements through time and social circumstances. This makes it useful for studies of education and development in their social and historical contexts (Roth, 2004: 5), rather than the subject-object duality of behaviourism (shown in Figure 2.1 as a direct line between subject and object). The representation of mediated social activity indicates CHAT's theoretical power for this formative intervention in boundary-crossing TEL, which examines the political reality of social activity in which contradictions had been insufficiently aggravated. In turn these limitations have led to social conditions which have hampered the development of activity.

CHAT can also highlight intertwined and complex relationships of context and culture (Cole, 1996c: 137). Context denotes how participants determine the significance of their thoughts and actions (discussed for TEL by Nardi, 1996: 69; Luckin, 2010a: 9); whilst culture is conceived as the accumulated artefacts of a group, representing "history in the present" (Cole, 1996b: 110). The metaphorical 'weaving together' of context, culture and TEL activity is a developmental process, rather than considering culture as a 'container' with TEL as an outcome (examined in Cole, 1996c: 135 and Luckin, 2010b: 164). Culture is instead communicated in multiple directions, with artefacts carrying markers of cultural knowledge and social experiences which shaped them (Kaptelinin, 1996: 109). These may be interpreted materially through social history, or more ideally through their direct meaning to individuals. These notions will prove important in my chapters describing the project's empirical stages.

Reasons for using, choosing and valuing Activity Theory in empirical HE research are in Bligh and Flood's (2017) examination of 59 empirical papers, framed by their "wish to understand what difference using Activity Theory makes in published research" (p. 128). Referring to Bligh and Flood's categorisations for *choosing* Activity Theory (p. 137), and applying them to this project:

- In Section 1.4, I set out my intentions for the project as a whole. The intent to empower participants to change the social conditions of their own learning, which

provided my impetus for the intervention, illustrates my own *epistemological agreement* with Activity Theory.

- In Section 1.6, I explained the relationships between expansive learning and the participants' uncertain requirements for work and learning. The identification and aggravation of contradictions for developing social activity, as discrete from the pursuit of consensus and completion, highlights Activity Theory's *comparative advantages* for the intervention.
- In Section 2.2 of this chapter below, I will describe how the theoretical framework of Activity Theory informs the intervention's *developmental focus,* highlighting potential changes to local practice in boundary-crossing TEL.
- In Section 4.3 of Chapter 4 I describe the methodological considerations and the intervention's design, indicating Activity Theory's *methodologically appropriate* match with a Change Laboratory intervention.
- In Section 7.5 of Chapter 7 and Section 8.3 of Chapter 8, I discuss and conclude the intervention with a review of the techniques to collect, present and analyse data. These illustrate how the intervention aspired to *investigate the theory*; reflecting on the data and results to examine how useful Activity Theory was.

Cognate examples of CHAT in educational research, which inform this project, include Algers, Lindström and Svensson (2016) and Waitoller and Kozleski (2013) who study learning's potential at boundaries. Like these authors I have used CHAT to theorise how meaning and sense-making can be revealed in the mediation of collaborative endeavours (Cole, 1996c: 140). Unlike other authors, I have aspired to establish how transformative agency relates to activity's organisation and its changing object (Davydov, 1999: 50). CHAT's theoretical framework has assisted my project in defining: the current and proposed object of activity; what people are doing; why they are doing it; and to some extent why they are doing it that way (see also Kaptelinin, 2005: 5). CHAT has then allowed participants to make future-oriented collaborative changes to their object-oriented activity. This requires some further explanation of CHAT's underpinning principles, as detailed below.

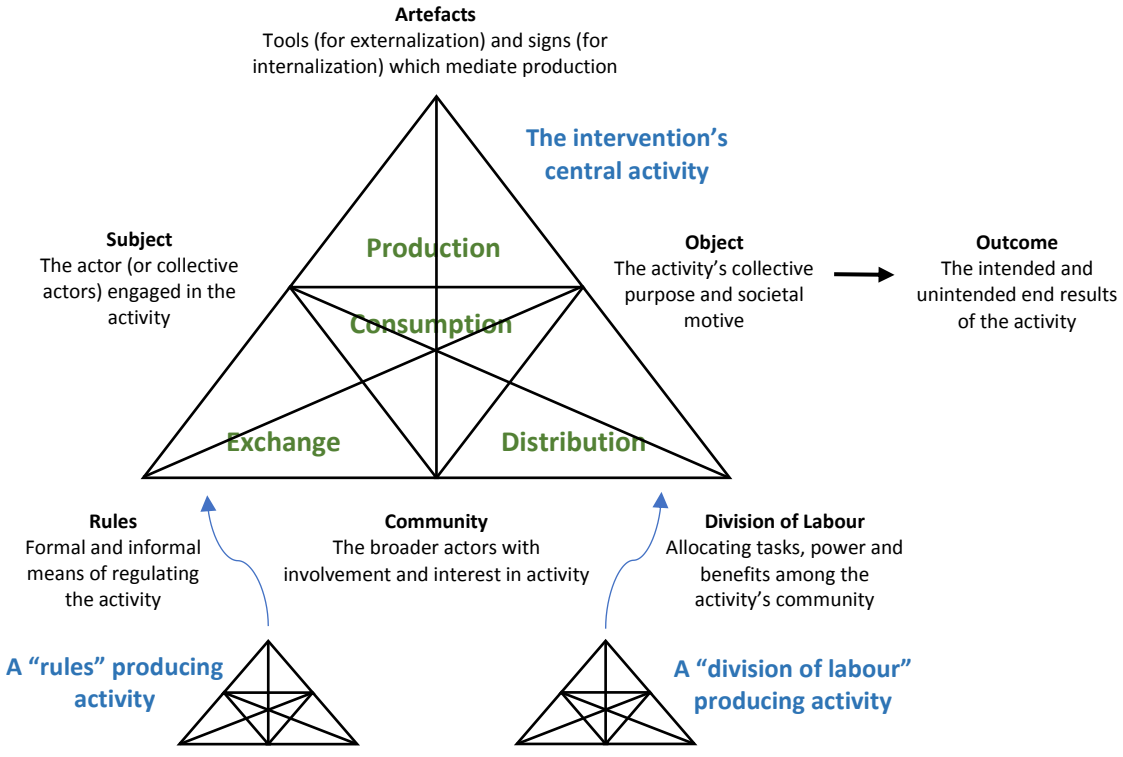
2.2 CHAT's key principles for work and learning

With a focus on the evolving meaning of artefacts to human development, and the non-dualistic interrelatedness of elements of cultural participation, CHAT has seen application to

the development of social learning in diverse work and learning settings of schooling (Yamazumi, 2014: 61), teaching and learning in HE (Ashwin, 2012: 53), and workplace learning (Solomon & Boud, 2011: 219). Of particular theoretical interest to this project is the appropriation and social creation of knowledge in its context (theorised for changes to HE by Wells & Edwards, 2013: 9). CHAT has guided my examination of work and learning, including the consideration of both internal (in the mind) and external (in the world) praxis (Nicolini, Gherardi & Yanow, 2003: 8; Bligh & Flood, 2017: 131).

Figure 2.2 shows CHAT's theoretical elements and functions, modelled by myself as three interacting activity systems for a generic intervention. The figure shows three neighbouring activity systems used for illustrating theories to participants, and for their collaborative exposure and aggravation of contradictions in activity: for learners (the central learning activity); for managers (the rules-producing activity); and for lecturers (the division of labour-producing activity). Other theoretical configurations for interacting activity systems are examined by Yamagata-Lynch (2010: 46-56) and other theoretical roles for CHAT are described by Bligh and Flood (2017: 133). In the sub-paragraphs below I describe the value of CHAT using five of its key principles which are taken from Engeström (2001: 133): collective activity; multi-voicedness; historicity; contradictions; and expansive learning.

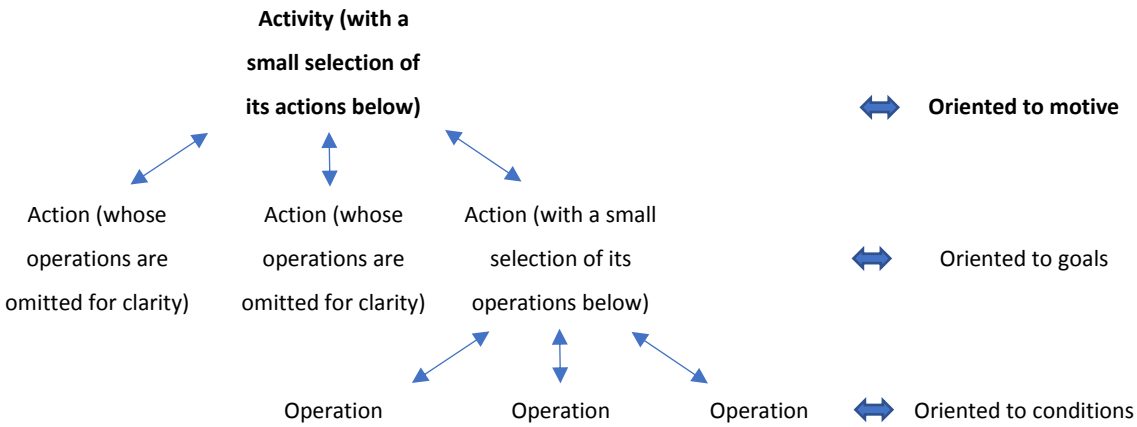
Figure 2.2. Interacting activities, using conceptions of "neighbour activities" for producing the central activity's rules and division of labour (adapted from Engeström, 1987: 71)



2.2.1 The first principle - collective and object-oriented activity

The first key principle is that collaborative and object-oriented activity is CHAT's prime unit of analysis (Engeström, 2001: 136). Activity systems realise themselves and reproduce through actions and operations, with CHAT's hierarchical structure in Figure 2.3. Activity has a societal motive and comprises individual actions, each oriented to a goal. Actions comprise operations, oriented to conditions. Actions may make little sense until considered as contributing to activity, and operations may be subconscious or require little conscious thought. Actions and operations evolve and adapt with the individual, and actions may be routinised to become operations. Conversely, problematic operations may be elevated to actions for conscious analysis (Kaptelinin & Nardi, 2009: 63).

Figure 2.3. The hierarchical structure of activity, adapted from Kaptelinin & Nardi, (2012: 28)



This notion of object-oriented activity also relates to dialectical materialism, an important Marxist notion implying "engaged practical agency rather than … detached intellectual contemplation" (Ollman & Smith, 2008: 3). Development is achieved through engagement with the practical world, where "social being determines consciousness" (Kaptelinin & Nardi, 2009: 37). Materialism describes the physical world's primacy over consciousness of it (Marx & Engels, 1888/1998a: 42) whilst dialectics describes how phenomena, even those that seem unrelated, are linked; their contradictory nature drives development. Marxist dialectics for social change are detailed in Martin (2009: 150) and Benson (1977: 6-17), with theoretical relevance to the project including: social structures emerge from everyday work and learning; behaviour is understood in its social context; and people recognise the limits and potential of their social activity through praxis.

2.2.2 The second principle - multi-voicedness

CHAT's second principle is of multi-voicedness, with many views, traditions and interests represented by activity's diverse subject and community (Engeström, 2001: 136). Diverse experiences and goals provide rich developmental material through discursive conflict (discussed in Lemos, Pereira-Querol, & Almeida, 2013: 720). Multi-voicedness relates to differing experiences of objects, rules and divisions of labour, with resulting disparities impacting access to artefacts, and representing a lucrative resource for uncovering and aggravating contradictions (Kaptelinin & Nardi, 2009: 56). On a related note, artefacts can be described as either motivating or directing activity, and whilst relationships between them are complex the division of labour will significantly affect multi-voiced perceptions of artefacts. A bureaucratic division of labour will likely result in directing, where individuals understand how artefacts relate to their own actions and goals yet feel isolated from societal motives for activity (Kaptelinin & Nardi, 2009: 59). Whilst activity may succeed in these circumstances it is unlikely to be as optimal, or as resilient to change, as alternatives where artefacts enable the collaborative negotiation of motives. That stated, some studies use dissociations of goals from motives as a source of multi-voiced development (e.g. Tkachenko & Louis, 2016: 149).

2.2.3 The third principle - historicity

The third principle is that activity's historical development provides means for understanding current problems and future potential (Engeström, 2001: 136). Activity systems are dynamic and developmental yet relatively durable, which can help analyse their object's past, present and future (Engeström, 2009: 327). Historicity may transcend known developmental cycles, originating outside the existing activity system in its enveloping cultures and adjacent activities (Blunden, 2010c: 286). Knowing is inseparable from doing in the historical context of activity (Nicolini, Gherardi, & Yanow, 2003: 8) with artefacts carrying markers of successive historical influences (Blackler, 2009: 31). Historicity is thus fundamental in progressing from the abstract to the concrete, theoretically tracing the origins of activity's most simple explanation (Engeström, Sannino, & Virkkunen, 2014: 122). This genesis is described as a germ cell; the most simple representation capable of developing (Vygotsky's and Davydov's work on germ cells is discussed by Daniels, 2007: 314). In CHAT, the germ cell is enriched to expose contradictions whilst examining concretisation. When abstract concepts are concretised their links with other phenomena are better appreciated, generating further contradictions.

2.2.4 The fourth principle – contradictions

Contradictions comprise the fourth principle of CHAT, specifically their importance as drivers of development and change (Engeström, 2001: 137). Contradictions have particular implications for change and dialectical analysis. They define interdependent, mutually defining, and historically accumulating layered tensions in activity, arising in particular socio-historical conditions. In CHAT, contradictions are collaboratively abstracted from data such as audio and visual (AV) media and jointly created artefacts, to be exposed and aggravated by analysing their manifestations (Engeström & Sannino, 2011b: 372). Rather than being directly exhibited, they require sustained effort for exposure and aggravation. They can be conceptualised in four forms (Bonneau, 2013: 10) illustrated in Figure 2.4, all of which can form the starting point for formative interventions (Postholm, 2015: 51):

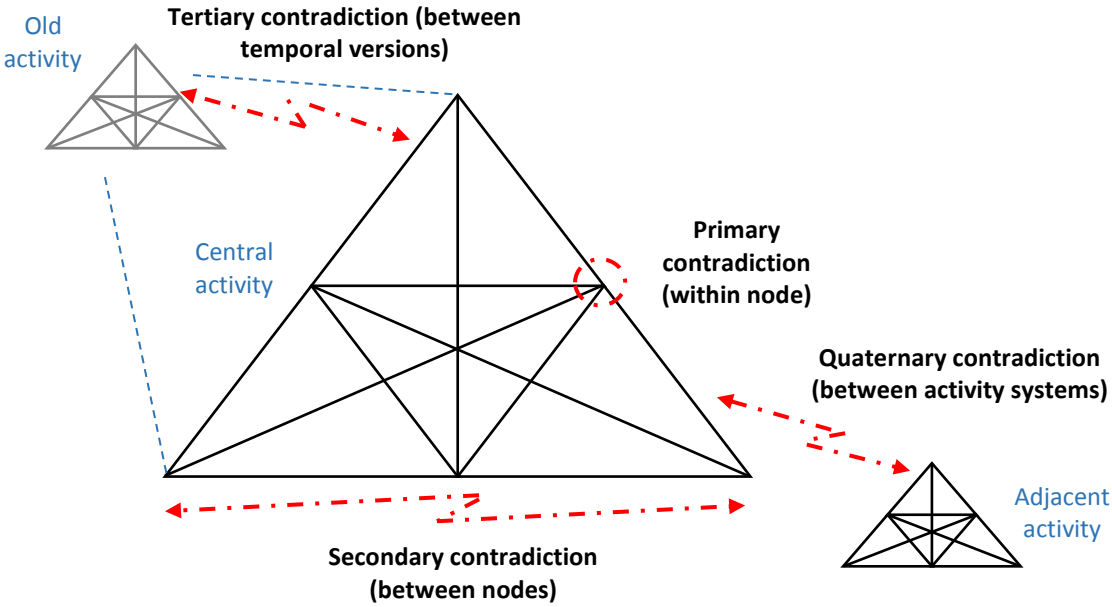
- Primary contradictions are the most persistent, existing within a node as its direct intrinsic worth versus its exchange as a commodity. This primary contradiction is the opposition of the direct value of purposeful use and the exchange value in a transaction. It is a continual tension of capitalist economics, which cannot be eliminated, and is cited as a distinguishing feature of CHAT (Foot & Groleau, 2011: 5).

- Secondary contradictions arise when two nodes are in conflict. For example, a change to an activity's rules may preclude a change to an artefact, or some embedded form of division of labour, exposing tensions between both. The aggravation of a secondary contradiction between two nodes is generally regarded as prompting a latent primary contradiction, revealing developmental opportunities (ibid.).

- Tertiary contradictions arise through time and cultural advancement, between old and new nodes of activity. An example could be the redesign of an object of activity, undertaken through attempts to alleviate related secondary contradictions, which is then found to present tensions between the new object and the nodes which remain from the established version of activity (Foot, 2014: 340).

- Lastly, quaternary contradictions arise between the central activity and its adjacent activities. They may be triggered by attempts to alleviate tertiary contradictions; for example, transforming the object of a central activity may generate disturbances with neighbouring activities, who share its object. Quaternary contradictions may also be exposed through power relationships between activities (ibid.).

Figure 2.4. Examples of contradictions within and between a generic constellation of activities, known as an "activity setting" adapted from Yamagata-Lynch (2010: 24)



Contradictions are theoretically differentiated from dilemmas and associated phenomena using conceptions by Putnam, Fairhurst and Banghart (2016: 63). Many of these describe how contradictions are subjectively manifested, as summarised in Table 2.1.

Table 2.1. Features and implications of contradictions, dilemmas, dialectics, double binds and paradoxes (adapted from Putnam et al., 2016: 70 and Engeström & Sannino, 2011b: 368)

Notion	Theoretical features and implications for this project	Seminal works
Contradictions	Mutually interdependent and mutually defining layered tensions in activity systems, arising from socio-historical conditions. Purposefully exposed and aggravated, as drivers of development and change.	Putnam (2013: 625)
Dialectics	The notion (and study of) interdependent syntheses of opposing forces in social activity, exhibited as moments about opposing poles. Studied as the simultaneous reliance of binary opposites in activity.	Langemeyer & Roth (2006: 31)
Dilemmas	Reproduced and socially shared expressions, describing perceptions of subject's incompatible experiences and observations in activity.	Yamagata-Lynch (2007: 456)
Paradoxes	Contradictions which are persistent through time, with unresolved conditions driving apparently irrational behaviours in activity.	Fairhurst et al. (2016: 173)
Conflicts	Exhibitions of behavioural resistance, disagreement or criticism in reaction to perceived or real incompatibility, termed critical conflicts when they result in a point of paralysis.	Behfar et al. (2008: 170)
Double binds	Processes in learning and work where participants repeatedly face equally unacceptable alternatives, which cannot be resolved with existing activity.	Schulz (2008: 457)

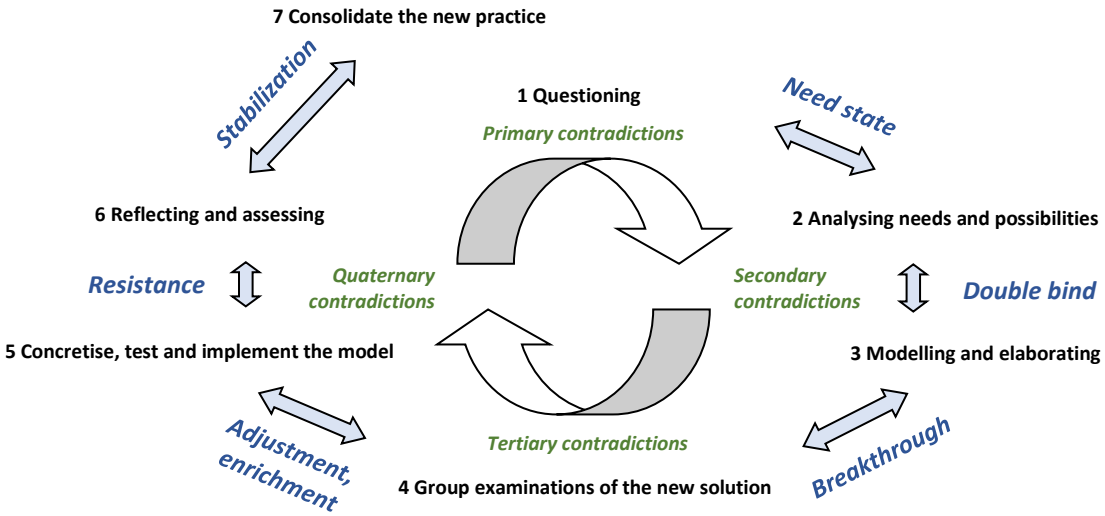
2.2.5 The fifth principle - expansive learning

CHAT's fifth principle relates to the possibility of expansive transformation of activity (Engeström, 2001: 137). The aggravation of contradictions can lead participants to question norms and to deviate from them; with escalation, this can promote endeavours of collaborative and future-oriented change. A change effort is considered expansive when the object and motive are collaboratively reconceptualised, leading to a "radically wider horizon of possibilities" than previously (Engeström, 2001: 137). The subsequent section is dedicated to this principle of expansive learning, and its representation of a Marxist ascension from the abstract to the concrete.

2.3 Expansive learning as ascension from the abstract to the concrete

The collective endeavour to expose and aggravate contradictions in work and learning is theoretically related to the concept of a double bind, which is an apparently irresolvable contradiction requiring new activity to proceed (Bateson, 1972: 308). Expansive learning describes the redesign of that new activity as participants collaboratively cross a zone of proximal development (ZPD) to overcome their double bind. The ZPD relates to Vygotsky's representation of the difference between what is achievable by an individual and what can be achieved with others (Vygotsky, 1978: 83), through social development rather than individual mastery of pre-ordained tasks (Leontiev, 1997: 29). The will to undertake expansive learning will generally be driven by critical conflicts, and the associated social conditions which lead to double binds. A typical expansive cycle is at Figure 2.5.

Figure 2.5. Actions in expansive learning, adapted from adapted from Engeström (1994)



Engeström (2016: 47) describes expansive learning as an epistemic means of ascending from the abstract to the concrete, using the cycle as a heuristic device for sustainable change rather than as a recipe or formula. Success in expansive learning will be accompanied by conscious re-imagination of activity, and evidence that the object of activity has been expanded, rather than merely reflected upon (Bligh & Flood, 2015: 153). Seven actions of expansive learning are generally proposed (Engeström, 2000: 970):

- Questioning activity. This first action involves participants engaging in the criticism or rejection of their accepted practice, current plans and established wisdom.

- Historical and empirical analysis. The second action of analysis has two related variants: examining the historical reasons and causes for the present situation; and identifying explanations of the existing order. Historical-genetic analysis traces the origins and evolution of activity, to understand how past development led to the current situation. Actual-empirical analysis identifies the inner systemic relationships of activity, to explain the current situation.

- Modelling new activity. In the third action of modelling, participants construct simplified, explicit and observable media which allow them to communicate explanations for the current situation and offer potential solutions to problems.

- Examining. The fourth action involves examining the model. It comprises the application of the model in practice, with further experiments and discussions to understand its dynamics, potential and limitations.

- Implementing. In the fifth action of implementation the model is further concretised. It is enriched by being practically applied and conceptually extended.

- Reflecting. The sixth action is to reflect on and evaluate the current process of expansive learning, generating critique and considering further requirements.

- Consolidating. In the seventh action, consolidation and generalisation, participants embed the outcomes into a new stable form of practice.

Recursive and iterative sub-cycles can occur at any point in the cycle, which overall may be more accurately described as a spiral, since it will not return to the same position. This is likened to concretisation's "negation of the negation" by Blunden (2010a: 62). Figure 2.5 shows the epistemic outcomes of expansive learning which are likely to dominate, at the

outer double-edged arrows of the cycle, and the likely corresponding contradictions at the inner edges (Engeström, 2001: 152).

In purposeful interventions, the initiating conditions for expansive learning are likely to arise in a primary contradiction presenting a double bind, identified during collaborative analyses of problems. The irreconcilable state leads to questioning of existing practice (the first action, questioning). Subsequent analyses expose the historical origins and empirical nature of systemic relations, leading to greater understanding of contradictions and the double bind (the second action, analysing). The investigative work is edited, curated and simplified into a model, through which remediation is socially negotiated (the third action, modelling). Fourthly, the model is used to identify and challenge the potential and limitations for change (examining). In reaction to its enrichment in trials, the model is practically applied (the fifth action, implementation) and evaluated (the sixth action, reflection). The seventh action (consolidation) involves stabilizing the practice and considering new contradictions. The subsequent section relates these epistemic actions to transformative agency.

2.4 Transformative agency

Transformative agency can be defined as collaboratively "breaking away from the given frame of action and taking the initiative to transform it" (Virkkunen, 2006: 49). It is "produced and maintained in collective change efforts and evolves over time" (Haapasaari et al., 2016: 232). This intervention sought to encourage participants' transformative agency, through double stimulation tasks as theorised in Engeström, Virkkunen, Helle, Pihlaja, and Poikela (1996). Transformative agency was considered to be important due to the increasing uncertainty of the PEW's contingent work and learning. These requirements to change boundary-crossing TEL activity, from externally imposed forms of bureaucratic control to internally negotiated forms of social activity, align with attributes for societal relevance described by Gibbons (1998: 10) and HE across boundaries by Beerkens (2002: 299). Common characteristics of relevance to transformative agency include: transdisciplinary foci; heterogeneity and organisational diversity; enhanced social accountability; and multi-vocal challenges. Promoting, identifying and tracing transformative agency required discursive activity. This can be politically unpalatable yet theoretically lucrative, as participants re-interpret their social conditions to understand manifestations of contradictions. Francis, (2013: 106) describes a "dialectic of disruption" in agentic sociotechnical change, with bottom-up disruptions to TEL including the uncertainty of control.

Seminal studies of transformative agency identify comparable expressions as participants break away from frames of reference. They also call for further research in work and learning to examine the validity of the original model and to make proposals for different representations. Haapasaari et al. (2016: 242) refine an earlier typology from Engeström (2011: 622) to propose six expressions which are used in this intervention:

- Resisting the management or the interventionist.
- Criticizing the current activity and highlighting tasks and objects for discussion.
- Explicating new possibilities for the activity.
- Envisioning new patterns or models of the activity.
- Committing to specific actions to change the activity.
- Taking consequential actions to change the activity.

These expressions inform later chapters, as participants collaboratively undertake future-oriented redesign of their boundary-crossing TEL activity. Their reconceptualisation and development of military TEL, even at the modest and local level of this intervention, was expected to be theoretically ambitious, challenging widespread conceptions of progress in military TEL as enculturation and mastery of preordained skills. In this project, development involved dialectical outcomes such as those examined for change in HE by Francis (2013: 110): rejection of old activity; development as horizontal movement and challenges to vertical expertise; and discursively fostering collective agency rather than channelling individual aspirations. Dilemmas in moving from a group of individuals to a collaborative subject, exhibiting expressions of transformative agency, have been theorised by Virkkunen (2006: 46), and are discussed in my methodological chapters. The salient observation here is that transformative agency is positively disruptive; its attributes are intrinsically related to the theoretical power of double stimulation, which is described in the next section.

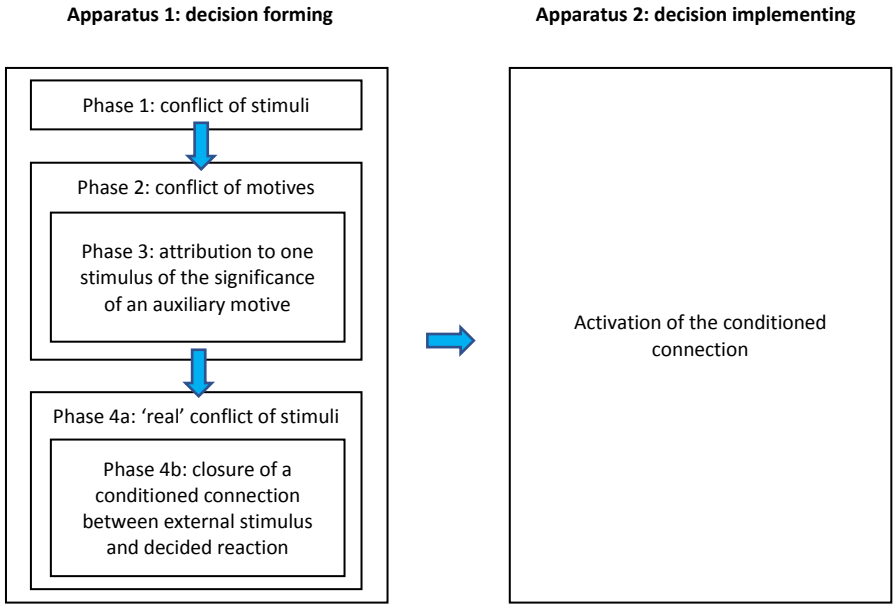
2.5 Double stimulation

Double stimulation is a Vygotskian principle and method which, along with ascending from the abstract to the concrete and transformative agency, completes the triumvirate of a formative intervention (Engeström, Sannino & Virkkunen, 2014: 119). In double stimulation a primary stimulus presents a problematic situation for participants, a secondary stimulus provides support with conflicting motives, and both stimuli are discursively combined to build agency (Sannino, 2015a: 4). Double stimuli are notably defined by Sannino, Sutter and

Engeström (2011: 606) as the primary means by which transformative agency is attained; "double stimulation as the core mechanism [of formative interventions] implies that the participants gain agency and take charge of the process" (ibid.). Participants in formative interventions use stimuli to gain the power to break out of critical conflicts in work and learning, using artefacts to mediate intentional actions in ways which nurture their agency.

Without conflicting motives and participants' volition to work through them, attempts at double stimulation will revert to a state of general mediation (Sannino & Engeström, 2017: 60). Unlike linear interventions, the exact format and outcome of a formative intervention using double stimulation is unknown: the intervention's progress is subject to collaborative negotiation; the outcomes are conceptual and agentic rather than positivistic; and the process is led and owned by participants themselves (theorised for TEL and boundary-crossing studies in Morselli, Costa & Margiotta, 2014: 335). Figure 2.6 is adapted from Sannino (2015a: 10) and illustrates the theoretical potential for Vygotskian double stimulation in formative interventions. It models a decision-forming apparatus on the left-hand column and a decision-enacting apparatus on the right-hand column.

Figure 2.6. Phases of double stimulation, adapted from Sannino (2015a: 10)



In Vygotsky's original waiting experiment (analysed by Sannino & Laitinen, 2015: 4) participants were placed in a waiting room, alone and with nothing to do. Phase 1 is the conflict between being asked to wait yet having no purpose, stimulating conflictual motives for phase 2 which alternately replace each other initiating volitional action. Initially the person is temporarily paralyzed between leaving and waiting for the guide's return,

eventually studying a timepiece to consider a point to leave. In phase 3 the significance is enhanced, in the most important part of the decision-forming apparatus. Studying the time is now given agentic meaning by the participant, with time promoted to auxiliary motive status; the decision is made that the timepiece as an artefact will control future behaviour, creating conditions for when the hands of the watch reach certain positions. In phase 4a the hands of the timepiece reach a predetermined position, signalling the participant and generating real conflict of stimuli for volitional enactment, the closure of which is phase 4b. The decision is then implemented, in the right-hand column. This volitional action warrants particular theoretical consideration at boundaries, which is discussed in the next section.

2.6 Boundary-crossing learning

In theorizing boundaries and learning, the research focuses on empowering participants to undertake boundary-crossing learning, which means purposeful and negotiated learning with culturally diverse people (other conceptions are in Akkerman, 2011: 21). Boundary-crossing may delineate organisations, locations and social groups; their exact natures are established in discussions between "boundary brokers" (introduced by Maaninen-Olsson & Carlsson, 2006: 10). Boundaries mark distinctions of characteristics such as political control, competence and behaviour. Boundary objects are artefacts of sufficient plasticity that they can be interpreted by multiple groups whilst retaining common identity for those groups (Kimble, Grenier, & Goglio-Primard, 2010: 437). Boundary objects ought to assist with collaborative work, whilst enhancing the contributions of diverse knowledge and meaning (Fominykh, Prasolova-Førland, Divitini & Petersen, 2016: 85).

Specific theoretical points of interest for boundary-crossing TEL, and associated examples from HE, include: how groups across boundaries perceive knowledge and meaning (Garraway, 2010: 211); how activity is mediated across boundaries by physical, digital and conceptual artefacts (Waitoller & Kozleski, 2013: 35); and how boundary work and contradictions relate to agency (Vähäsantanen, 2015: 7). CHAT has been used in various studies of TEL-related boundaries including: Virkkunen and Newnham (2013a: 187) and Fuller and Unwin (2013: 52) for workplace learning; Doyle (2008: 446) and Zitter, de Bruijn, Simons and Cate (2012: 119) for HE; and Edwards (2011: 33) and Anatan (2015: 711) for collaborations between learning and work. Their motives for boundary-crossing TEL include: attaining compliance; accessing resources; integrating content; authenticity; and marketing. A more humanistic motive is described by Margaryan and Littlejohn (2014: 175): emerging

TEL practices need to transcend boundaries due to learning's complexity, unpredictability and reliance on dispersed technologies.

2.7 The Change Laboratory methodology

This intervention required theoretical commensurability with development and enhancement (defined in Trowler, Saunders, & Bamber, 2009: 10) and specifically with CHAT's framing of Vygotskian development (for detailed critique see Peim, 2009: 167). A Marxist epistemology foregrounds theoretical notions of practice and dialectical materialism: material activity has primacy; knowing is social and inseparable from doing; and understanding activity's meaning requires consideration of social and historical context (Nicolini et al., 2003: 8). The Change Laboratory methodology is theoretically commensurable with these conditions (Engeström et al., 1996: 17). The intervention set out to provoke transformative agency, through two theoretical principles described above; double stimulation and expansive learning. As the Change Laboratory interventionist (as described by Engeström & Sannino, 2011b: 368) I orchestrated methodological arrangements for double stimulation and expansive learning: mirror data to problematise the need for change; group work to understand, model and develop activity; and future-oriented changes to activity.

My theoretical and methodological considerations were drawn from comparisons with applied examples such as those described by Daniels (2013: 110); Postholm (2015: 43); Bligh and Flood (2015: 141), but most notably from the relatively prescriptive theoretical guidance in Virkkunen and Newnham (2013b: 29-55). My theoretical considerations for the empirical stages of the intervention aimed to provoke a Marxist ascension from the abstract to the concrete with purposeful change to work and learning. Yet, of more importance for the specific research questions, the empirical stages intended to develop participants' transformative agency through the Change Laboratory methodology, attending to "… how participants see themselves as learners in developmental processes, which creates a new understanding of what learning is …" (Engeström, 2014: 68).

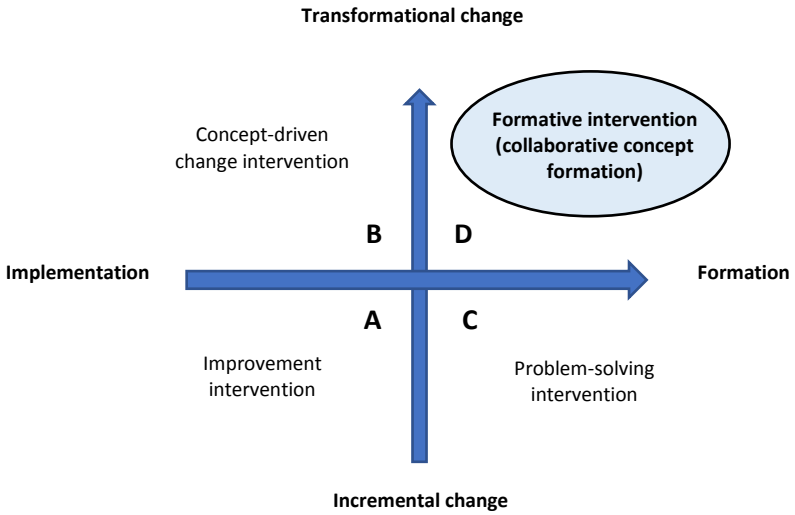
Foregrounding theoretical principles during the methodological design helped to protect my research from "naïve theories" and "everyday thinking" (Langemeyer, 2012: 807; Virkkunen & Newnham, 2013b: 30) which could otherwise have impaired its potential, its impact on daily reality and its contribution to knowledge. The following considerations were considered prevalent:

- Activity systems undergo fluctuations of instability and stability. Stability is likely to be enabled by people being unaware of, or consciously disregarding, activity's contradictions (Kaptelinin & Nardi, 2009: 109). Objects and phenomena have "inherent inner dynamic, self-motion and transformation" (Virkkunen & Newnham, 2013b: 29). A Change Laboratory intervention must allow participants to purposefully and safely examine problematic and troublesome instabilities, presenting undeniable evidence of their need for change and the potential for collaboratively overcoming contradictions through double stimulation (ibid.). This can be described as the theoretical abstraction for the practical transformation of activity (Sannino & Engeström, 2017: 62; Virkkunen & Schaupp, 2011: 652).

- A Marxist epistemological impetus for the intervention necessitated my support of socially conflicting motives, uncertain outcomes and heterogeneous participation, whilst concurrently being culturally and historically sensitive. Related tensions were intended to provoke dialectic movements between the individual and the social or between action and activity (Virkkunen, 2006: 44) with participants examining individual and collaborative capabilities in challenging social circumstances (see also Rajala, Martin & Kumpulainen, 2016). Cultural and historical sensitivity was required for the redesign of activity to be sustainable when led by participants. This fell short of the "management's approval of a project outline, which defines the intervention…" (Virkkunen & Newnham, 2013d: 61) placing ownership with myself.

- The intervention's methodology could not be controlled by edict. The Change Laboratory methodology is notable for theoretical parity of oscillations between "aspects of top-down and bottom-up thinking" (Bligh & Flood, 2015: 157) empowering multiple and troublesome influences. The formative intervention intended to be in quadrant D of Figure 2.7, taken from Virkkunen and Newnham (2013c: 4). If the intervention had neglected the multi-voiced role of participants in provoking mutual agency and disturbance-inducing innovations, it would at best revert to an improvement intervention, shown at quadrant A. These have been attempted at the RSME and have consistently failed, believed to be related to the unpredictable requirements of boundary-crossing TEL in preparing participants for their contingent work and learning challenges.

Figure 2.7. Intervention types, taken from Virkkunen and Newnham (2013c: 4)



2.8 Critique of the theoretical framework

Critiques of CHAT are predominantly offered by activity theorists themselves. Dominant concerns include: ambiguity between derivative and essential concepts during modelling (Blunden, 2010d: 231); limited generalizability, privileging the exchange value of results (Avis, 2007: 152); conflation of diverse philosophies such as Leontiev and Vygotsky into one theory (Kaptelinin & Nardi, 2009: 173); the over-socialisation of participants who may exhibit ironic agency (Langemeyer, 2012: 807); and problematic time lags, where approaches takes so long that the relevance of results are surpassed (Arnseth, 2008: 289). The reliability and validity "stretch" of formative interventions in general are forewarned by Ludvigsen and Digernes (2009: 242). Similarly, the differentiation of accidental outcomes highlights the challenges of bracketing needs-based, delegated and conditional agency (Kaptelinin & Nardi, 2009: 248). Further theoretical problems for my relatively unpredictable intervention included the paradox of using relatively prescriptive techniques for generating and sustaining transformative agency. Three notable concerns emerge from such theoretical critiques:

- Firstly, the parsimonious difficulty of selecting irreducible yet meaningful activity (introduced by Martin & Peim, 2009: 136) was epistemically challenging and attracted political attention. Interests of the RSME's strategists included the potential for them to concede political control of participants, as a result of those participants benefitting from agentic outcomes. This relates to the intervention's explicit intent to empower participants to influence their own activity. The intervention set out to engage in genuine changes to social conditions, rather than merely to model and comment on

those conditions (also examined in de Souza, 2008: 267). The RSME's strategists are unaccustomed to participants of educational research driving such change.

- The second prominent point related to formative interventions with CHAT being driven by conflict and surprise. In light of such conflict, stakeholders required sensitive handling when communicating the intervention's progress, particularly in sharing the agentic outcomes for military learners who had rank and power relationships to manage in their daily realities beyond the intervention. The potential for occlusion of power relationships in groups is analysed as a limitation by Bligh and Flood (2017: 142).

- The third concern related to my inability, as the researcher-interventionist, to assume that the project's process and outcomes would be appreciated by all of the related stakeholders. Attempts by me to be apolitical were likely to fail (Peim, 2009:167), and on a related note the Marxist and developmental language of CHAT can over-simplify the agentic aggravation of contradictions as universally welcomed, which is unrealistic (Avis, 2007: 153).

My detailed responses to these critiques are deferred for Chapter 4, with my attempts at mitigation of these perceived limitations being methodological in nature.

2.9 Summary of the theoretical framework

This chapter has mapped and critically discussed my theoretical framework for the project, informing the intervention on three main themes:

- Firstly, the political control of military TEL was frustrating participants' daily lives, hampering the genuine development of their contingent learning activity (Griffin, 2017: 200). This has been theorised as policy's misalignment with practice's evolving requirements, warranting activity's social reconsideration in the contextually and culturally sensitive manner of CHAT.

- Secondly, the PEW's increasingly complex and contingent requirements for TEL presented activity with the need for collaborative, relational and uncertain forms of social engagement with dispersed technologies. These advanced forms of innovative collaboration with diverse others has called for theories of agency and boundary-crossing (Edwards, 2009: 204).

- Thirdly, managerialist and preordained changes had consistently failed in attempts at sustaining adaptable TEL activity (see e.g. Eri, 2012: 2459). Formative interventions were instead demanded with the triumvirate of double stimulation, ascending from the abstract to the concrete, and most importantly for my project, transformative agency.

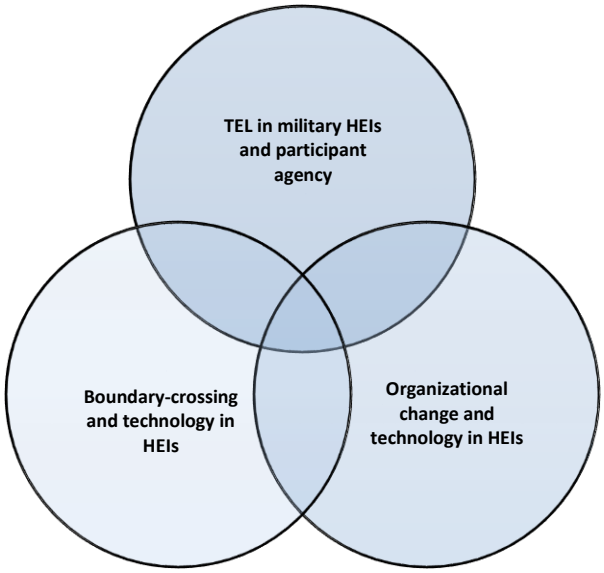
Whilst all of these themes inform the remainder of the thesis, transformative agency remains its theoretical focus. The theoretical framework assisted in my design of an intervention to empower participants, aggravating and resolving contradictions (Haapasaari et al., 2016: 235) through collaborative and future-oriented reconceptualisation of activity (examined in Laitinen, Sannino, & Engeström, 2016: S20). The next chapter describes a literature review which applied the themes identified here to areas of the existing bodies of knowledge: TEL in military HEIs, which is compared with the potential benefits of CHAT's principles; contingent TEL, which is examined with the motives and dimensions of boundary-crossing; and lastly TEL relating to organisational change in HEIs, which is evaluated with the orientations and drivers of organisational change efforts.

CHAPTER THREE – LITERATURE REVIEW

3.0 LITERATURE REVIEW

This chapter summarises my identification and examination of existing research to inform and position the project. The review's conduct is first described, followed by each field in some detail and then a summary. My intent is not to focus on methodological options, but instead to present a synopsis of the project's justification, importance and feasibility when positioned with related works. The review identified potential implications for the intervention: conceptions and theories in existing research; arguments used in problematizing studies; and exemplars of consensus, debates and a gap in which to position my project. Following discussions with my supervisor and peers on the broader intent of the project, and relatively informal consideration of related seminal literature (the scoping review described by Booth, Sutton & Papaioannou, 2016: 110) three themes were focused on as illustrated in Figure 3.1: TEL in military HEIs, with potential benefits of CHAT for participant agency; TEL across boundaries in HEIs, with motives for boundary-crossing; and technology-related organisational change in HEIs, with orientations of change efforts.

Figure 3.1. Intersecting aspects of the literature review, illustrated as a Venn diagram



Having presented these fields, it is appropriate to briefly discuss alternative fields which were rejected. A field which may seem conspicuous by its absence is digital media for standardised training and assessment. These media are used extensively in scalable military training, with their dismissal driven by foci on memorisation and recall of declarative

knowledge about facts. In terms of social attributes (described by Beerkens, 2002: 297) such media tend to address the insular interests of a specific group, with little criticality or interculturality (e.g. Buck, 2006: 7), and would therefore have yielded little informative or positional value for this project. A further dismissed field was immersive simulation, often termed virtual, augmented and mixed realities. In micro-studies at the PEW, simulation has raised anecdotal concerns including: media can prioritise fidelity over contextual value (also noted by Ohlsson, 2012: 618); hardware has been materially unmanageable for spontaneous or group learning (see also Dunleavy, Dede and Mitchell, 2009: 17); and showcasing of artefacts has been prioritised to the detriment of learning (c.f. Remtulla, 2011: 118). Returning to the fields which were reviewed, Figure 3.1 represents "stocks of evidence" (Hart, 1998: 19), to inform my project and position it within an intersecting gap. Following the description of the review's conduct and structure below, the fields are discussed in separate sections, each summarising my analyses undertaken from mid-2017 to mid-2018.

3.1 Conduct and structure of the literature review

The full record detailing analyses of 122 papers has been retained, with extracts presented at Appendix 1. My conduct for examining each field followed the protocol below, adapted from: Hart (1998: 192); and Jesson, Matheson and Lacey (2011: 109):

- Key words, inclusion criteria and exclusion criteria were abstracted from my theoretical appreciation of the research methodology and research questions. This included consulting related research thesauri (Institute of Education Sciences, 2017; STELLAR Consortium, 2017) to identify associated terms, concepts and descriptors.

- These criteria were used to identify studies in the Elsevier Scopus® bibliographic database, supplemented by hand searching journals of HE and TEL listed in Tight (2012: 229), noting further works by bibliography and citation searching. For the military field, I included grey literature due to its esoteric nature and its practice of embargoing data.

- Google Scholar's 5-year Metrics (from June 2015) were used to identify the 20 primary ranked publications by h-index and h-median metrics (Harzing, 2010), in the fields 'educational technology', 'military studies' and 'science and engineering education'. In a cross-disciplinary sift (Kalz & Specht, 2014: 415) I manually scrutinised abstracts.

- The amassed titles and abstracts were then inspected to remove unoriginal studies, descriptive works, contemplative pieces, false returns, and those where I deemed that criteria had been coincidental; this reduced the yielded results to relevant, original and empirical pieces whose full texts were then analysed in further detail.

- These individual papers were categorised, deductively noting their empirical and theoretical characteristics (structural dimensioning in Schreier, 2014: 61). Categories included aims, theoretical approaches, methodologies and conclusions. Deductive analyses identified relationships between methodologies, arguments and claims.

- The next stage evaluated each study's alignment with my own project's context, aims and methodology, similar to "analysis by subsumption" in Schreier (2014: 115). Papers were then inductively analysed to identify their theoretical and methodological characteristics and their outcomes, which were then iteratively traced in other studies of the field to compare their features.

- All of these steps of reduction and categorisation were continuously recorded, to enable repeatability and comparison with future projects (the documentation stage in Booth et al., 2016: 123). Final records were abridged in an auditable format and passed to a disinterested colleague who audited its trustworthiness and repeatability.

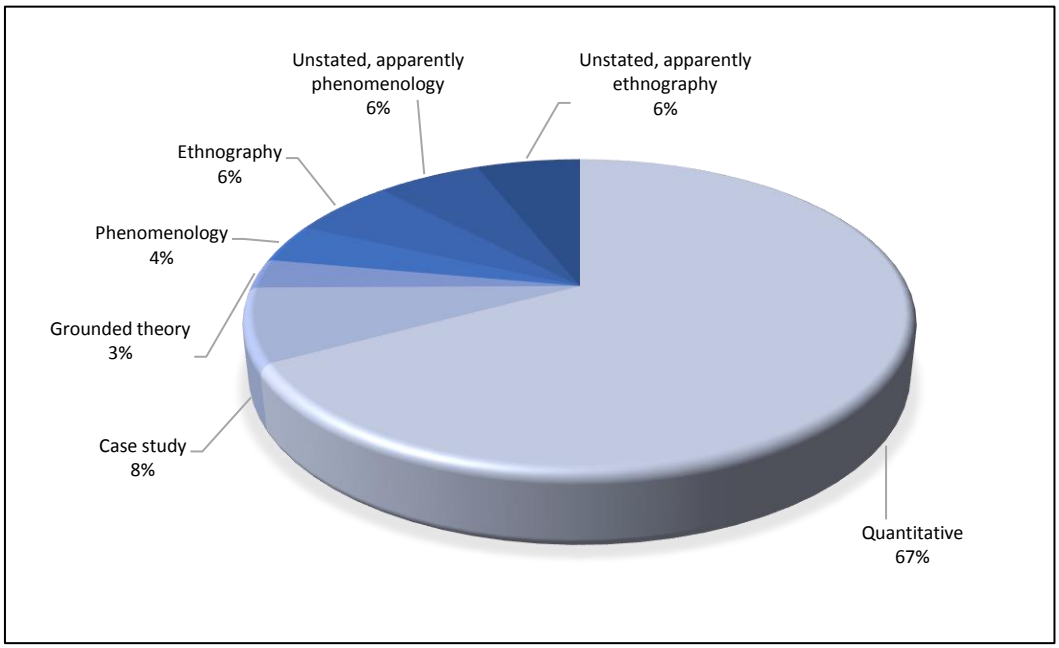
3.2 Military TEL and activity

At the time of writing, research in military TEL had almost exclusively focused on efficiencies and deterministic approaches in individual military *training*, as discrete from the social and cultural conditions of military *learning* (the differences relate to increasing intellectual agility, as in Kime & Anderson, 1997: 9). Notions of purposefully breaking away from behaviourist training pedagogies have only recently been theorised and only in isolated ways. Calls for higher-order military learning have imported theories and extrapolated predictions from other fields, rather than organically researching military TEL (e.g. Sookermany, 2017: 312; Juhary, 2015: 1257). These observations appear to corroborate Stauffer's (2017) content analysis of journals purporting to specialise in military TEL, which found no empirical studies for the five-year term. It seems that this intervention is the first empirical study of participant agency in military TEL, with a summary of related studies in Sub-section 3.2.1 and relationships with principles of Activity Theory in Sub-section 3.2.2.

3.2.1 Existing peer-reviewed TEL research in military HEIs

A database trawl of [(military OR army OR navy OR "air force") AND technology AND (learning OR teaching OR education)] yielded 330 returns from the Elsevier Scopus® database. Reduction by removing alternative definitions, withdrawing studies where military terms are metaphors, and extracting research of veterans, military families and recruiting left 93 studies, of which 77 were peer-reviewed, original and empirical. When the full texts of these were examined to identify those likely to inform TEL and military HE, 24 were relevant. Figure 3.2 summarises their paradigmatic drivers. The majority were quantitative studies, with 67% explicitly declaring methods and techniques for the analysis of variables (ANOVA) for cost and time efficiencies; almost all ANOVA data were based on test results or Likert scales. The remaining 33% of empirical studies were based on qualitative designs with non-interventionist traditions, namely: grounded theory; case study, ethnography and phenomenology. The studies which had not declared a tradition of inquiry were scrutinised for inferences and arguments, and using my own judgement they appeared to be equally divided between ethnographical and phenomenological studies.

Figure 3.2. Research paradigms and traditions in studies of TEL in military HEIs



A source of empirical (though not peer reviewed) studies was grey literature, sponsored by lobby groups and government departments. There were 18 grey literature studies for public release of relevance to my project. Grey literature predominantly comprised case studies by private research agencies in the US and UK, with burgeoning Nordic and Australasian studies. Papers were frequently released after embargoed terms, although in many cases access

arrangements for the public, and for the learning communities that were studied, were unclear. For example, the UK Ministry of Defence, via BAE Systems, commissioned Kent et al. (2015) to examine the effects of learning technologies on UK defence capability. This remains embargoed to all readers outside the commissioning authority for an unspecified period, purportedly including information "whose unauthorised disclosure would cause damage to the interests of BAE Systems and Edinburgh Napier University" (ibid.). In contrast, the RAND Corporation had funded Straus, Galegher, Shanley and Moini (2006) to examine the US Army's distributed learning, with findings immediately available for public access.

Research of military TEL to date had generally set out to improve cost and time efficiencies of pre-ordained platforms, media or content, despite frequently implying social perspectives. The streamlining of military TEL in Fletcher (2009: 72) claimed to focus on social and cultural effects of learning, yet described systemic threats and opportunities as a series of digital artefacts; Kerry (2016: 29) claimed to discuss the cultural role of managers in military TEL, yet concluded that managers' unfulfilled potential lay in the efficiency of media's procurement; and Straus, Galegher, Shanley and Moini (2006: 6) commented on TEL's effectiveness by examining media and platforms in apparent isolation from social factors. On a related note, much military TEL research had presented false and unhelpful dichotomies between face-to-face learning and learning with technology. Durlach (2012: 331), for example, conflated technological skills-based mastery with the elimination of face-to-face contact, in a study of US military learning which was conducted without any input from learners.

There were no identified reports of bottom-up interventionist studies in military TEL; the closest to an exception appeared to be Kollars's (2014: 787) retrospective case study of teams learning socially using military communicative platforms, illicitly sharing bottom-up ideas for the illegitimate modification of weapons platforms. Kollars usefully presented this as a dialectic between organisational learning and bureaucratic stasis, the only study identified in this field which openly declared contradictory or dialectical perspectives. Two papers did examine TEL from the perspectives of learners, both aligning findings with the avoidance of suboptimal behaviourist outcomes: one challenged stereotypes of digital literacy (Bollard, Whitney, Fidock & Kerry, 2015); and one investigated perceptions of digital courseware (Juhary, 2007). Where interventions were conducted, they involved preordained trials of platforms or media, attempting to emulate cost or time efficiencies reported

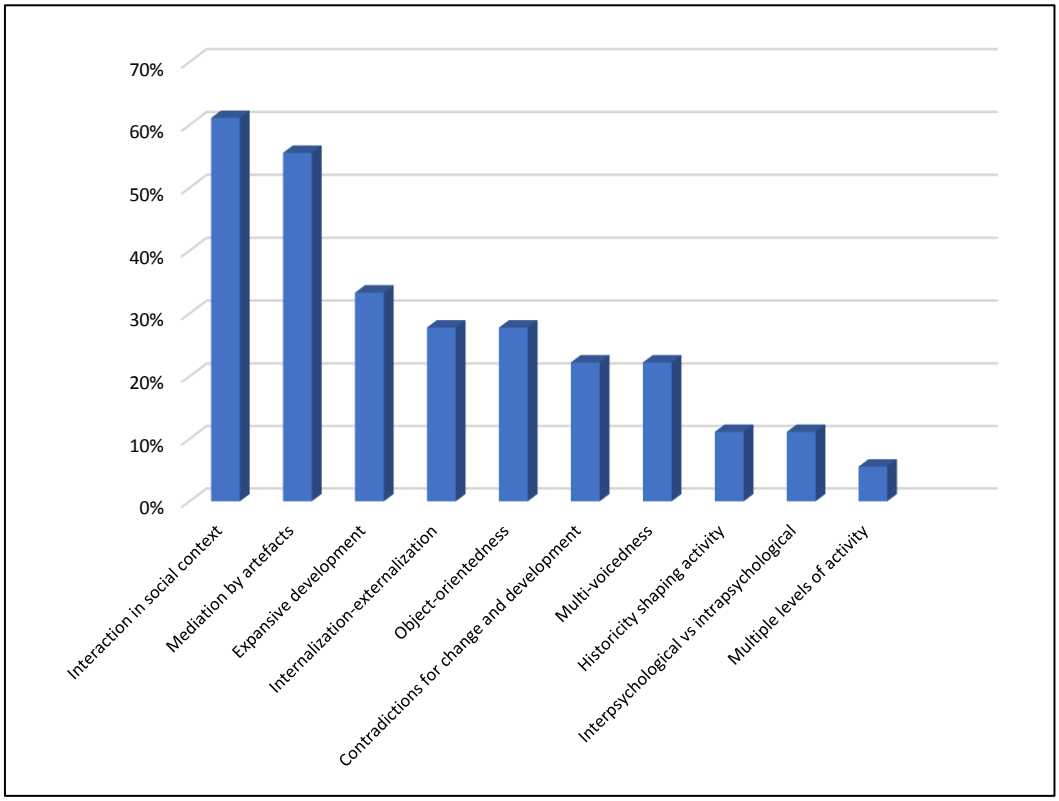
elsewhere, such as design-based research for military online learning by Bienkowski (2012: 319). Studies which examined aspects of post-behaviourist issues in military TEL had called for more researchers to contribute to this body. Forerunners included: Cornell-d'Echert (2012) studying social factors and criticality in TEL for military strategists; Dietz & Schroeder (2012) examining networked decision support for commanders; and Zacharakis & van der Werff (2012) investigating how military HEIs can learn from other HEIs' postmodern cultures.

3.2.2 Latent principles of Activity Theory in existing research of military TEL

Following the papers' broad dimensional analyses, full texts were aggregated and analysed to identify and relate traces of the theoretical principles of Activity Theory, based on Engeström's (1987: 52) formulation of CHAT. I am acutely aware that CHAT requires the integration of all of these principles to succeed; my intent was not to conflate the frequency of my observations with nascent impact. Rather, it was to illustrate that TEL activity in military HEIs could have yielded social benefits from CHAT which were unexamined; whilst activity theorists differ on the primacy of social context, they agree that the social nature of the mind is important for developmental interventions. These potential benefits are summarised in Figure 3.3, indicating where the origins and methodological principles of CHAT may otherwise have informed the original research agendas, although it is noted that Activity Theory was not used in any of this field's studies. Many studies could have benefited from multiple principles, which is why there is statistical overlap.

One of the earliest studies in this field (Wager, 1986) and one of the most recent (Sonesson, Boffard, Lundberg, Rydmark & Karlgren, 2017) exemplified missed opportunities of theorizing socially contextualised and culturally mediated activity. Wager's (1986: 98) study of educating military tele-typists described differing norms of learners, supervisors and maintenance technicians, and how reactions to changing artefacts (in the form of instructional keyboards) were unexpectedly varied. Consideration of social contexts could have aggravated the contradictory nature of these voices which, coupled with an expansive perspective, could have informed sustainable redesign. Similarly, Sonesson et al.'s (2017: 4) study of military medics researched TEL outside its authentic social context; this effectively diminished engagements with horizontal experts, who were available yet not included. Focusing on dialectics and contradictions may have foregrounded the developmental value of such troublesome and multiple perspectives.

Figure 3.3. Tacit representation of CHAT's principles in existing studies of military TEL



A further trace observation was of a conspicuous absence of mediation and historicity in analyses; conceiving of artefacts as active carriers of social knowledge may have added value to a number of studies. O'Connor's (2013:8) study of military learning through video gaming, for example, exposed how social and cultural disparities were only understood during their use; ineffective design was identified too late in time. Their findings showed stark differences between the social values embedded by the producers of AV media and the military personnel who used the media in preparing for combat. This misalignment led to counterproductive impacts for military teams who could not use the artefacts effectively, which could have been aggravated and resolved through CHAT. Similarly, CHAT may have exposed the embedded cultural misalignment of artefacts researched by Hickox, Turner and Aretz (1998: 608). Their study of human factors students discussed the top-down implementation of innovative digital assessments, which were embraced by some students yet flatly rejected by others.

Future challenges to military TEL are likely to warrant an epistemology which challenges the solely vertical acquisition of knowledge, and there was no evidence of interventions to promote boundary work despite it being recommended for both high technology organisations (e.g. Blackler, Crump & McDonald, 2003: 131), and high reliability organisations (e.g. Duffield & Whitty, 2014: 311). I ought to explicitly recognise, for probity

and fairness, that none of the dominant drivers for the original authors of these military TEL studies were related to agency, boundaries or the cultural mediation of TEL. The dominant drivers, in almost all of the existing literature, were combinations of: one-to-many transmission models of behaviourism; implementing platforms and media for time and cost efficiencies observed elsewhere; and the massification and transmission of standardised media. The review now examines how the existing body of knowledge related to the second of the literature fields; boundaries and learning.

3.3 Boundary-crossing and epistemological critique

There was a scarcity of empirical research of boundary-crossing and technology in HEIs, particularly studies which considered contradictory conditions, agency and diversity as epistemic resources (Doyle, 2007: 234). Whilst boundary work was welcomed by some it threatened others, implying that a form of internal epistemological critique was at play whose aggravation was usually suppressed or unexamined, highlighting missed opportunities of contradictions as drivers of change. Whilst some researchers used diluted forms of dialectics (e.g. Garraway, 2010: 216), the majority pursued consensus to altogether avoid conflict (e.g. Rourke & Kanuka, 2007: 107). There were apparent policy trends and managerial ideologies which sought to avoid dispute, implying false homogeneity (Milbourne, Macrae, & Maguire, 2003: 20). Boundary work with unfulfilled radical potential was generally presented in non-aggressive and palatable terms (the "watering down" of motives in HEIs, in Forstorp & Nissen, 2011: 21). This intervention appears to be a rare example of studying boundaries as sources of diverse epistemic critique, which technology can help to access. Sub-section 3.3.1 describes the conceptions of boundaries in other studies, and Sub-section 3.3.2 summarises their drivers and motives.

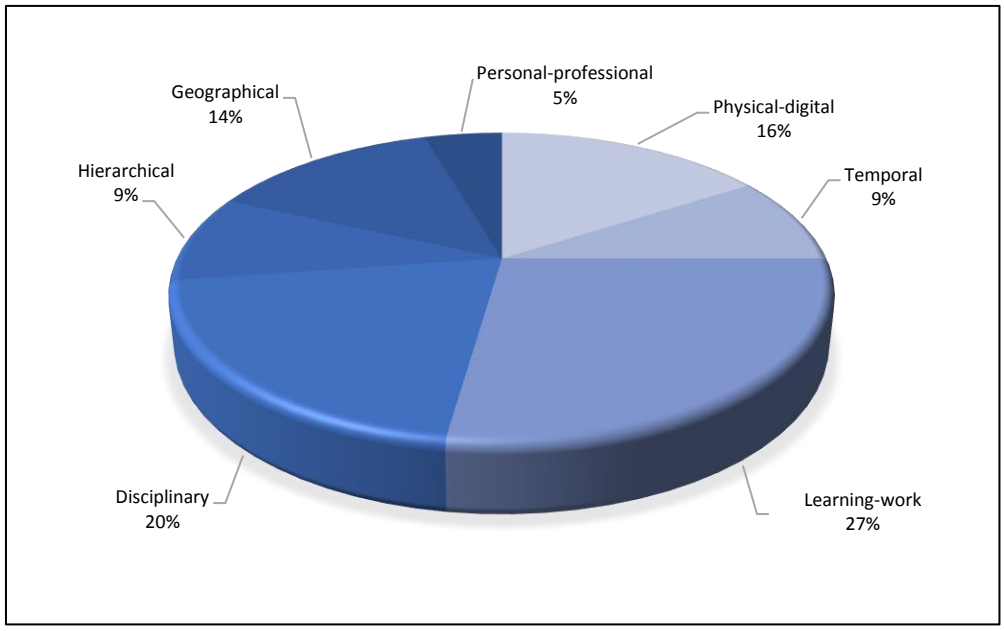
3.3.1 The role of technology in learning across boundaries in HEIs

A search of existing studies with the criteria [(boundary AND (knowledge OR learning OR crossing OR object)) AND technology AND "higher education"] yielded 116 results. Rejections included: studies of boundaries between nations and geological timeframes; projects in solely commercial and industrial arenas; and projects to specifically reinforce boundaries between groups, rather than examine heterogeneity. Manual sifting of the abstracts of the remaining reports resulted in 17 which were relevant, original and empirical works. Further studies were then identified by tracing the works of specialist interdisciplinary researchers, focussed book series and esoteric journals for boundary-

related studies of learning, which increased the number of analysed studies to 44. Boundary work has had various metaphorical representations including crossing, bridging and brokering (Akkerman & Bakker, 2011: 139), which were coarsely aggregated to review the field.

The limited examination of socially mediated learning at boundaries was discussed by de Roiste, Breetzke and Reitsma (2015: 476) in pan-HEI collaborations, who found that TEL's technological artefacts were less enduring than the boundary learning processes they mediated. On a related note, sustained engagement with stakeholders beyond one's own organisation can precipitate "boundary breaking", identified by Kidron and Kali (2015: 14) as politically contentious, particularly in processes for hierarchical organisations. These boundaries have been more than convenient placeholders of similarity and difference in TEL; they distinguish political control (e.g. Thorpe & Edmunds, 2011: 390) and allocation of roles and resources (e.g. McPherson & Whitworth, 2008: 411). My own intervention for TEL's horizontal interactions with experts (learners who are internal generalists engaging with external specialists) appeared to be unexamined, although cognate studies from similar contexts positioned this intervention, with conceptions of boundaries in Figure 3.4.

Figure 3.4. Conceptions of boundaries in empirical studies of TEL and boundary work in HEIs



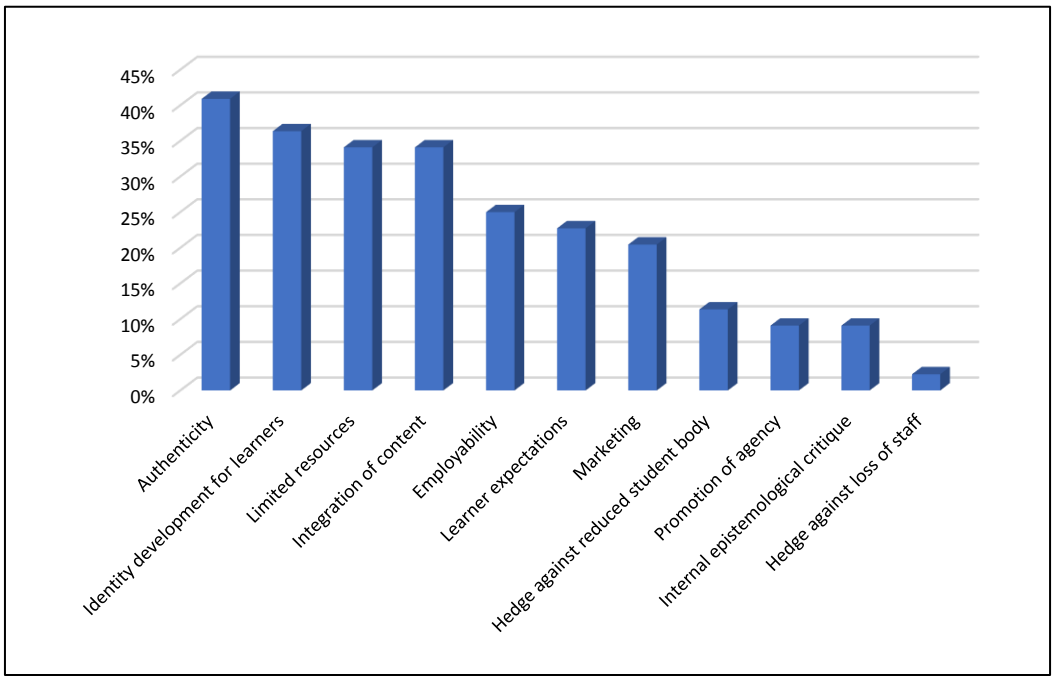
A agreement amongst empirical studies was the importance of clarity when communicating at boundaries. Garraway (2011: 212), for example, analysed "recontextualisation" of concepts in boundary interactions, whilst the collaborations studied by Christensen (2012: 66) suggested that deliberate effort was required to move cross-boundary communication

beyond technical considerations of artefacts, to include social interactions. The majority of studies appeared to isolate their foci to the relative efficiency and compatibility of digital technologies across boundaries, rather than the social effects on subjects. This may relate to three compounding and not easily examinable notions for social interactions at boundaries: firstly, boundary objects are created and modified by all collaborators, each embedding their cultural and social influences (Bharosa, Lee, Janssen & Rao, 2012: 11); secondly, boundary objects are partially conceptual, and not solely physical (Thorpe & Edmunds, 2011: 393); and thirdly, boundary-crossing materially changes the activity's object and the activity's subject (Oliver, 2015: 376). These notions seemed to manifest themselves in the challenges of most studies, although they were seldom explicitly recognised or stated.

3.3.2 Drivers and motives for boundary work in empirical studies

Analyses of the papers described in the previous section showed that their dominant drivers and motives were: accessing authentic learning; developing learner identities; accessing scarce resources; and integrating TEL to share the time and cost liabilities of media. Figure 3.5 summarises drivers and motives. There are statistical overlaps, since many studies exhibited multiple drivers and motives.

Figure 3.5. Drivers and motives for boundary-crossing in empirical studies of TEL in HEIs



Dilemmas in social interactions were often recognised in these studies, yet they were seldom aggravated to become sufficiently contradictory for development. In their study of outreach with ICTs motivated by limited resources, Hodgkinson-Williams, Slay and Siebörger (2008:

433) researched collaboration with different schools yet precluded opinions of teachers, who instead endorsed the imported aims of researchers. Conversely Thorpe and Edmunds (2011: 385), in a rare exception to this observation, acknowledged that activity systems "may conflict but may also work in creative tension … bridging between the contexts … in constructive ways". In many studies, social contradictions and opportunities were only discovered on reflection of the failing top-down implementations of artefacts, for example: Ridwan, Mohamed and Ali (2016: 227), "the main challenge ... is that students came from a different background and have different cognitive mind set"; McLoughlin and Lubna Alam (2014: 132), "Students require both orientation and training in using Web 2.0 tools even though they are familiar with … Myspace and Facebook"; and Humberstone, Beard and Clayton (2013: 250), "we see in the students' dialogue above little to suggest that their learning has created a 'buzz' for critical engagement with the world …".

In almost all studies which set out to provoke agency across boundaries, political control was reported as problematic. Various theoretical notions and concepts such as boundary zones, third spaces and boundary objects were used in attempts to mitigate political challenges. Internship and training, for example, were conceptualised as boundary work for teachers by Max (2010: 215) and Snoek (2013: 309) respectively. Both authors investigated collaborative spaces which were flexible enough for multiple stakeholders yet pervasive enough to sustain commonality of purpose, exposing political challenges when simplistically assuming mutual benefits. Other political examples included: underestimated differences in values and ideals for HEI departments, by McClam and Flores-Scott (2012: 231); misjudged variations of global and local outlooks for foreign educational experts, examined by Liu and Fisher (2010: 180); and the control of spatial access during boundary work, through conceptions of "mooring" and "boundary marking" by Edwards, Tracy and Jordan (2011: 219).

Political interest in controlling activities at boundaries indicated what HEIs' strategists considered risky or beneficial (for example Tonyan & Auld's 2013: 226 boundaries between HE and the professions). Political interest also indicated the importance of managing expectations, analysed as a competence for HEI managers by Hartley (2010: 349). Participants likely had different expectations in contested terrains, with "going native" examined by Kinti and Hayward (2013: 186-191), who considered boundary expertise as comprising both technical undertakings and navigation of the boundary itself. Similarly, Ludvigsen, Rasmussen, Krange, Moen and Middleton (2011: 110) focused on temporal expectations during boundary work, collaboratively analysing historicity. In these latter

studies, the dynamism of social interactions and historicity was analysed with CHAT, drawing out the relational impact of cultural mediation. Boundary expertise was presented as a relational attribute with organisational dimensions, best enabled by foregrounding cultural mediation and historicity. This indicated the interrelated potential benefits of TEL, boundary-crossing and organisational change, informing my intervention and leading to the subsequent theme.

3.4 Multiple stakeholders and organisational change

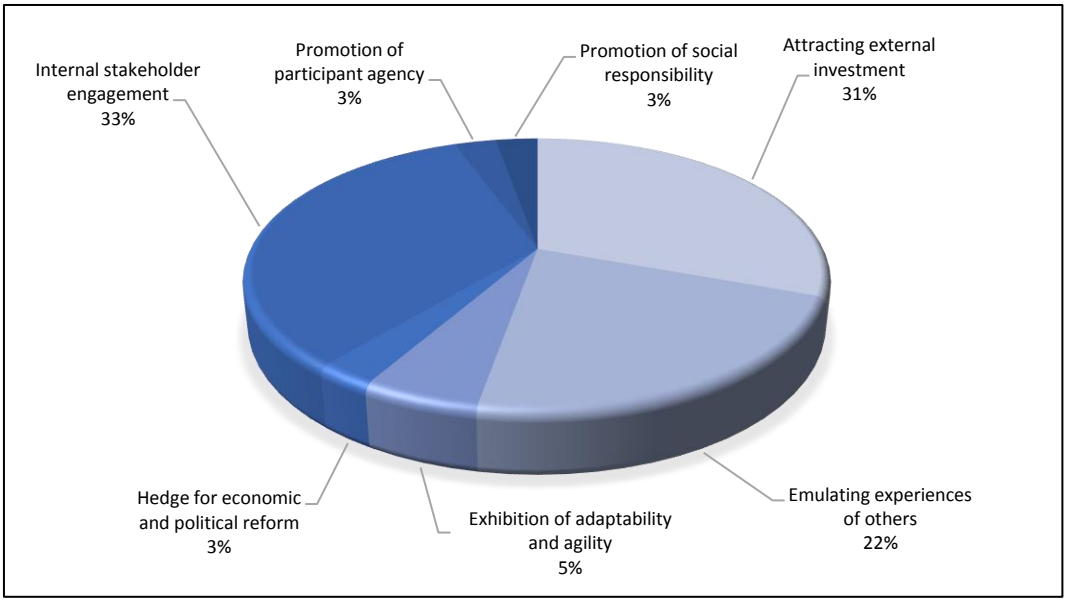
There were few studies in the literature which examined participant agency for organisational change, with fewer again to have examined the cultural mediation of learning. The majority prioritised improving cost or time liabilities of teaching by top-down predetermined interventions (a particular "challenge of change" for technology in HE noted by Bates & Sangrà, 2011: 10). A minority examined solely bottom-up change, which in isolation may channel and isolate participants (Anderson & Dron, 2014: 57). Theorizing TEL-related change was often presented as capitalizing on technologies to lever economies of scale in HE (e.g. Neave, 2015: 22), generally where one stakeholder group was bestowed with artefacts to replicate and scale results from elsewhere (e.g. educational technologists in Marshall, 2011: 17 and academics in McNaughton & Billot, 2016: 13). My intervention's multi-voiced aggravation of contradictions appeared to be relatively unexplored for TEL-related change in HE. The orientations of other studies of technology-related change in HEIs are presented in Sub-section 3.4.1, with the dimensions of their change efforts analysed in Sub-section 3.4.2.

3.4.1 Organisational change and technology in HEIs

A search of peer-reviewed articles for [(organisational OR organisational) AND change AND education AND technology] yielded 656 returns. Of note, searching within those results for "Activity Theory" returned only 14 empirical studies, indicating Activity Theory's nascence. This persistent observation (also discussed by Roth, 2004: 3; Benson, Lawler & Whitworth, 2008: 456) seemed surprising to me, given CHAT's description by Engeström two decades ago as "the best kept secret of academia" and considering how change and TEL align with Vygotskian principles of mediation. In returning to the 656 returns, additional terms of HE and technology with [(organisational OR organisational) AND change AND "higher education" AND technology] returned 165 articles. 78 of these were rejected due to focusing on cost and time efficiencies of specific and pre-ordained technologies. By manually interrogating

the remaining 87 abstracts, 24 studies were selected as relevant for the examination of technology-related organisational change in HEIs. Bibliography searching of these studies then increased the total to 36 relevant works in this field. Figure 3.6 illustrates their orientations.

Figure 3.6. Orientations of organisational change efforts in HEIs involving TEL



In the majority of empirical studies where technology and organisational change correlated, the majority of changes were implemented to engage internal stakeholders, and were examined from one group's perspective (e.g. teachers in Zhu, 2015: 65; managers in Wall, 2015: 393; and learners in O'Donnell, 2016: 101). A notable exception was Singh and Hardaker's (2017: 11) reconciliation of top-down and bottom-up levers (although with a managerial focus it excluded learners). A widespread shortfall in studies was the assumption of participants' appetites for change. Wilson, Raish and Carr-Chellman (2016: 278) set out to deepen students' understandings of TEL and systemic change, yet left many contradictions unexamined by amalgamating the disparate needs of designers with those of faculty. Other studies presumed intentionality, resulting in unforeseen rejection such as Magen-Nagar and Maskit's (2016: 215) study where "… teaching staff [were] surprised and sometimes even against incorporating technological methods of teaching …".

A significant driver for technology-oriented organisational change was to attract external investment. An unforeseen side effect of was the decision-making expectations of investors, with a number of studies experiencing overtly dominant economic forces. Deželan, Laker and Pavlin (2016: 107) adopted an external orientation to their HEI, engaging with local and regional enterprises to examine aspirations for the "practical orientation" of HE. Their

results raised concerns of HE faculty undergoing “task hybridisation” and “de-professionalisation”, with implications of investors influencing how HEIs would contribute to society. Influence on the HEI included: commercialisation of research; restrictions on loan programmes; increasing tuition fees; and control of expenditure on facilities. Babaiev, Kadykova, Husieva and Chumachenko (2017: 134) went further to propose that inevitable organisational change, driven by technological advances, ought to drive their HEI to become a project-led and profit-driven institution having parity with business.

One of the lowest representative orientations in the literature was the promotion of agency. Rare exceptions included Lin, Singer and Ha's (2010: 45) post-hoc study of faculty resisting top-down technology-oriented change, with the authors recognising “a clear divide between university administrative officials and individual faculty and staff members based on their stands and positions on the issues of technology”. The emotional responses of staff and their agentic resistance were nurtured by being ridiculed by managers, who had labelled them as “Luddites” (ibid.). Bell and Bell's (2005: 643) study examined participant agency and learner management systems, although it was limited in its exclusion of participants from the project’s design. It included analyses of the misalignment of division of labour and rules, which impacted on day-to-day practice with artefacts such as inadequate ICT server access levels for staff to take ownership. Agherdien’s case study of academic technologies in Hardman et al.'s (2015: 163) CHAT studies was a rare example of studying relationships between mediating artefacts and organisational change for HE.

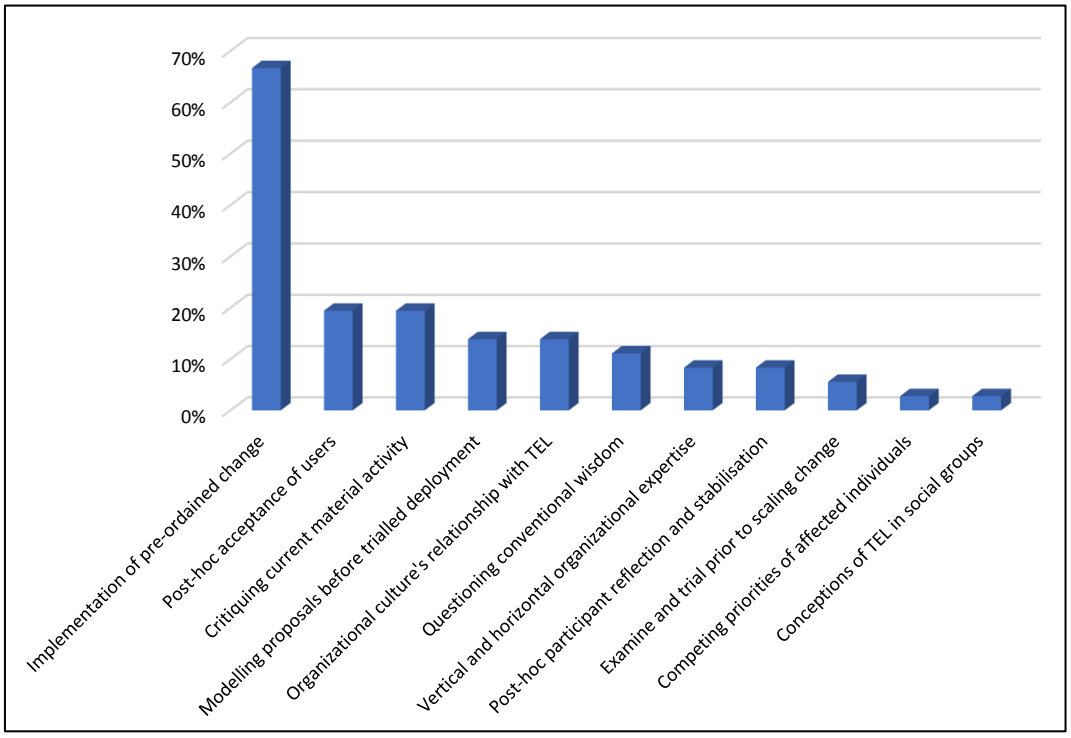
Irrespective of their drivers, these studies of technology-related organisational change in HEIs implied that challenges for cultural mediation were in ascension. There was an apparent need in the literature for adaptable policies, flexible decision making models and changes to preconceived managerialist interventions, to enable the emerging opportunities of technology (e.g. Shattock, 2009: 7). Given that a significant driver was the attraction of external investment, the compounding effects of managerialist policies may prove to exacerbate the effects of “technologies of domination” (predicted by Peters, Marshall & Fitzsimons, 2000: 121). These concerns seemed to amplify Rinne and Koivula's (2009: 183) contemporary dilemmas for HEIs; market orientation is increasingly expected of HEIs, yet many societal actors value the stability of HEIs. As a result, HEIs are expected to respond to issues such as massification and reductions in public funding, whilst providing enduring institutional predictability. In combination these factors may threaten existing teaching,

research and management configurations, which provide HEIs with stability yet inhibit the very changes being called for.

3.4.2 Evidence of dimensions of organisational change in empirical research

Various theoretical models and approaches were evident in studies of organisational change in HEIs which featured technology. Mid-range theories of change in HE were discussed in Saarinen and Välimaa (2015: 41) with many commentators claiming that organisational change in HE was particularly under-theorised when related to technology (e.g. (Kirkwood & Price, 2012: 14; Fahy, 2008: 190). Dominant schools of thought for change efforts in HE were compared by Kezar (2014: 24) with common shortfalls including: leadership driven by tacit theories; ignoring context; following simplistic change models; and ignoring research. The most common dimension of studies relevant to my intervention was that of implementing some pre-ordained change of technological platforms or media, evident in around two thirds of the literature. This was followed by the post-hoc acceptance of change for one group of a population, evident in around one fifth of the papers. There is some statistical overlap in the different dimensions, which are Illustrated in Figure 3.7.

Figure 3.7. Dimensions of organisational change efforts in studies of HEIs involving TEL



The reflection and invention necessary for organisational change often depended upon some failure, crisis or critical problem. An example was Miettinen and Virkkunen's (2005: 437) relationships between organisational change and epistemic objects, a rare example of

recognising the importance of mediation, contradictions and rejection of current social and cultural conditions. Evidence of engaging participants in questioning and modelling their own crises in activity was present in only a minority of studies. An example was Forman, Nicol and Nicol's (2015: 162) proposals for scenario planning in TEL for medics, acknowledging that reframing inter-professional practice and sustainable change requires "not only the identification of current resources and capabilities but also an exploration of mental models and attitudes". The researchers also recognised that the embeddedness of their participants' assumptions evoked defensiveness of the status quo.

Conversely, studies such as Waring and Skoumpopoulou (2012: 513) and Barak (2012: 135) omitted examination of participant critique, which seemed to conceal the agency of resistance to change and miss opportunities to aggravate lucrative contradictions. In the former study, sociocultural relationships were acknowledged, as was the recognition that "a culture of instrumental command and control may be incongruent with academic and collegial values". Yet the authors examined the implementation of technologies which had already been procured, with participants endorsing change decisions which had already been made. In Barak's study of organisational change to undertake online HE, a proposal was made to "… provide solutions … while *dismantling the resistance* of faculty who still believe in traditional teaching" (my italics), negating the expansive potential of resistance. The TEL case studies examined by Powell, Olivier and Yuan (2015: 6) indicated that the stability of boundaries and artefacts was an important resource for participants during change endeavours; their familiarity provided organisational stability in times of flux.

This notion of stability had varied manifestations in the literature. A study of ambiguity and uncertainty by Schrader, Riggs and Smith (1993: 73) examined how organisational stability had been used by strategists as structural inertia, called upon in resisting bottom-up attempts at change irrespective of the potential benefits. It cited in turn Hannan and Freeman's (1984: 141) findings on boundaries and artefacts, where organisational and technological stability, deployed to resist change, avoided the dissonance of personal responsibilities. Conversely, meta-ethnographies by Hoover and Harder (2015: 175) had associated structural stability with enabling agency, fostering bottom-up criticism and assisting with change beyond functional and technological boundaries. The separation of structure and agency was used by many researchers as a dichotomy for examining TEL and change, yet it was rejected by others including by Hodkinson, Biesta and James (2007: 417) who described it as an unhelpfully reductionist duality in researching this field.

There were few identified studies which focused on multi-voiced perspectives, cultural mediation or local design when considering organisational change in HEIs, which may relate to the field's predilection for top-down implementation. In studies of unsuccessful implementations, reflective recommendations included: change ought to have considered social interactions at multiple levels; TEL artefacts were imbued with cultural and social content during organisational change; and, for sustainability through time, the enveloping culture ought to have been generally amenable to change. A further common observation, implied in studies rather than explicitly concluded, was that technological changes induced other organisational changes of unexpected intensity, and vice-versa. An example was Perret-Clermont and Perret's (2011: 97) study, which recognised that changes in artefacts affected identities, meaning schemes, access to expertise and other social and cultural factors. Such observations illustrated my impropriety in separating out the three fields of this review, and of neglecting others. The subsequent section discusses neglected fields then closes the chapter.

3.5 Summary of the literature review

The scoping exercise which initiated the literature review revealed ongoing and reassuring calls for valuable and original research of transformative TEL (e.g. Drysdale, Graham, Spring, & Halverson, 2013: 90; Coghlan & Brannick, 2005: 61; Potter, 2006: 103) although wider debates of the effectiveness of technology on learning persist (e.g. Laurillard, 2012: 83; Brennan, Cochrane & Williams, 2010: 10; Selwyn, 2011: 84). Interventionist research of TEL elsewhere appears to have had agentic benefits for participants, particularly when it includes the notions of authenticity and engagement across boundaries (e.g. Zitter, de Bruijn, Simons & ten Cate, 2012: 119; Guile, 2011: 55; Penuel, 2014: 97). There are related calls for research on expansive change and agency in TEL, accompanied by a paucity of coverage of military HEIs and organisational change. Returning to the three fields of the review, the stocks of evidence have indicated justification, importance and feasibility for empirical research at the intersection in Figure 3.1.

In summarising the overlapping gaps in empirical research in these fields, which position my project: in military TEL there is a dominant focus on predetermined, behaviourist and enculturation approaches; in boundary-crossing TEL there is an apparent de-coupling of drivers for crossing boundaries from the contradictory, troublesome and epistemically valuable input of multiple stakeholders; and in empirical studies examining TEL-related organisational change there are limited examples which consider the cultural mediation of

activity, as discrete from the study of productive artefacts. The potential originality of my intervention seems clearly bound to a local agenda, which will be explored in subsequent chapters, yet the literature implies that the project shows moderate generalizability and potential interest to other researchers. The subsequent chapter now turns to developing the intervention's methodology.

CHAPTER FOUR – RESEARCH DESIGN AND METHODOLOGY

4.0 RESEARCH DESIGN AND METHODOLOGY

This chapter describes the Change Laboratory methodology for the intervention's empirical phases, building on the theoretical principles discussed in Chapter 2. It compares the guidance of seminal works (e.g. Engeström, 2007b: 363-382; Engeström, Virkkunen, Helle, Pihlaja, & Poikela, 1996: 10-17; Virkkunen & Newnham, 2013d: 61-116) and discusses the designed intent of my specific instantiation of the Change Laboratory methodology. The design was conceived from my position as an insider researcher, with relative familiarity of participants' daily realities and some confidence of adapting seminal guidance to suit the locale, people and routine. Nonetheless it is important to reiterate that in *formative* interventions, designs intentionally differ from concretised reality since regulation is dependent on the agency of participants. In this chapter I first introduce my selected methodology's advantages and consider alternative methodological options. Latter sections describe the intended sequence and structure, with methods and instruments for collecting and analysing data during, between and after interactions. The chapter closes with a critical acknowledgement of limitations, leading into the subsequent chapter which depicts the participants' concretised reality.

4.1 Methodological advantages and alternatives

The Change Laboratory is one of a number of variant methodologies in the wider tradition of Developmental Work Research (DWR) (Engeström et al., 1996: 10). None of DWR's variants specialise in this intervention's setting of HE, and notably the Change Laboratory's potential for specific application in HE appears to have been relatively under-developed to date (Bligh & Flood, 2015: 167). There are a small number of similar research-interventions in education, which I collectively define as cognate since their authors have emphasised similar challenges to mine. In many cognate studies, themes are shared with Chapter 1's description of problematic activity: issues of power in TEL's mediation; unanalysed historical evolution of TEL activity; and uncertainty in developing TEL across boundaries. That stated, interventionist research is relatively uncommon in the theoretical arena of CHAT, which is generally used descriptively rather than as a basis to change activity or to harness multi-voiced resistance and critique (Bligh & Flood, 2017: 148).

The Change Laboratory's methodological advantages can be summarised in relation to the conditions of my intervention's design: my agency-oriented research questions; my conflictual, political and history-laden context for activity; and the influence on my design and on myself of a Marxist epistemology for social change. The specific methodological intent was to empower participants to redesign their own activity, thus engendering their transformative agency to be capable of improving and sustaining social conditions for learning. In Chapter 1, I set out my related personal motives and those of the participants. Here I summarise how those motives align with the methodology:

- **Resistance and critique**. Firstly, interventions using the Change Laboratory methodology foreground participants' political resistance and critique, facilitating the emergence of individual and collaborative agency. This is important because, historically, military and civil service strategists have found it difficult to differentiate learners' agency from insubordination (Gaeta, 1999: 188). Paradoxically, military strategists tend to lapse in uncertain circumstances to "command and control" modes of authority (Young, 2002: 41) further isolating learners who could otherwise become lucrative sources of knowledge and meaning in TEL.

- **Dilemmas and dialectical change**. Secondly, the methodology is associated with the examination of dilemmas and organisational dialectics, with a diverse group authoring and enacting material changes in ways which are theoretically grounded (Sannino, Engeström, & Lahikainen, 2016: 246). This importantly accommodates different needs of participants, oscillating between: those who may aggravate historical conflict and contradictions to "push" change through transformative agency (Sannino & Engeström, 2016: 94); and those who may envision future-oriented proposals to "pull" change through transformative agency (ibid.).

- **Sustaining agency**. Thirdly, the methodology enables formative interventions through the exposure and examination of troublesome conflicts, generating innovative and qualitative change and fostering future-oriented, collaborative, transformative agency. This is considered important to sustain change beyond the intervention (Sannino, 2015a: 2), and to legitimise post-behaviourist criticality in TEL (Engeström & Sannino, 2012: 47). Given the unpredictability and contingency of the RSME's future learning, this transformative agency ought to become a lucrative source of adaptability and development when "nobody knows exactly what needs to be learned" (Engeström, 2016: 39).

In synopsis, formative interventions with the Change Laboratory methodology align with a Marxist epistemology (from the 11th Thesis on Feuerbach, Marx & Engels, 1888/1998b: 569), and with the agentic themes of my research questions. My considerations of alternative methodologies were delimited by the need to understand activity in its social and historical context and to materially change social conditions (see Nicolini et al., 2003: 8). My chosen methodology thus needed to assist in empowering participants to change their own activity, whilst being historically and culturally sensitive to their research setting, and with their transformative agency as a critical "layer of causality" (Sannino, Sutter & Engeström, 2011: 610). The dismissal of alternative methodologies included:

- **Action Research**. Action Research attractively foregrounds participation (Cohen, Manion, & Morrison, 2011: 346), yet it was considered unduly managerialist in its pursuit of consensual dialogue and its perceived finality of outcomes. Action Research would have been unlikely to yield or sustain transformative agency, instead sustaining the existing political status quo through participants seeking consensus and compromise (Al-Haddad & Kotnour, 2015: 245). This contrasts with the need for commitment to genuine change to social conditions, by exposing problematic and emotive contradictions in activity and aggravating them. Participants would also have focussed on individual tasks, rather than collaborative and societal activity (Virkkunen, 2006: 44), which was likely to result in isolated or disjointed change endeavours rather than aggravating contradictions and expanding the object of activity.

- **Actor Network Theory**. Actor Network Theory, whilst more accurately termed a theory rather than a methodology, was initially considered due to its association with the design of bespoke methods and "relations between things, human and non-human" (Tight, 2012: 205). That stated any methodological design, irrespective of its methods, would likely have been difficult to align with the reflexivity for understanding and changing individuals' and collaborations' problematic social circumstances. Actor Network Theory was deemed to insufficiently examine the social effects of learning, and to unduly de-contextualise the agency of human participants in research (Savin-Baden & Tombs, 2017: 87).

- **Design-based research**. Design-based research is increasingly common in research of TEL, and it usefully adopts iterative cycles of interventions in contextual settings (Savin-Baden & Tombs, 2017: 81). The challenge for my research setting, specifically its systemic problems and future uncertainties, was the emphasis in design-based

research of finality. This pursuit of final resolution could have destabilised the agency of participants (Sannino, Engeström, & Lemos, 2016: 600). It was thus dismissed due to incompatibility with uncertainty; it was deemed to insufficiently prioritise participant agency which is vital for the intervention's sustenance, due to the unknown effects of time and changing social conditions (ibid.).

4.2 The methodological intent of a Change Laboratory intervention

The Change Laboratory methodology uses a relatively prescriptive structure to assist formative interventionist research, where participants collaboratively and qualitatively transform their own activity in ways aligned with CHAT's dialectical materialism. There may be apparent paradoxes in using a relatively prescriptive structure for an intervention which itself exists to encourage agency. To explain, the tasks and arrangements are carefully designed and prepared, yet there are no expectations with the researcher-interventionist that there will be unquestioned implementation of that plan by participants. To the contrary, participants are expected and encouraged to take control for themselves, to "take over the process at some point and generate deviations from the interventionist's intentions" (Engeström, Sannino & Virkkunen, 2014: 123).

The Change Laboratory methodology builds on CHAT's use of contradictions and tensions as motive forces for change and development in the material world; dialectical thinking helps participants to explore deep and continually developing connections within their own activity, many of which may have been conceived as unrelated (Bligh & Flood, 2015: 144). Participants critique deterministic and objective claims to knowledge (Engeström & Miettinen, 1999: 9) whilst "questioning the premises of current, problematic practices … through innovative reconceptualisation of the purpose and principle of the activity" (Virkkunen & Ahonen, 2011: 230). These dialectical acts underpin concerted efforts to understand the world by materially changing it (c.f. Marx & Engels, 1888/1998b: 574). A group of up to 20 participants typically meet weekly to undertake six to 12 fairly structured two-hour sessions, with follow up workshops some months later (Engeström, 2007b: 372). They are guided by the interventionist through expansive development, with an expansive cycle typically taking four to six months (Engeström, Virkkunen, Helle, Pihlaja, & Poikela, 1996: 12).

The Change Laboratory methodology builds on historical and ethnographic data, empowering participants to jointly expose and aggravate contradictions and to

collaboratively redesign their own activity (Laitinen, Sannino, & Engeström, 2016: S20). Vygotskian double stimulation tasks are undertaken, with stimuli generally adapted from seminal methodological guidance to have local meaning to the participants. They are encouraged to think in expansive ways with these stimuli, aggravating and overcoming their problematic double binds "making subjects masters of their own lives" (Engeström, 2007b: 363). The Change Laboratory research-intervention is *itself* an activity to change other activity (Bligh & Flood, 2015: 142), characterised by its methodological interference in another activity to elicit expansive learning. It is uncertain, cyclical and iterative (Engeström, 2013: 98), differing from pre-ordained change in three crucial ways:

- **Inception**. The exact starting point for developing activity is unknown. Rather than the researcher directing the initiation of the intervention, the activity's problematic and contradictory object is identified and analysed by the participants, who establish the inception and direction of change efforts.

- **Process**. Interventions are negotiated by participants. Somewhat counter-intuitively, the interventionist conducts a relatively detailed design for the intervention's process yet encourages that design to become owned and adapted by participants. Rather than the researcher directing the process to be followed, with participants' resistance and uncertainty seen as a design flaw to be overcome, the formative intervention's structure is intended for adaptation by the collaborative subject. It is therefore profoundly shaped by participants themselves, who are enabled to lead the process.

- **Outcome**. The outcome is relatively uncontrolled. In formative interventions researchers do not control variables or implement standardised, scalable and replicable solutions. Instead collaborative transformative agency, the most important characteristic for this project, increases through expansive learning.

The sequence of the intervention intends to develop transformative agency as participants search for ways to identify and overcome their activity's contradictions. These transformative characteristics are very different from the incremental improvement of a particular activity's current form (Virkkunen & Ahonen, 2011: 434). Participants shift their foci as sessions proceed, through a series of epistemic actions which were introduced in Chapter 2 as an expansive cycle (Engeström & Sannino, 2010: 7): questioning received wisdom; analysing the situation through historical-genetic and actual-empirical techniques; modelling explanatory relationships using communicative means for sharing with others;

examining the dynamics, limitations and potentials of models; implementing pilots with practical enrichments and extensions; reflecting and evaluating on the process; and consolidating models into relatively stable practice. Ideal-typical sequences are seldom found in reality, since expansive actions are recursive, chaotic and digressive, yet expansive cycles are expected to yield these actions in some form (Engeström, Rantavuori, & Kerosuo, 2013: 86).

It is important to note that, during and between sessions, participants are expected and encouraged to deviate from designed intent. The principal prerequisite of the intervention is that participants "feel safe to freely express their opinions and are allowed to experiment with new ways of acting" (Virkkunen & Newnham, 2013c: xxiii). This is enabled through methodological arrangements such as: sub-group work to critically trial facilitated models; intensive work in and between sessions to understand the historical evolution of activity; and the encouragement of resistance and critique. These uncertainties and associated methodological processes result in a non-dualistic approach, stimulating and sustaining expansive activity by exposing, aggravating and resolving contradictions. This is wholly different from a "structure versus agency" dichotomy (Lemos, Pereira-Querol, & Almeida, 2013: 724) and seeks to provide a structure to deliberately promote and sustain participant subjectivity, conceiving of conflict and contradiction as a source of empowerment.

4.3 Methodological elements of a Change Laboratory intervention

The Change Laboratory methodology seeks to promote and sustain expansive learning, a notion which was theorised in Chapter 2. It integrates qualitative changes to organisational practice and individual learning, where participants collaborate while "essentially learning something that does not yet exist" (Sannino, Engeström, & Lemos, 2016: 603). In enabling and sustaining expansive learning, a Change Laboratory intervention intends to fulfil the methodological requirements of the triumvirate of formative interventions: double stimulation; transformative agency; and ascending from the abstract to the concrete (Engeström, Sannino & Virkkunen, 2014: 119). The triumvirate was previously theorised in Chapter 2, and notable methodological concerns for each concept are below.

4.3.1 Double stimulation

The Change Laboratory methodology informs interventions which apply double stimulation in concerted efforts to drive volitional actions and overcome uncertainty. The aspiration is that, in turn, these volitional actions develop participants' transformative agency (Sannino &

Laitinen, 2015: 16). In response to methodological guidance, my design thus needed to anticipate the increasing control that participants would have when applying theoretical principles such as double stimulation, as these principles would progressively become more influential on their real-world interventions (Bligh & Flood, 2015: 157). Participants were aided in their problematic endeavours by artefacts of varying conceptual "levels" (compared in Table 4.1), which assisted them in gaining control of their circumstances.

Table 4.1. Conceptions of artefacts by Wartofsky (1979: 201) and Engeström (2007a: 35), with comparisons from Susi (2006: 2211) and examples from Botha (2017: 87-88)

Conception in Wartofsky (1979: 201)	**Conception in Engeström (2007a: 35)**	**Methodological uses from Susi (2006: 2211) and examples in bold from Botha (2017: 87-88)**
Primary artefacts: material entities which are used directly in production.	"What" questions and artefacts are usually noticeable and definable through their physical evidence.	To be deliberately foregrounded in sessions to elevate their use beyond that of actions and unconscious operations. Example: "material facet of the tools … a notice board to publicise and spread information and a resource cabinet with documents, **booklets, pamphlets, video and other materials** relating to teachers' professional practice …".
Secondary artefacts: internal and external representations of primary artefacts, which preserve and transmit conventions, rules and norms of use in activity.	"Why" artefacts inform the object of activity, to justify the use of the primary artefact. "How" artefacts are routines and procedures describing how to handle an object in the activity.	Secondary artefacts to be manifested and manipulated when considering and discussing primary artefacts, analysing the effects of cultural mediation before, during and after activity. Example: "… the way that **social spaces are modelled** [through the study's graphical representations] … has the potential to radically alter teachers' and management's relationships with each other and the school's resources …".
Tertiary artefacts: imaginary and are unconstrained by activity's usual conventions, rules and norms.	"Where to" artefacts are described as models / visions, e.g. modelling changes to primary artefacts.	Tertiary artefacts used as secondary stimuli for future-oriented possibilities, as motivational and epistemic resources for envisioning and concretizing future activity. Example: "… should significant educational change be desired, it can best be achieved by understanding and addressing the **activity system's network** [a model of the school's interacting activity systems] …".

The use of mediating artefacts, to elucidate and overcome what were previously irresolvable problems, is a defining feature of double stimulation (Virkkunen & Schaupp, 2011: 634). Artefacts are used during and between an intervention's sessions in ways summarised in Table 4.1, which are adapted from conceptions of Wartofsky (1979: 201); and Engeström (2007a: 35; 1990: 171). The tabulated examples include methodological uses from Susi (2006: 2211) and applied examples from Botha's (2017: 73-94) study of changing traditions in spaces for schooling, selected as an example of "challenging conventional processes of educational transformation as well as hegemonic knowledge-making traditions themselves" (ibid.). In my intervention these levels informed practical arrangements, allowing me to provide appropriate artefacts for participants' internalisation and externalisation (Elbers, 2008: 297). Through double stimulation, my design intended to enable participants to use

various artefacts to change and develop their understanding of problematic and contradictory aspects of activity (Sannino & Engeström, 2016: 82).

There are two persistent tertiary artefacts common to most interventions with a Change Laboratory methodology; the expansive cycle and the activity system (Virkkunen & Ahonen, 2011: 236). To empower the exposure and aggravation of problematic circumstances, participants also require irrefutable evidence of problematic work and learning which exhibits personal involvement. The preferable means of communicating this evidence is the provision of ethnographic data using audio-visual (AV) media from recognisable experiences of activity's problems. These collected artefacts are termed mirror data, described by Bligh and Flood (2015: 156) as "provoking visceral reactions within sessions and conveying that problems exist *undeniably*" (italics in original). Participants also benefit from cues and models of historical and future visions of their activity, "couched in terms of CHAT which they can then use to analyse the contradictions, tensions and dilemmas that exist" (Daniels et al., 2007: 131). Also, they require means to facilitate their collaborative generation, critique and testing of ideas. In Change Laboratory interventions, such data are presented, recorded, analysed and re-presented in sessions using "surfaces" with supplementary means of collaborative communication described below and illustrated in Figure 4.1.

Figure 4.1. Engeström's prototypical configuration of the Change Laboratory surfaces, with the image below from Daniels (2013: 110)

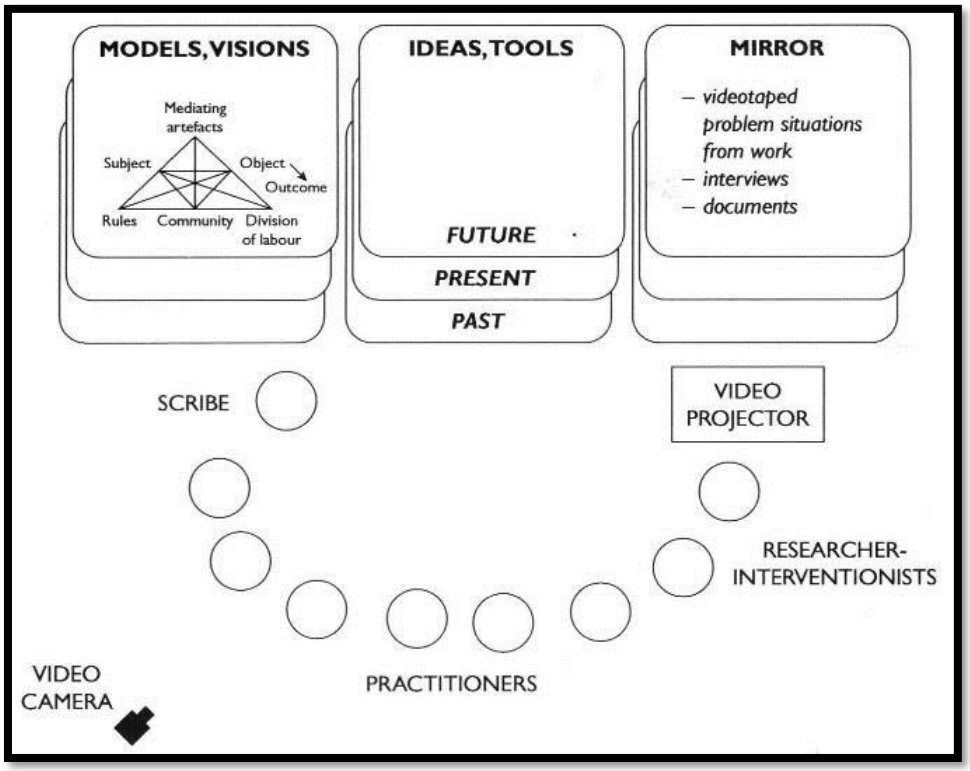


Figure 4.1 shows the prototypical layout of surfaces in a session informed by the Change Laboratory methodology, indicating their use as the "space and instruments for supporting an interplay between emotional involvement and theoretical-genetic reflection" (Virkkunen & Ahonen, 2011: 237). The dimension in the vertical plane, from past to present to future, shows how the surfaces can be used to analyse change through time. The horizontal dimension from the mirror to the ideas / tools and to the models / visions shows the degree of abstraction or generalisation, which can be said (ibid.) to represent the levels of artefacts described above and in Table 4.1. The "mirror" denotes concrete data, usually primary artefacts; "ideas / tools" are used for intermediate generalisations and secondary artefacts; and "models / visions" are typically tertiary artefacts such as the expansive cycles and modelled contradictions of activity systems. Using the surfaces, participants can collaboratively access, create and curate artefacts of all these levels.

Double stimulation tasks take place using the surfaces, while group work is captured as AV media, with the aggravation and resolution of contradictions also contributing to the archive of mirror data. First stimuli are usually questions based on problematic situations in activity, initially provided by the interventionist and subsequently negotiated by participants, including through analyses of mirror data showing their own interactions from previous sessions. The interventionist may also provide initial tools and signs, although they are intended for adaptation by participants as they negotiate meaning and form their own second stimuli. Second stimuli are thus creatively used for problem solving, imparting their meaning through relationships with the context of problems (Virkkunen & Schaupp, 2011: 634). As the sessions proceed, participation becomes increasingly expansive and double stimulation tasks empower that expansivity. My intervention's design thus arranged for participants to equitably access surfaces and other means as they created, tested and concretised their own models to engender transformative agency, described below.

4.3.2 Transformative agency

Transformative agency is a collective quality; attempts to generate it include undertaking collaborative double stimulation tasks (Sannino & Engeström, 2016: 81). My methodological considerations were supported by examining the corpus of scholarly works, including the expressions of transformative agency and their related considerations exemplified in Table 4.2. My methodological aspiration was that transformative agency would be engendered through the deliberation and negotiation of stimuli, with contradictions collaboratively uncovered, aggravated and resolved using the arrangements and stimuli described below.

Table 4.2. Expressions of transformative agency from Haapasaari et al. (2016: 242), related to methodological factors from Virkkunen and Newnham (2013f: 230)

Expression of transformative agency	Meanings and design criteria for methodological alignment of transformative agency with double stimulation and ascension from the abstract to the concrete, with quoted examples from the corpus of scholarly works
Resisting	*Meaning*: Opposing the change, the new suggestions or the initiatives. *Example*: "… in this changing work situation, I try to do my work as well as I can, but I carry out my tasks so that I protect myself and my well-being" (Vähäsantanen, 2015: 7). *Design criteria*: Empower participants to resist change; directed at managers, colleagues or interventionist. Encourage positive potential of resistance, through integrating (rather than simply overlaying) new knowledge.
Criticising	*Meaning*: Identifying problems in current ways of working and learning. *Example*: "… when a problem occurs, I think that the superior should gather people together and form teams to improve things" (Heikkila & Seppanen, 2014: 13). *Design criteria*: First stimuli to encourage critique of activity and organisation. Develop stimuli and propose double binds likely to expose and critique problems in activity. Nurture conceptions of critique as a positive force.
Explicating	*Meaning*: Explaining new possibility and potential, usually with reference to previous experiences. *Example*: "…there are issues, which we would like to get information about … we want to influence [on decision making] and participate [in development] …" (Haapasaari & Kerosuo, 2015: 41). *Design criteria*: Design stimuli to allow equitable access to surfaces. Tasks to include proposals for new possibilities; relate to past experiences and practices. Encourage framing of problems as positive sources of possibility.
Envisioning	*Meaning*: Future-oriented observations of patterns in activity and visualisations of new models. *Example*: "… we ought to look at our work as a whole, what we should do altogether during the day … if this was a functional way of working …" (Haapasaari et al., 2016: 242). *Design criteria*: Present second stimuli to envision: new patterns or models of activity; future oriented suggestions; or new ways of working. Encourage group ideas / tools work ranging from partial to comprehensive visions.
Committing to actions	*Meaning*: Speech acts related to concretisation, with self-obligating actions and specific details. *Example*: "… Sure I can make some material to the meetings and I can also call everyone to the meetings. This is not the issue." (Vänninen, Pereira-Querol, & Engeström, 2015: 41). *Design criteria*: Stimuli to encourage relative specificity and measurability of time and place for consequent actions, and their perceived effects on activity. Nurture collaborative debate of likely contradictions in co-configuration, and dialectics when committing to concrete changes to activity.
Taking actions	*Meaning*: Historical accounts of actions with consequent concretisation, taken in or between sessions. *Example*: "It was yesterday when I had a three-hour meeting … We went through the alternatives of how we will continue. We decided on this kind of solution …" (Haapasaari et al., 2016: 242) *Design criteria*: Stimuli to represent awareness of iterative and cyclical nature of expansivity as long-term commitment. Second stimuli to revisit and merge, with iterative envisioning and modelling of activity's contradictions.

Transformative agency is difficult to directly observe, yet it can be recognised in traits of engagement as participants resist, criticise and enact consequential change to their activity (Tuominen & Lehtonen, 2017: 7). The six expected expressions below directly relate to my

research questions: resisting the change or the interventionists; criticising the current activity and organisation; explicating positive sources of possibility and potential; envisioning future-oriented activity; committing to change activity; and taking consequential action to change activity (Haapasaari et al., 2016: 242). Methodologically, these expressions of transformative agency were to influence my work in two dominant ways: to guide how I designed double stimulation tasks and the sequence of sessions; and to assist analyses of empirical data.

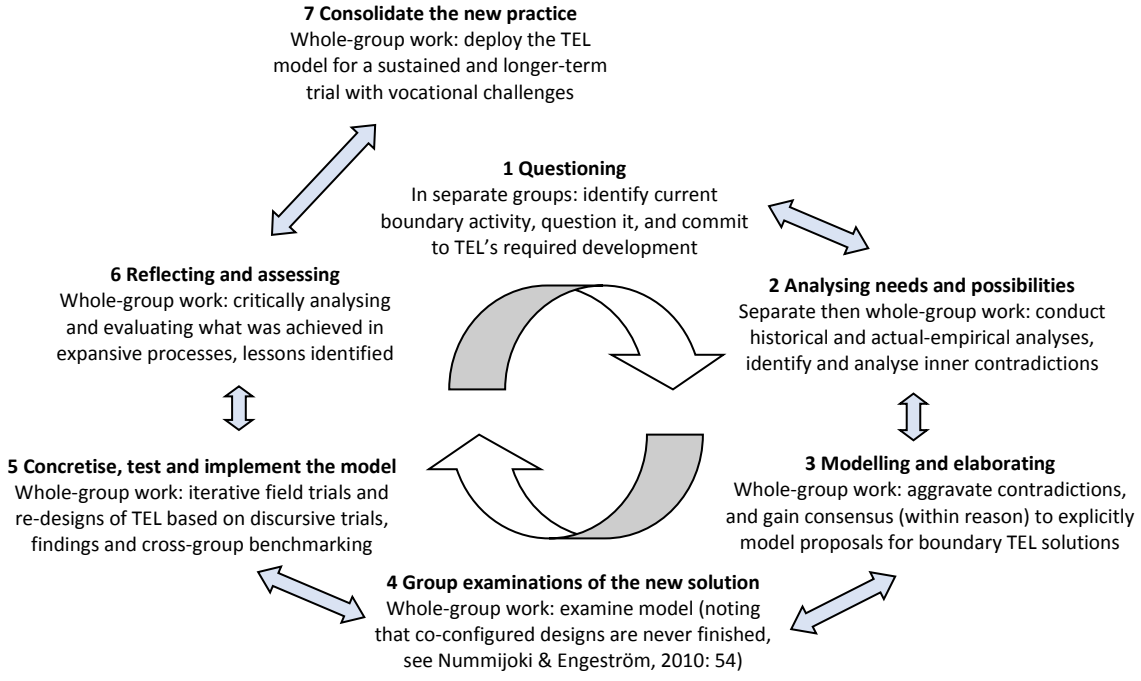
Change Laboratory interventions are designed to empower the collaborative reconceptualisation of the activity's object, and the change to other elements in response (Laitinen, Sannino, & Engeström, 2016: S20). I thus anticipated that participants would exhibit transformative agency as they collaboratively developed their boundary-crossing TEL activity through the identification, aggravation and resolution of contradictions in their own work practices: respecting individuals' internalisations, yet transcending any one individual (Haapasaari et al., 2016: 235); empowering all participants to collaboratively aggravate oscillations about moments of top down and bottom up organisational change (Bligh & Flood, 2015: 142); and foregrounding social, cultural and historical interactions (Cole & Engeström, 2007: 484). Task stimuli ultimately aspired to empower participants to understand and concretise proposals, discussed in the next section.

4.3.3 Ascending from the abstract to the concrete

Formative interventions which use the Change Laboratory methodology are explicit attempts at expansive learning, which in turn are explicit examples of ascending from the abstract to the concrete (Bligh & Flood, 2015: 142). Semantically, ascension infers vertical movement, yet concretisation takes place through both vertical and horizontal modes of expansivity (e.g. Kerosuo & Toiviainen, 2011: 49). Ascension, proposed by Marx (1859/1998: 21) and further illustrated by Ilyenkov (1974: 61), methodologically informs a dialectic of analysis and synthesis. In this way I sought to empower participants to expose, aggravate and resolve contradictions whilst iteratively applying their proposals to test interactions with daily reality. These proposals then either required re-examination or became progressively generalisable and necessary, stabilised through social practice to connect with other phenomena (Virkkunen & Newnham, 2013b: 45). Expansivity itself was also exposed for critique and enrichment by participants (Bligh & Flood, 2015: 153).

The model of an expansive cycle was intended for use as an important tertiary artefact for concretisation. Participants had access to their own model of an expansive cycle to trace their intent and predict their progress, as individuals and as a collaborative group. Models were intended to be updated in sessions along with modelled activity systems; all individuals could thus predict and chart concretisation. Ascension from the abstract to the concrete did not terminate on cessation of the intervention's sessions; a principal intent of the Change Laboratory methodology is to imbue the requisite transformative agency to sustain expansive learning after an intervention, including the ongoing concretisation of abstract proposals (Virkkunen & Newnham, 2013b: 45). Figure 4.2 illustrates the iterative and cyclical progress of concretisation. The figure is adapted from Engeström et al. (1996: 14) and is a methodologically-focused enhancement of the cycle shown in Figure 2.5, here including a methodological summary of each intended expansive action.

Figure 4.2. An expansive cycle, adapted from adapted from Engeström (1994) and used as a tertiary artefact



4.4 Specific issues and preparatory negotiations

This section turns to focus on my specific intervention's preparation. Guidance on preparing for Change Laboratory methodological interventions (predominantly from Virkkunen & Newnham, 2013d: 61-78) provided me with relatively prescriptive, theoretically-informed guidance. Despite their specificity these recommendations are flexible, with each

instantiation “anchored to the current situation and problems in the activity and management of the client organisation” (Virkkunen & Newnham, 2013d: 61). Anchoring the intervention to local problems assisted my direct attempts at provoking participants to undertake: the identification and aggravation of contradictions; the reconceptualisation of their activity’s object; the development of new artefacts, rules and divisions of labour; and rethinking activity’s interactions with other activities. Of note, there is limited specific guidance for insider-researchers using the methodology (also acknowledged in Bligh & Flood, 2015: 155) which may partially explain some differences between the recommendations of Virkkunen and Newnham (2013d: 61-78) and my own intervention.

4.4.1 The pilot unit and participants

A key ontological feature of CHAT is the radical localism of an activity system which contains characteristics of the whole. That stated, Levant (2018: 100) and Peim (2009: 171) analyse claims that CHAT over-socialises those inside an activity system and side-lines those outside it, thereby stultifying radical localism. The issues confronted in a Change Laboratory intervention are usually aggravated locally yet are seen as indicative of wider organisational concerns (Virkkunen & Newnham, 2013b: 45). The methodological guidance thus recommends a pilot unit to focus on “problems in local practice taken as indicative of wider systemic incongruity” (Bligh & Flood, 2015: 142). The pilot unit comprising this intervention’s participants, who were introduced in Chapter 1, all requested involvement having collaborated in prior small-scale and unpublished Change Laboratory interventions. In contrast to outsider interventionist perspectives (see e.g. Postholm, 2015: 47), I had witnessed the participants being energised through shared experiences of previous interventions.

The subject group comprised three sub-groups, each sub-group sharing organisational appointments at the RSME and having similar daily responsibilities: ten military learners; six civilian lecturers; and three military middle-managers. They had faced the daily reality of conflictual social circumstances in their boundary-learning TEL activity, although with different subjective perspectives within and between their sub-groups as learners, lecturers and managers. They were part of one disciplinary branch of the PEW, which in turn is one of seven of the RSME’s hierarchical units and specifically the one with responsibility for HE. The PEW’s degree programmes, at a minimum of two years, are the longest undertaken at the RSME and they involve significant co-ordination across boundaries: with other military units which materially support the programmes; with HEIs who are conferred to award the

School's degrees and advise on quality; and with industrial and defence stakeholders beyond the RSME who collaborate in TEL by sharing knowledge and meaning.

These factors were methodologically relevant. The participants' familiarity with other stakeholders, and their relative temporal stability, presented desirability for a pilot unit. Participants themselves also had attractive characteristics (from Virkkunen & Newnham, 2013d: 65) including: as volunteers, and with relative familiarity with the methodology, they anecdotally declared during participant briefings that they had sufficient resilience to withstand the undertaking; their relatively central perspectives, coupled with collective breadth of subjectivity, would likely assist with expansive work; and in their sub-groups they had expressed appetitites for accepting the risks and the efforts of the intervention. As a plenary of sub-groups they met the principle of "dealing with the same object in their daily work … despite differences in their occupation, task or hierarchical position" (Virkkunen & Newnham, 2013d: 65). For a period of around two years they had been colleagues, learning and working with each other and with me on a more-or-less daily basis.

Despite these factors, poignant concerns for preparation were gleaned from more experienced researchers including: Greene's (2014: 10) cautionary notes with "friend-informants"; Clegg's (2012: 407) calls for increased theoretical rigour from insiders; Coghlan's (2007: 296) challenges of bracketing role duality, preunderstanding and politics; Kirke's (2013: 17) concerns of military power relationships; and Leirner's (2014: 68) expectations of influence on the study by military and civil service strategists. A summary of my methodological priorities for sub-groups follows:

- **Expressing agency**. During preparatory discussions, the ten learners anecdotally expressed concerns for their ability to express agency in a group which included peers and managers, their dominant reasons being professional embarrassment and power repercussions beyond the intervention. My design thus required learners to be comfortable in raising concerns without political penalties. Concerns included concurrently constraining and sustaining motives of boundary-crossing TEL: they understood the value of developing credibility and capability at unforeseen tasks; yet they wanted to exhibit compliance with rules for reasons of enculturation and promotion in rank. Through examining their activity's dialectics, the design intended to legitimise such subjective conflicts in their identities: as critical learners; as professional engineers; and as dutiful service personnel (see also Billett, 2013: 68).

- **Developmental responsibility**. For the three military managers, they described concerns of conflicting motives for their participation in expansive change. They described a dialectic of managerial roles, though not using those exact terms: on one hand, they wished to maintain managerial control of TEL's development; on the other hand, they had ideas which could place subordinates beyond their control. Their responsibilities for allocating TEL resources further highlighted paradoxes of promoting agency (Tuominen & Lehtonen, 2017: 4). This reflected how some people have power to force a change yet, through distanced involvement, they lack motivation; others have personal incentives for change, yet lack the requisite power (Garud, Hardy, & Maguire, 2007: 957). My design thus required specific techniques for managers to be assisted in their sensemaking of changes to their organisational realities.

- **Political reality of work and learning**. The six civilian lecturers' dominant concerns comprised: on one hand, fostering in learners the critique and intrinsic benefits of HE (described by Ashwin, 2012: 61); and on the other hand, wishing merely to meet contractual terms of their employment by transmitting pre-ordained curricula (described for military HEIs in Wiarda 2011: 151). Exposing and aggravating such dilemmas were critical methodological concerns, to empower lecturers to contribute to the qualitative transformation of TEL. These dialectics informed the design of arrangements to identify and analyse the germ cell of activity, since somewhat paradoxically civilian lecturers were the most enduring of the RSME's employees through time. Their political experiences were likely to be laden with lucrative historicity and contradictions, useful for the historical-genetic tracing of TEL's problems.

4.4.2 Negotiating the project outline

Virkkunen and Newnham (2013d: 62) recommend that an early "project outline" is constructed between the client organisation's managerial representatives and the researcher-interventionists, to negotiate shared understandings of the scope, scale and object of the intervention. As an insider researcher, my intervention intended to directly confront strategists' conceptions of TEL activity, which had been taking place in the conflicting social circumstances described in Chapter 1. Learners, lecturers and managers faced a daily choice: either conduct non-compliant boundary-crossing TEL by rule-bending

and rule-breaking; or comply with defence's perplexingly slow political controls and continue to use outdated modes of learning, obsolete content and redundant technologies.

To that end, the configuration and the communication of my project outline was negotiated directly with participants. This represents a point of divergence from the recommendations of Virkkunen and Newnham (2011: 67). In their recommendations are recurring themes of managerial consultation and strategic alignment, which my designed instantiation opposed, including: "[the Change Laboratory methodology] can only be effective when connected to the ongoing discussion on the strategic management of the activity …"; and "management … have to be well informed about its progress and intermediate results …" (ibid.). Rather than prioritising the intentions of the RSME's strategists, I intended to conduct a-posteriori briefings to manage their expectations and discuss their managerial sustenance of the agency which I hoped would emerge. Importantly, these briefings were also to allow me to deliberately assume an 'interlocutor' role, overtly liberating the participating local managers from that responsibility.

There was an identified risk at the design stage that this deliberate divergence from the established methodological guidance, regarding prescriptive connections between the research-intervention and management, could stall top-down input. This could have threatened the sustenance of the intervention, had top-down initiatives been wholly neglected during change endeavours; the intervention demanded oscillations about top-down and bottom-up initiatives (Engeström & Sannino, 2010: 20; Bligh & Flood, 2015: 142). Thus my decisions warrant brief clarification of this divergence on three counts of marginalisation, influence and interference:

- **Marginalisation**. Firstly, participating local managers were considered to represent top-down influencers of change to activity; to invite overt involvement from strategists would likely have marginalised participants' voices, due to power relationships of military and civil service ranks. The formative intervention relied on challenging military norms, to prevent "rationalising or mainstreaming" of rank-based hierarchies (Sookermany, 2017: 324) which could have been undermined along with dialectical outcomes if strategists were involved in its design.

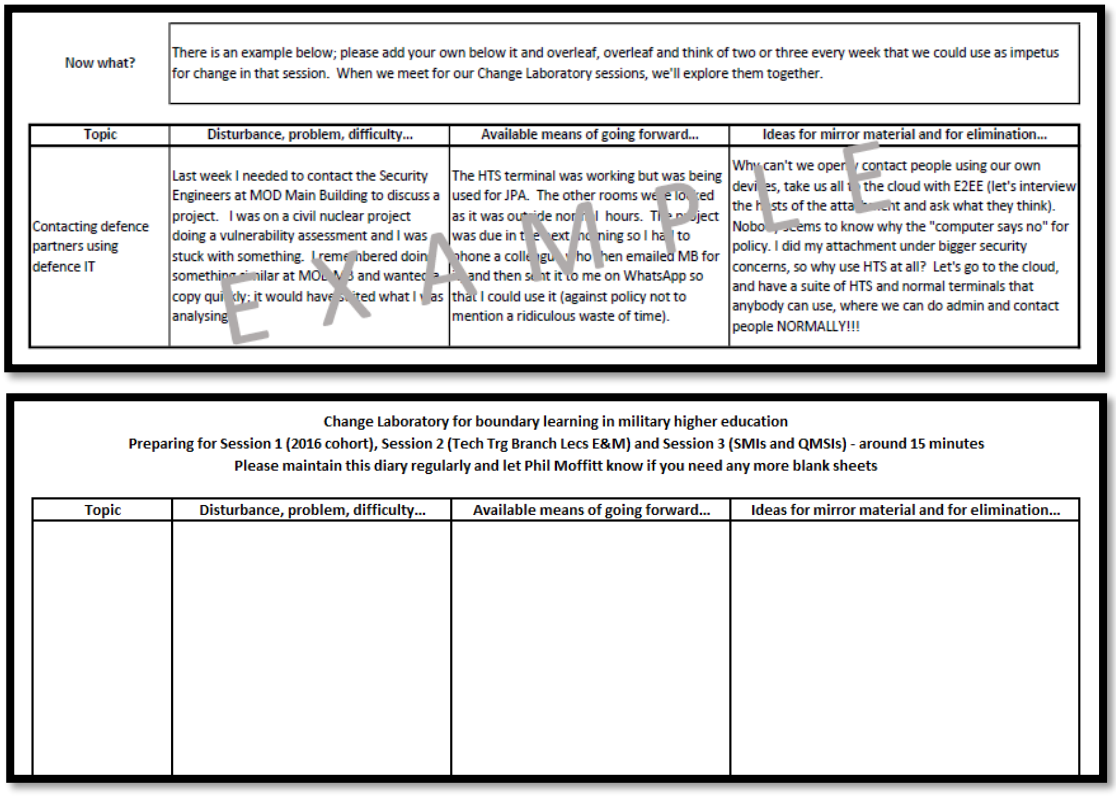
- **Influence**. Secondly, the expansive endeavours of theoretical-genetic analysis, historical analysis and concretisation were likely to influence the problem definitions of this and future interventions. The project intended to form the "application of a

local innovation", upon which to expand findings and consider strategic sustenance (Virkkunen & Schaupp, 2011: 638). Engaging strategists during design would likely result in a-priori influence on those problem definitions, without intimate understanding of historicity or local daily reality.

- **Interference**. Thirdly, my design did not entirely preclude strategists from communication; rather I purposefully designed empirical phases to shield participants from strategic interference. This assured participants of being relatively insulated from negative career implications, given the engendering of political acts of resistance and critique. It also bracketed the likely autocratic input of military and civil service strategists, who on principle are usually inconsistent or simply unengaged in bottom-up innovations (Morse, 2012: 22).

To concurrently negotiate the sanction of participants for my design, and to normalise their future conduct in resistance, critique, emotional attachment and detached intellectual analyses, a 'Session Zero' was conducted to discuss the project outline with participants followed by a-posteriori briefings for strategists. Examples of exhibits used in Session Zero are at Figures 4.3 and 4.4.

Figure 4.3. Extracts from the workbooks used during sessions and to negotiate the project outline

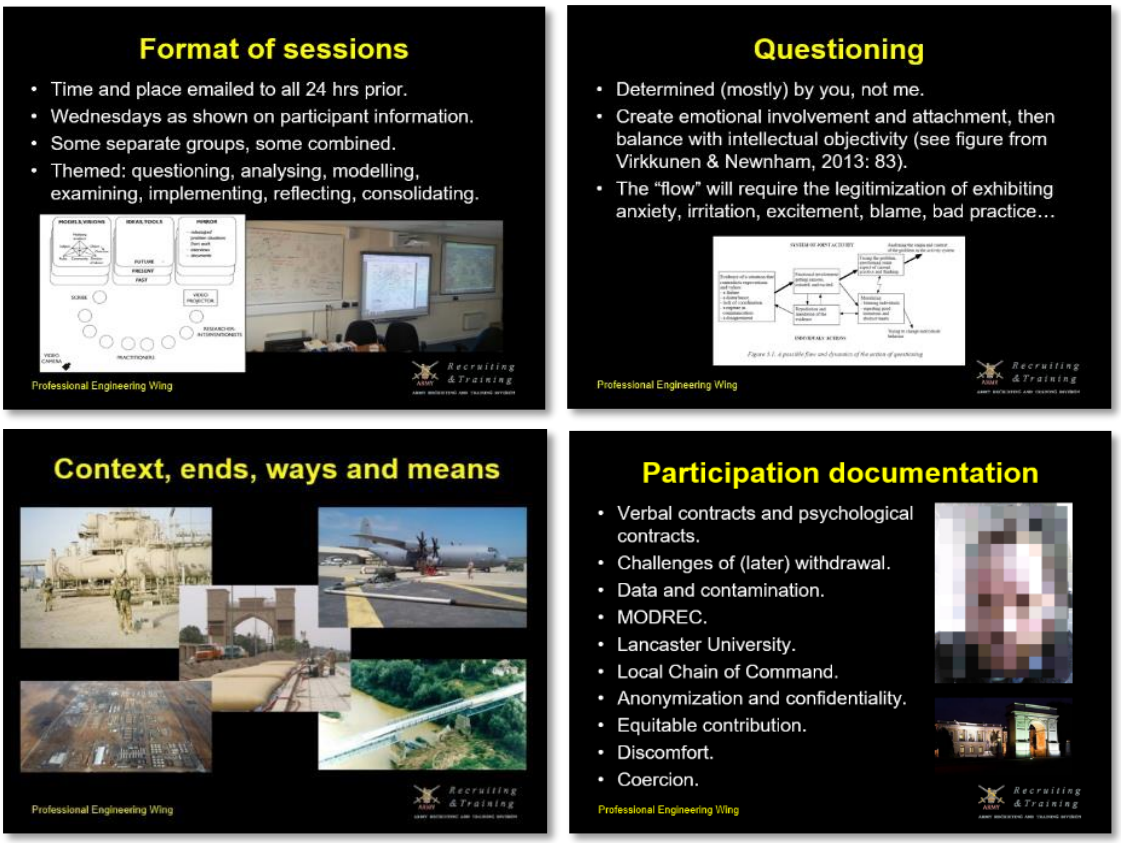


Now what?	There is an example below; please add your own below it and overleaf, overleaf and think of two or three every week that we could use as impetus for change in that session. When we meet for our Change Laboratory sessions, we'll explore them together.		
Topic	**Disturbance, problem, difficulty...**	**Available means of going forward...**	**Ideas for mirror material and for elimination...**
Contacting defence partners using defence IT	Last week I needed to contact the Security Engineers at MOD Main Building to discuss a project. I was on a civil nuclear project doing a vulnerability assessment and I was stuck with something. I remembered doing something similar at MOD and wanted a copy quickly; it would have assisted what I was analysing	The HTS terminal was working but was being used for JPA. The other rooms were locked as it was outside normal hours. The project was due in the next morning so I had to phone a colleague who then emailed MB for and then sent it to me on WhatsApp so that I could use it (against policy not to mention a ridiculous waste of time).	Why can't we open contact people using our own devices, take us all to the cloud with E2EE (let's interview the hosts of the attachment and ask what they think). Nobody seems to know why the "computer says no" for policy. I did my attachment under bigger security concerns, so why use HTS at all? Let's go to the cloud, and have a suite of HTS and normal terminals that anybody can use, where we can do admin and contact people NORMALLY!!!

Change Laboratory for boundary learning in military higher education
Preparing for Session 1 (2016 cohort), Session 2 (Tech Trg Branch Lecs E&M) and Session 3 (SMIs and QMSIs) - around 15 minutes
Please maintain this diary regularly and let Phil Moffitt know if you need any more blank sheets

Topic	Disturbance, problem, difficulty...	Available means of going forward...	Ideas for mirror material and for elimination...

Figure 4.4. Examples of exhibits used in Session Zero to negotiate the project outline with participants



A key aspect of these early engagements was the legitimisation of resistance and critique, assisted during these first sessions, and beyond, by personal workbooks similar to Bligh and Flood's (2015: 165) "Lab Books" and Virkkunen and Newnham's (2013: 239) "Disturbance Diaries". These were designed to encourage the curation of personal notes: recording personal thoughts on disturbances in activity; individual opinions for subsequent collaborative tasks; and personal concerns for the intervention in general. Workbooks included relatively structured reflective and double stimulation tasks, to assist in the preparation for group sessions. They were intended to be held as personal records, with some content designed to be collected on cessation, and other content to be retained. Participants were accustomed to such means, since they maintained written reflections in work diaries for professional registration with the Engineering Council; the format of workbooks deliberately emulated the layout of familiar artefacts. Examples are in the subsequent chapter.

4.4.3 The scope and timing of the intervention

Virkkunen and Newnham (2013d: 66) explicitly relate the success of a Change Laboratory intervention to its continuity and intensity. As an insider researcher I had advantages in the design of continuous and intense work, with relative familiarity of the School's routine and participants' daily lived reality. Participants' other commitments included: routine learning programmes in infrastructure engineering; formal physical training; organised sports and adventurous training; maintaining military skills such as weapons and first aid training; overnight command, leadership and management tasks; and reactive duties in response to national threat levels. To accommodate these commitments, my designed timings differed from the archetypal "five to twelve two-hour sessions weekly in successive weeks and a period of four to six weeks of the first experimentation with the newly produced solutions" (ibid.). My instantiation was formulated to suit other commitments whilst provoking expansive work in and between sessions.

The intervention's design was planned for fourteen 90-minute sessions (disregarding Session Zero), with participants in separate sub-groups for the stages of questioning and implementing, and with two weeks between all sessions. Plans for each session were intended to be negotiated with participants on the cessation of the session before, with time allocated to allow us to reflect and prepare task stimuli in workbooks and on surfaces before the subsequent session. I intended to negotiate and share my intent for capturing and analysing data, to promote equity and to protect the privacy of sessions given their political ramifications. I intended to publish the coarse findings and the subsequent session's outline on the RSME's virtual learning environment, with a private subject area devoted to the Change Laboratory sessions with access limited to participants (c.f. Virkkunen & Newnham's, 2013d: 67 recommendations to openly publish minutes). These arrangements included administrative details such as timings, locations, and downloadable templates of task stimuli.

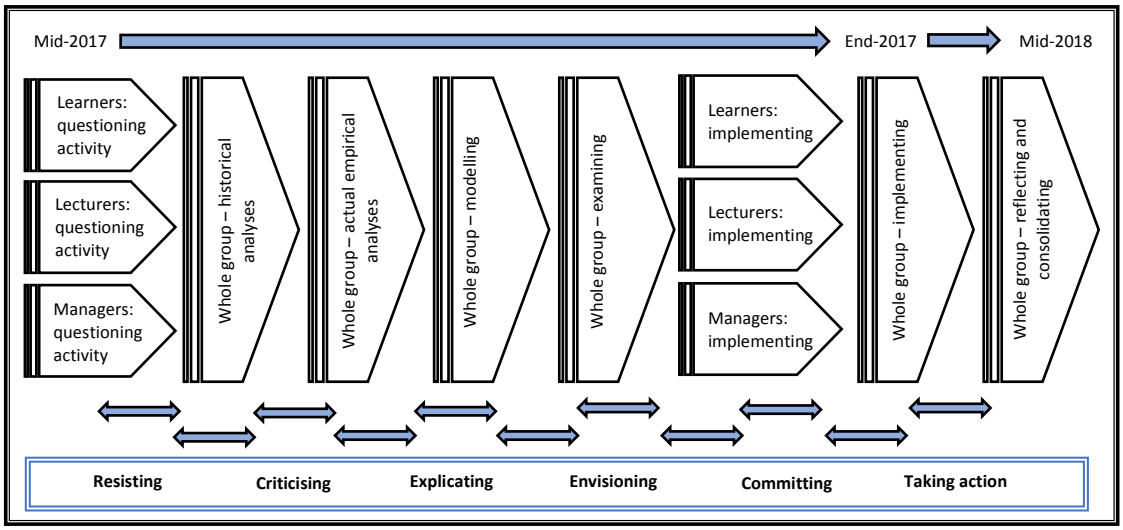
An important design consideration was presented by the increasing contingency of sessions. To explain, each session in a Change Laboratory intervention relies on contingent and compounding factors including: outcomes of antecedent sessions; results of reflection and consolidation between sessions; and the agentic intent of participants on arrival, who are increasingly encouraged to control the conditions and intentions (Bligh & Flood, 2015: 146). This required flexibility, yet the scope and timings were intentionally detailed to allow preparation. Formats were thus designed, yet neither assumed nor intended to be rigidly followed, instead envisioned as structures for adaptation. Importantly, sessions were

anticipated to yield lucrative data on transformative agency, describing how the realised intervention diverged from the planned intervention; a critical aspect of expansive learning (Virkkunen & Newnham, 2013d: 79). The design aspired to nurture turning points, with a recognisable "qualitative change in the nature of the participants' discourse and a jump in the quantity and quality of their expressions of transformative agency" (Haapasaari et al., 2016: 243).

4.5 Sequencing and conducting the sessions

The subsequent sections describe my *designed* sequence and conduct of sessions, influenced by the accounts of established researchers including in particular Virkkunen and Newnham (2013d) and Bligh and Flood (2015: 155-161). The scope and timings are illustrated at Figure 4.5. As described previously, participants were encouraged to take control of the intervention, focussing on subjective sources of trouble. There were two broad intended means for me to promote, trace and analyse data from the intervention's sessions: firstly, arrangements were made for my hasty analyses and re-presentation of AV mirror data and second stimuli artefacts during sessions, in response to notable interactions between participants which were deemed relevant for further work in that session; secondly, more deliberate forms of analyses were to be made between sessions, with transcription and coding undertaken to enable re-mediation and re-presentation of mirror data and task stimuli.

Figure 4.5. The intended scope and timings of the intervention, related to the predicted expressions of transformative agency and the typical stages of expansive learning



The former ad-hoc forms of data were typically intended to be re-presented from surfaces, digital cameras, workbooks and voice recordings in reaction to my observations in that session and on the requests of participants. The latter, more deliberate forms of data, were typically intended to be transcribed and analysed between sessions by me "re-speaking" (Tracy, 2012: 177) turns of speech. These were intended to be taken from detailed images of surfaces and workbooks, and AV media recordings, using Nuance® Dragon Naturally Speaking® software version 13, whilst curating media and transcripts using computer aided qualitative data analysis software (CAQDAS), namely ATLAS.ti™ 8.1.28. The progress was likely to be much more iterative and cyclical than implied in Figure 4.5.

My intent was to ensure that all participants could contribute equitably to discursive, multi-voiced and troublesome negotiations. This can be described as sustaining dialectical moments about top-down and bottom-up concepts of change, ensuring that proposals were appropriately represented by contradictions of systemic concepts "from above" and everyday concepts "from below". This has also been described as the "basic dilemma in the transformation of the concept of an activity" (Virkkunen, 2006: 48). It was also important from the outset that I managed expectations of participant conduct: firstly ownership, allowing participants to control the sessions themselves; secondly progress, dissuading participants from prematurely proposing solutions rather than understanding problems; and thirdly political relationships, normalising parity of esteem for all regardless of their rank or status, legitimizing input in conflictual circumstances.

Key design concerns for particular sessions are below. My descriptions relate to methodological structure rather than solely "data collection methods", as cautioned in Postholm (2015: 48). An example session plan is shown at Figure 4.6, adapted from the "Researchers' Plan" at Appendix 1 of Virkkunen and Newnham (2013e: 244). The figure indicates how plans were drafted at the design stage, for negotiation with participants at the end of each session in preparation for the next session. It was intended that discussions at this point would include: key points for the design and administration of subsequent sessions; ideas for methodological adaptations for the intervention; the capture of consequent actions required for subsequent sessions; potential mirror data that participants would find valuable; and task stimuli in participant workbooks and on surfaces. The indicative designs are summarised at Table 4.3 with details in the subsequent sections structured in terms of expansive actions. Where expansive actions spanned multiple

sessions in the design, they are collated for brevity of discussion. The descriptions follow this common format:

Designed intent. Firstly, a paragraph describes the sessions' designed expansive intent, and whether it was designed to be conducted in separate sub-groups or as a plenary of the whole group. Whilst expansive learning is by definition unpredictable, sessions were intended to promote specific expansive actions. In this paragraph I have also set out the dilemmas which I perceived to be pertinent to the development of particular expressions of transformative agency.

Task stimuli and the development of double stimulation in tasks. The second paragraph summarises the double stimulation tasks. The first stimuli were intended to define the problem and create initial "ambiguous and contradictory challenges for development" (Virkkunen & Newnham, 2013: 182a) generally framed as relatively straightforward questions. Second stimuli were usually pre-designed models and ideas to be provided to the participants, that I invited them to think with and modify on surfaces and in workbooks. Their intended purpose was to provide "potential psychological tools with which the participants could structure the chaotic field of problems and work out the core problems" (ibid.). These included tertiary artefacts such as four-field models, timelines, activity systems and expansive cycles.

Illustrating problematic aspects of activity. Descriptions of ethnographic mirror data comprise the third paragraph, with explanations of its provision of irrefutable evidence of participants' personal involvement in problematic activity. Figures show the designed stimuli for use in workbooks and on surfaces. Since the design was increasingly contingent, these figures and their preceding descriptions become successively simplistic and limited.

Figure 4.6. Example of the session plans used to prepare, plan and negotiate the intervention with participants

Project: Transformative agency for boundary learning in military higher education; empowering participants to change their activity

Session number:	7th	Date:	13-Sep-17	Social org:	Whole group in PEW Seminar room	Purpose:	3. Modelling

Preparation: AV data: 20170429 Moffitt CL models tools mirror session 7

Policy and practice; evidence for re-presentation and discussion including from previous sessions. Flip charts 1 per pair + 1.

Brought forward from last session:

Politically contentious terrtitory for managers in presence of learners, and for managers in presence of lecturers.

Time:	Min:	Themes:	First stimulus:	Mirror data:	Second stimulus:	Participant data:
1330	0	Configuration of sessions and layout Recap of previous session; move to modelling Progress on workbook exercises Pg 17 & 18	What does the new object need to be? What do the new mediating artefacts need to be?	Illustrate old elements to help model new activity: video interview of previous cohort on experiences of inner contradictions; challenges and opportunities from peers. Re-present AV data, evidence of contradictions from ETUs in Sierra Leone as springboard. AV: Reports and discussions of consistent failure to install Kajaki Dam turbines. Any thoughts on the object and artefacts?	Exchange, distribution & consumption; new and old activity; tertiary contradictions. SWOT and DEEPLIST assessment templates, partial model for redesigning a military ZPD. Residual disturbances in poorly modelled historical activity; ID role of artefacts and objects.	Reflections on previous TEL experiences related to "old rules and new tools" contradictions. Consider, from a personal perspective, how contradictions can be a positive impetus for change. Pareto analysis of future issues. Workbook exercises Pg 21 - Examining the redesigned activity.
1400	30	AV Consider production for TEL, boundary work,Kajaki Dam Q: How do we model current activity's success & failure? Consider previous definitions of what "good" looks like. Model activity's production introduced in Session 1, 2 & 3: • Subject - directly involved in production • Object (discuss WRT objective) and outcome				
	45	• Artefacts (here and now, look forward to aspirational) Introduce other elements and review KJI mirror material: • Rules - identify potential for aggravation				
1430	60	• Community - identify potential for aggravation • Division of labour - identify potential for aggravation				
	75	Review exchange, distribution, consumption Relate (generally) SWOT and DEEPLIST to TEL activity				
1500	90	Closedown, workbook Pg 21, look forward, questions				

Participants' points raised for next CL session:

Action and information for researcher:

Lead references:

Virkkunen, J., & Newnham, S.D. (2013). Preparing and Carrying Out Change Laboratory Sessions. In *The Change Laboratory: a Tool for Collaborative Development of Work and Education* (pp. 79–115). Rotterdam: Sense Publishers.

Engeström, Y. (2015). Toward an expansive methodology. The cycle of cultural-historical methodology: Vygotsky, Scribner, and Cole. In *Learning by Expanding: an* (pp. 249–257). New York: Cambridge University Press.

Table 4.3. Indicative coverage of intended sessions, showing the sequenced design for enabling expansive learning and transformative agency, conducted over fourteen sessions of approximately 90 minutes each.

Expansive learning actions	Sessions and attendance	First stimuli (problem as presented to all participants)	Second stimuli (frameworks for participants to think with)	Mirror data (illustrations of problems, audio-visual where possible, textual where necessary)	Participant data from workbooks for subsequent re-presentation	Potential expressions of transformative agency
1. Questioning	3 x separate groups. 1 x whole group.	What drives current activity for TEL and boundary learning? What are the problems?	Templates of group activity and individual action; models of how artefacts mediate	Illustrate problems with current activity: images from recent tasks; AV of TEL activity involving all participants; AV of failures implicating current activity	Completed models of production in workbooks; perceived problems with activity	1. Resisting 2. Criticising
2a. Historical analyses	1 x whole group.	What or who are the main problems with our current activity? How did we get to this point?	Timelines; expansive cycle; templates of objects / activity and goals / actions	Exhibit evolution of activity: AV data showing participant involvement; TEL from Afghanistan, South Sudan and Sierra Leone to expose historical problems	Lessons identified from personal experiences; problems in objects and historical contradictions	2. Criticising 3. Explicating
2b. Actual-empirical analyses	1 x whole group.	What are the requirements for change? How do our actions align with our activity?	Templates of activity with primary and secondary contradictions	Progression to actual-empirical analyses; AV data of participants contributing to the object; graphical exhibition of inner contradictions	Exercises on the control of activity; proposals for changes to how activity is delineated	3. Explicating 4. Envisioning
3. Modelling	1 x whole group.	What does the new object need to be? What do the new mediating artefacts need to be?	Exchange, distribution & consumption; new and old activity; tertiary contradictions	Illustrate old elements to help model new activity: video interview of previous cohort on experiences of inner contradictions; challenges and opportunities from peers	Reflections on previous TEL experiences related to "old rules and new tools" contradictions	4. Envisioning 5. Committing
4. Examining	1 x whole group.	How will our new model be trialled? What are the key areas of concern for its sustenance?	Interacting activities; expansive cycle; quaternary contradictions	Promote intersubjective ownership of new model and its contradictions: participants' jointly compiled model of new activity; proposals for all contradictions	Reflections on previous TEL experiences of "old division of labour and new tools" contradictions	4. Envisioning 5. Committing
5. Implementing	3 x separate groups. 1 x whole group.	How will the trialled implementation of the model change the model?	Completed activity system; neighbouring systems; policies; strategies	Prepare for a strategic trial: re-present the completed model of activity; re-examine its real and potential contradictions	Diary entries of problems experienced during implementation	5. Committing 6. Taking action
6. Reflecting	1 x whole group.	What would you pass on to the next cohort for a similar intervention?	Expansive cycle to re-iterate the back-and-forth nature of change	Promote reflection: re-present a synopsis of all previous mirror data and stimuli in chronological order of the intervention	After-action review and reflections on effects of transformative agency	1. Resisting 2. Criticising 3. Explicating 4. Envisioning 5. Committing 6. Taking action
7. Consolidating	1 x whole group.	How do we influence RSME and defence policies for sustenance?	Reconfigured RSME QA plans; defence directives; Deming cycle	Promote consolidation: all previous mirror data and lessons identified from implementation to be available	Reflections on what was expected and what was unexpected	

4.5.1 Sessions one to four: questioning activity

Designed intent. Questioning enables epistemic actions of "criticizing or rejecting some aspects of the accepted practice and existing wisdom" (Engeström et al., 2014: 123). Questioning intended to explore dilemmas of emotional involvement and intellectual analysis (Virkkunen, 2006: 54), enhancing consciousness of TEL's problems from a detached manner but also from a stance of the emotional attachment of oneself and others (Bligh & Flood, 2015: 160; Virkkunen & Newnham, 2013d: 81). Initial sessions were designed to question activity in sub-groups of learners, lecturers and managers from sessions one to three, with the fourth session as a plenary. This configuration intended to legitimise critique and resistance prior to introducing power relationships; to quote Virkkunen and Newnham (2013d: 66) "inviting all who are working with the same object sometimes contradicts the need to enable open and direct discussion". By initially questioning in sub-groups, I aspired to ameliorate power differentials of the plenary, which were to be exposed from the fourth session onwards. Transformative agency's expressions of resisting and criticising informed the design, with tasks and stimuli intended to develop positive and agentic aspects of resisting both TEL activity and the intervention itself (Sannino, 2010: 839). Authors such as Haapasaari et al. (2016: 246) and Engeström and Sannino (2011b: 380) observe that methodological shortfalls in encouraging resistance are likely to drive partial reformism, repudiating the potential for radical change.

Task stimuli. Stimuli were designed to balance two intentions: cultivating an irrefutable need to criticise and change activity; and legitimizing participants' resistance to that change. First stimuli thus included questions on: drivers for and problems with boundary-crossing TEL activity; local manifestations of problems; and social comparisons of problems. Second stimuli included models of: artefacts mediating activity; expansive cycles; and individual actions contributing to activity. Some stimuli were in workbooks for individual completion, prior to joint analyses in sub-groups. Others were first encountered in the plenary. Tasks began with analysing actions and activity for familiar work tasks, then turning to question boundary-crossing TEL. Examples at Figure 4.7 show personal tasks for questioning, with Figure 4.8 showing stimuli for collaborative questioning of boundary-crossing TEL on global deployments.

Illustrating problematic aspects of activity. Ethnographic mirror data were designed to disclose participants' problems in actions and activity, at individual and systemic levels. They intended to provoke individual and social resistance and critique, with AV evidence of direct

and problematic involvement in boundary-crossing TEL activity. Some AV data were designed and prepared for tasks, whilst other data were ready to be reactively sourced in response to interactions, including: anecdotal experiences of historical failures; AV media of irrefutable evidence of personal involvement; managerial documents such as directives and policies; and personal examples of defensive, moralizing and rule-bending acts.

Figure 4.7. Templates and tasks from individual workbooks on questioning

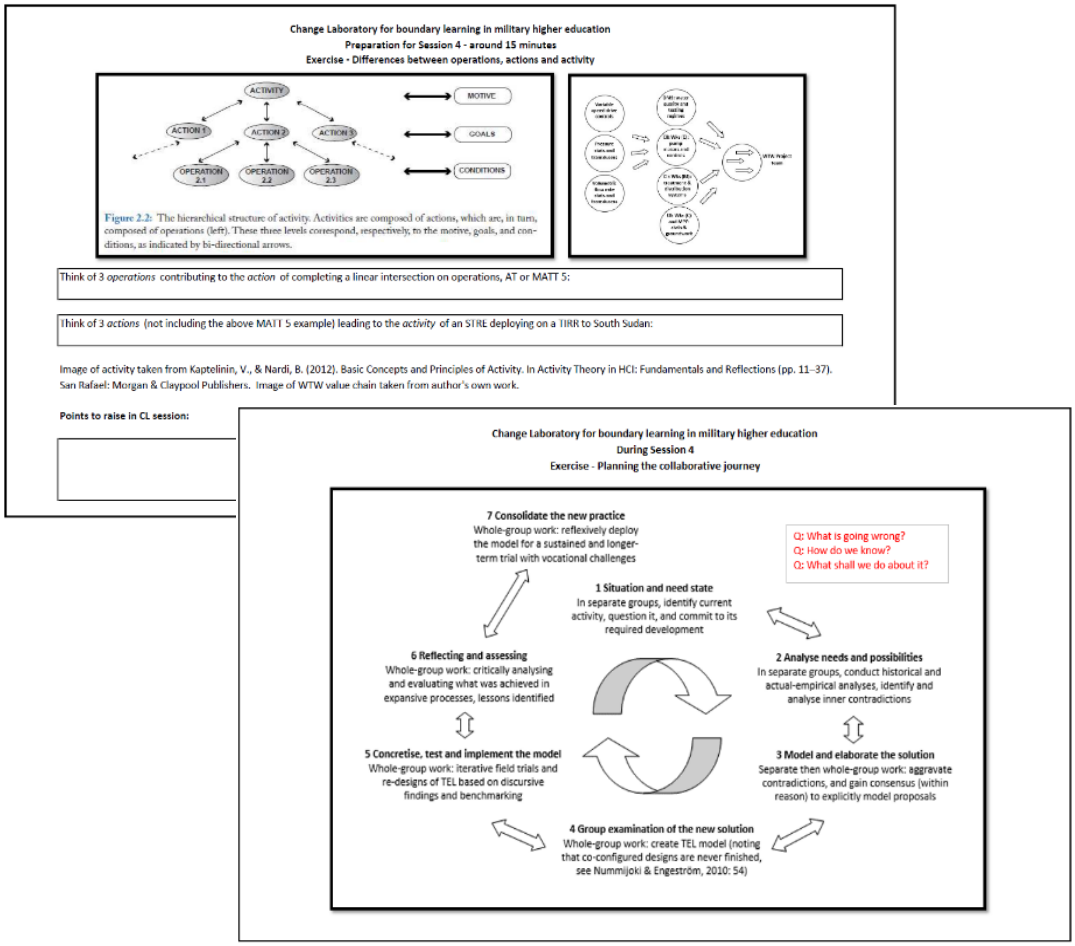


Figure 4.8. Extracts from typical exhibits designed for the sessions on questioning activity

4.5.2 Session five: historical analysis

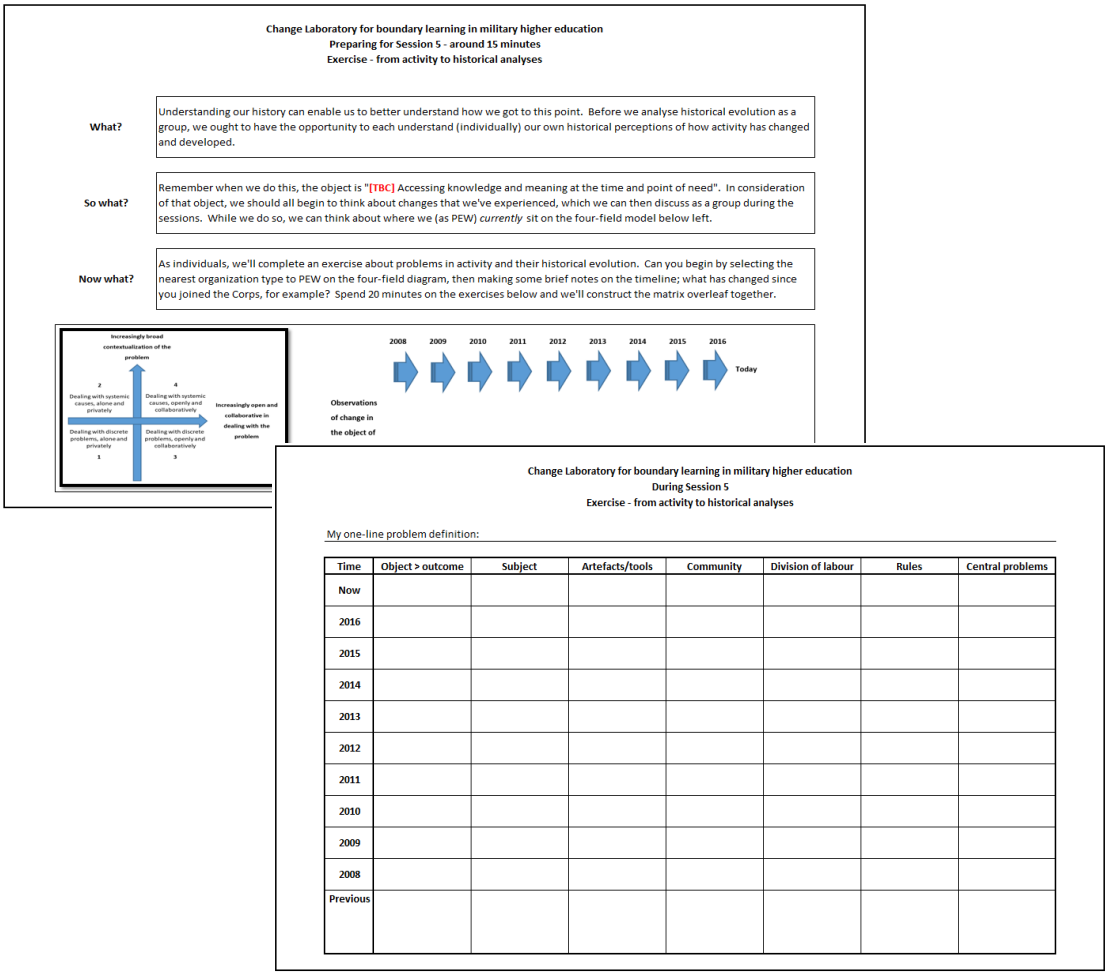
Designed intent. Historical analysis intended to engender understanding of how activity had evolved, and alternatives which may have evolved yet did not (Virkkunen & Newnham, 2013d: 85). Historically-informed analyses of shortcomings and contradictions aspired to assist participants to "identify elements of the activity system that have changed and made the prevalent principle inadequate" (Virkkunen, 2006: 57). The session was designed to be conducted as a plenary. Participants reviewed the evolution of their TEL activity through the past three decades, jointly developing understanding of its contradictions and possible historical alternatives. Tasks were designed to develop agency through a dialectic between old ways of solving problems and new concepts of activity (Virkkunen, 2006: 57) stimulating discussions of how contradictory circumstances had influenced TEL activity (Bligh & Flood, 2015: 160). Transformative agency's expressions of criticising and explicating informed the design, with tasks designed to specifically relate "past experiences … new possibilities and exciting challenges" (Virkkunen & Newnham, 2013f: 231).

Task stimuli. The stimuli were designed to pre-empt and prompt emotional yet accurate recollections of historical activity, and to "correct false conceptions about the past" (Virkkunen & Newnham, 2013d: 85). Workbook and surface exercises provided stimuli intended to structure and record observations about changes in activity. First stimuli comprised subjective questions on the evolution of activity's problems, to prompt participants to critically analyse historical boundary-crossing TEL and to discuss: what or who they considered to be historically embedded problems; how they considered activity had evolved through time; and how activity had reached the current point with its embedded problems. Second stimuli comprised templated models through time for adaptation: activity systems; expansive cycles; operations, actions and activity; and timelines of work and learning. Four-field templates were intended for individual and collaborative work on past, present and future forms of TEL and problem-solving, an example of which is shown at Figure 4.9.

Illustrating problematic aspects of activity. Mirror data included ethnographic accounts of TEL through recent history which had shaped and been shaped by artefacts, doctrine and policy, and division of labour, with examples at Figure 4.10. Data included interviews with members of previous cohorts in problematic, historical, boundary-crossing TEL for military tasks in humanitarian crises. These were intended to aggravate historical contradictions and promote thought on how past activity had satisfied need in its historical context, allowing

the historical advancement of current activity to be discussed. Participant data included: personal problems with historical objects and other elements of activity; how actions may have contributed to activity through time; and subjective opinions of how historical contradictions in their activity had become persistent.

Figure 4.9. Templates and tasks from individual workbooks on historical analysis



Change Laboratory for boundary learning in military higher education
Preparing for Session 5 - around 15 minutes
Exercise - from activity to historical analyses

What? Understanding our history can enable us to better understand how we got to this point. Before we analyse historical evolution as a group, we ought to have the opportunity to each understand (individually) our own historical perceptions of how activity has changed and developed.

So what? Remember when we do this, the object is "[TBC] Accessing knowledge and meaning at the time and point of need". In consideration of that object, we should all begin to think about changes that we've experienced, which we can then discuss as a group during the sessions. While we do so, we can think about where we (as PEW) *currently* sit on the four-field model below left.

Now what? As individuals, we'll complete an exercise about problems in activity and their historical evolution. Can you begin by selecting the nearest organization type to PEW on the four-field diagram, then making some brief notes on the timeline; what has changed since you joined the Corps, for example? Spend 20 minutes on the exercises below and we'll construct the matrix overleaf together.

Increasingly broad contextualization of the problem
Dealing with systemic causes, alone and privately
Dealing with systemic causes, openly and collaboratively
Dealing with discrete problems, alone and privately
Dealing with discrete problems, openly and collaboratively
Increasingly open and collaborative in dealing with the problem

2008 2009 2010 2011 2012 2013 2014 2015 2016 Today

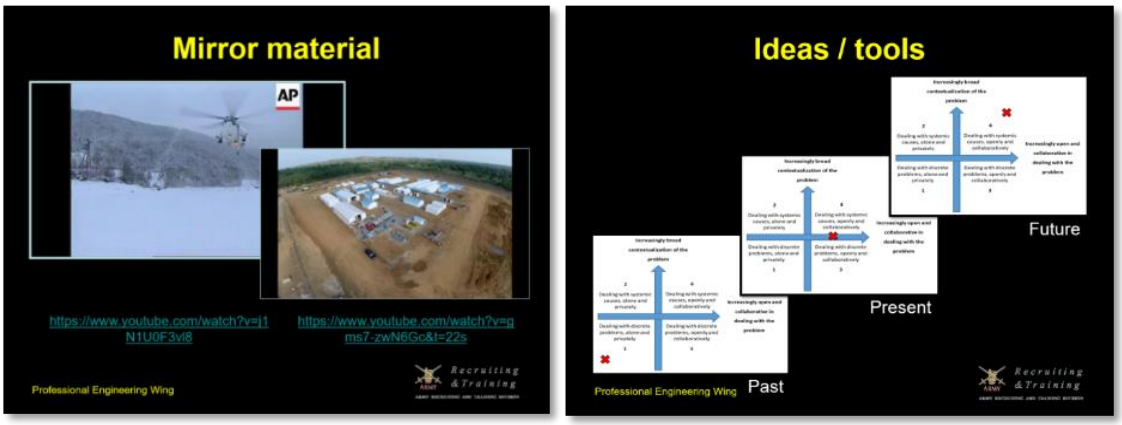
Observations of change in the object of

Change Laboratory for boundary learning in military higher education
During Session 5
Exercise - from activity to historical analyses

My one-line problem definition:

Time	Object > outcome	Subject	Artefacts/tools	Community	Division of labour	Rules	Central problems
Now							
2016							
2015							
2014							
2013							
2012							
2011							
2010							
2009							
2008							
Previous							

Figure 4.10. Extracts from the mirror data and ideas / tools for historical analysis



4.5.3 Session six: actual-empirical analysis

Designed intent. Actual-empirical analysis intended to elaborate how activity's internal contradictions were manifested in the participants' daily reality; "as disturbances, ruptures and waste … as well as conflicts and disagreements between individuals, individuals' dilemmas, and their experiences of paralyzing motive conflicts and double bind situations" (Virkkunen & Newnham, 2013b: 52). Actual-empirical analysis was designed to be conducted as one group, to develop understanding of mediation and identify the causes and effects of the systemic contradictions in boundary-crossing TEL. It was envisioned at the design stage to be the most politically charged of the sessions, due to the conflictual and emotional themes of analysing problematic daily practice. Transformative agency's expressions of explication and envisioning informed the design (Virkkunen & Newnham, 2013f: 231). Tasks were designed to encourage confrontation and debate, encouraging participants to "bring about the double bind" and create a "developmental form of the activity system" (Engeström, 2015: 256). The intent was to advance previous dilemmas of old ways of solving problems and new concepts of activity, whilst considering the drivers of tensions between systemic and local problems (Virkkunen, 2006: 57).

Task stimuli. First stimuli were questions intended to "produce a more detailed picture of the causes of the problems and disturbances encountered in the daily work" (Virkkunen & Newnham, 2013b) confronting: problematic collaborations within and between sub-groups; misalignment of the intent and impact of actions; and communicative challenges between individual actions and social activity. These were designed to stimulate discussions of: subjective and objective change; multiple levels of activity; and how the goals of actions aligned with the object of activity. Second stimuli introduced the notion of cultural mediation, to model functions of activity other than production. Provided models such as those at Figure 4.11 included: activity and its contradictions; examples of use value and exchange value; and systemic levels of operations, actions and activity. Participant data from workbooks included: personal experiences of activity; ideas for change and potential contradictions; and springboard ideas from other work and learning activities (see e.g. Engeström, 2016: 69).

Illustrating problematic aspects of activity. The designed ethnographic and mirror data included: AV interviews with members of previous cohorts who had experienced problems with coordination and cooperation; AV media of previous sessions and participants' discursive activity; interviews discussing how attempted solutions to contradictions drove

other contradictions; and problematic actions which had likely inhibited participants from effectively contributing to activity. Examples are shown at Figure 4.12 for problematic boundary-crossing TEL activity for projects in the UK and Sierra Leone, where actions and activity were potentially misaligned.

Figure 4.11. Templates and tasks from individual workbooks on actual-empirical analysis

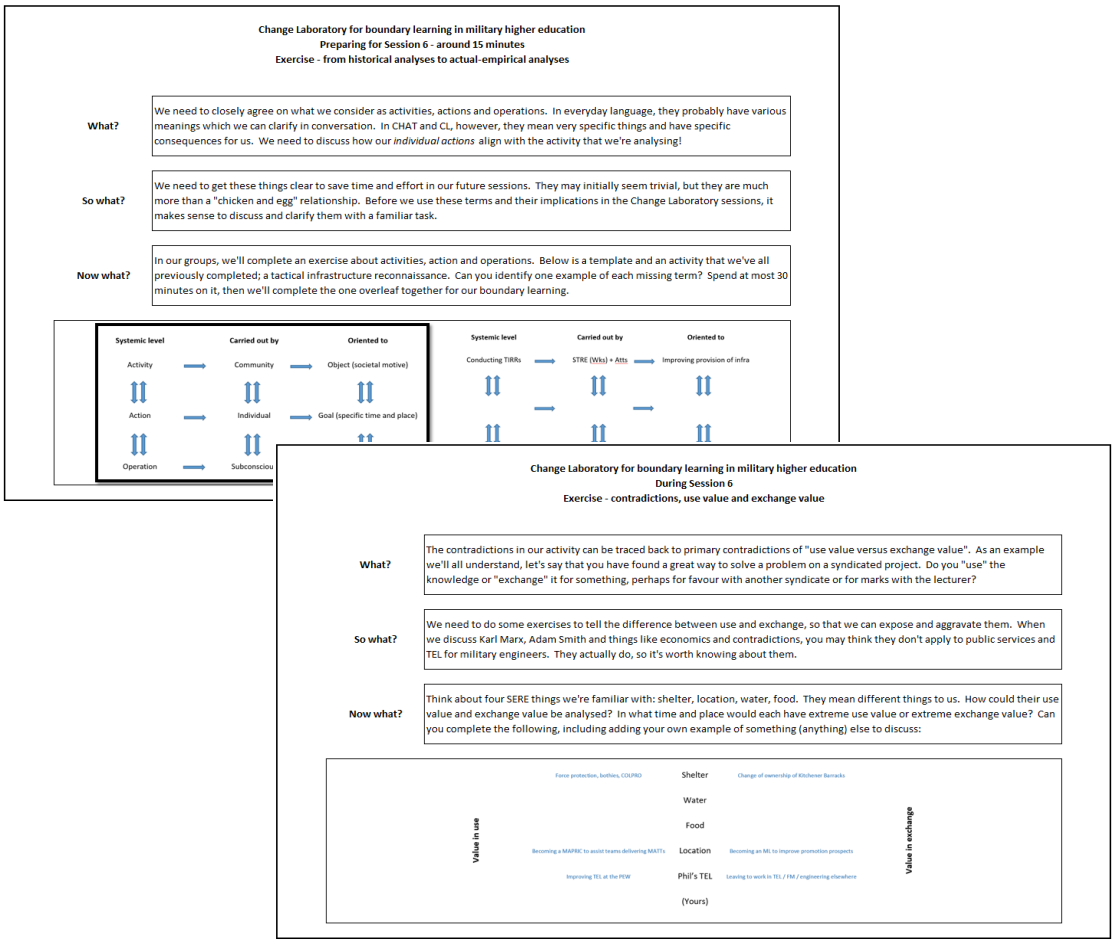
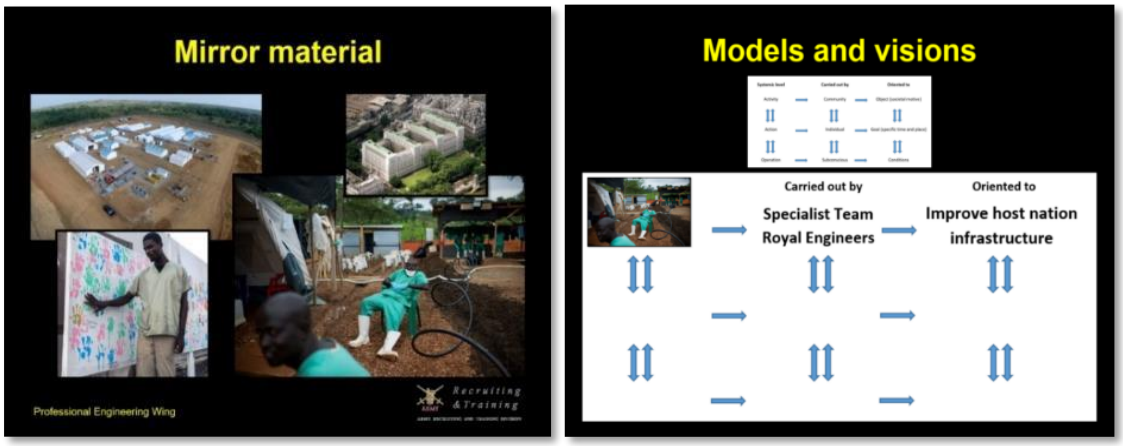


Figure 4.12. Extracts from the mirror data and ideas / tools for actual-empirical analysis



4.5.4 Session seven: modelling activity

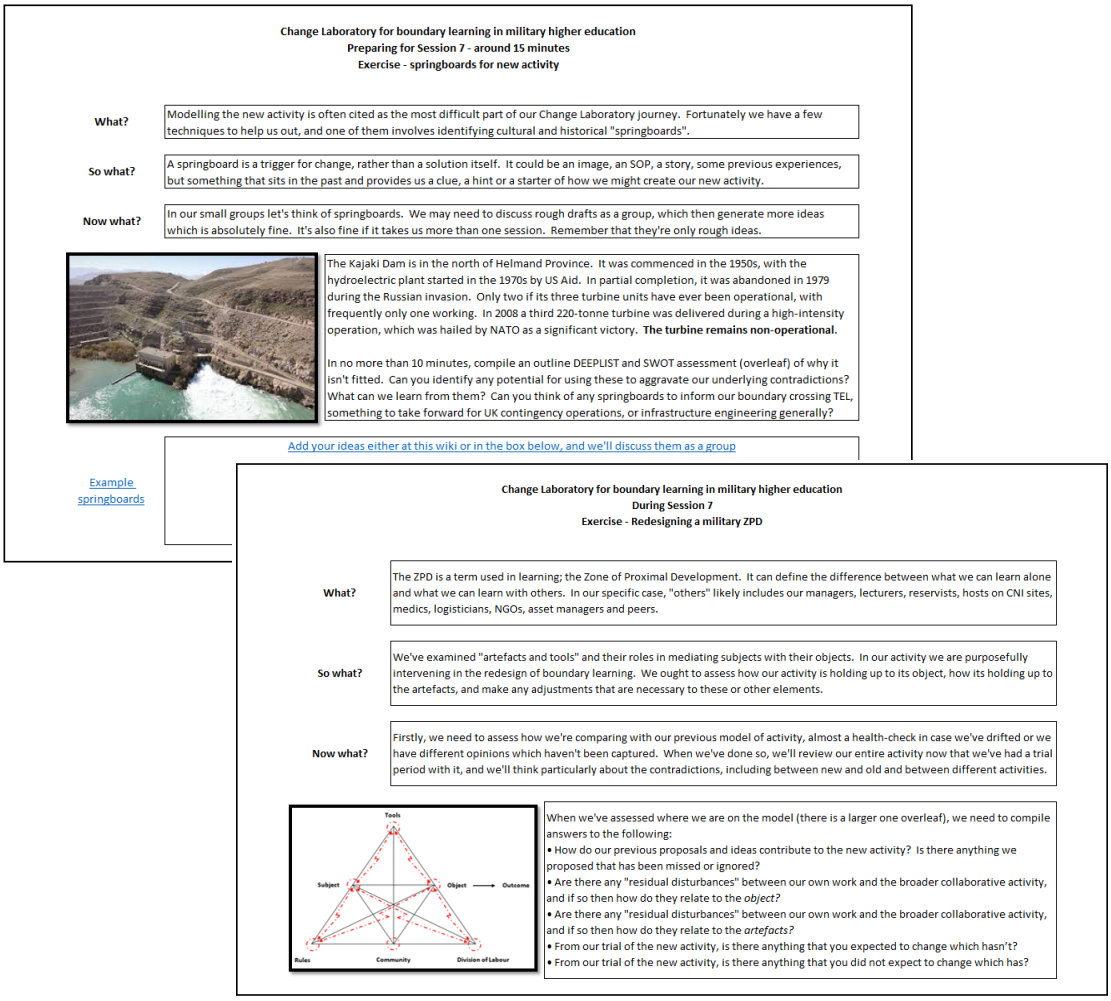
Designed intent. The session to model activity was designed to be conducted as a plenary. It aspired to stimulate participants to collaboratively construct representations of their activity system, proposing solutions to problems and constructing visionary models for use as second stimuli (Virkkunen & Newnham, 2013d: 75). Having constructed these models and considered their contradictions, the session was designed to identify an important, particularly problematic, secondary contradiction and to "crystallise the contradiction as sharply as possible and then in the empirical reality to search for an object or process that contains in it both sides of the contradiction" (Virkkunen & Newnham, 2013b: 91). This can be described as: modelling proposals to overcome double binds; generating and modelling new contradictions; and iterating. This intended to introduce dilemmas of visionary modelling and concrete experiences (Virkkunen, 2006: 58) as participants exhibited expressions of envisioning and committing, negotiating commissive proposals to carry through their acts, and to then concretise visionary models in practice.

Task stimuli. It was envisaged that double stimulation would lead to the dialectical modelling of new activity, with oscillations of top-down and bottom-up beliefs (Bligh & Flood, 2015: 160). First stimuli were relatively straightforward questions to promote the collaborative construction of a new object and the elaboration of artefacts to mediate production. Second stimuli included the provision of templates with interacting activity systems and related contradictions. These were intended to allow dialectical modelling and re-modelling of solutions and consequent contradictions, comprising further developments of expansive cycles and "culturally advanced" versions of activity (Engeström, 1999a: 33). These intended to provoke collaborative thought on the future sustenance of proposals.

Illustrating problematic aspects of activity. Mirror data were designed to illustrate problematic nodes and functions of both old and new activities, with potential contradictions arising from introducing some new element into what was otherwise old activity (Virkkunen & Newnham, 2013b). Data included: AV of historic TEL activity which had failed through introducing new elements of activity with no regard to old activity or its mediation; interviews discussing successful changes to TEL activity; and potential springboards from other projects. Designed examples at Figure 4.13 include discussing "new tools with old divisions of labour" and "new tools with old rules". Data from workbooks intended to include: reflections on previous TEL experiences; how rules and divisions of labour affected their artefacts; and proposed changes to activity (Virkkunen & Newnham, 2013d: 75). The

examples at Figure 4.14 show previous attempts to change boundary-crossing TEL which were ultimately unsustainable, and successful changes to similar activity which may provide "springboards", or triggers for change in solving problems (Engeström, 2015: 256).

Figure 4.13. Templates and tasks from individual workbooks on modelling of activity



Change Laboratory for boundary learning in military higher education
Preparing for Session 7 - around 15 minutes
Exercise - springboards for new activity

What? Modelling the new activity is often cited as the most difficult part of our Change Laboratory journey. Fortunately we have a few techniques to help us out, and one of them involves identifying cultural and historical "springboards".

So what? A springboard is a trigger for change, rather than a solution itself. It could be an image, an SOP, a story, some previous experiences, but something that sits in the past and provides us a clue, a hint or a starter of how we might create our new activity.

Now what? In our small groups let's think of springboards. We may need to discuss rough drafts as a group, which then generate more ideas which is absolutely fine. It's also fine if it takes us more than one session. Remember that they're only rough ideas.

The Kajaki Dam is in the north of Helmand Province. It was commenced in the 1950s, with the hydroelectric plant started in the 1970s by US Aid. In partial completion, it was abandoned in 1979 during the Russian invasion. Only two if its three turbine units have ever been operational, with frequently only one working. In 2008 a third 220-tonne turbine was delivered during a high-intensity operation, which was hailed by NATO as a significant victory. **The turbine remains non-operational.**

In no more than 10 minutes, compile an outline DEEPLIST and SWOT assessment (overleaf) of why it isn't fitted. Can you identify any potential for using these to aggravate our underlying contradictions? What can we learn from them? Can you think of any springboards to inform our boundary crossing TEL, something to take forward for UK contingency operations, or infrastructure engineering generally?

Add your ideas either at this wiki or in the box below, and we'll discuss them as a group

Example springboards

Change Laboratory for boundary learning in military higher education
During Session 7
Exercise - Redesigning a military ZPD

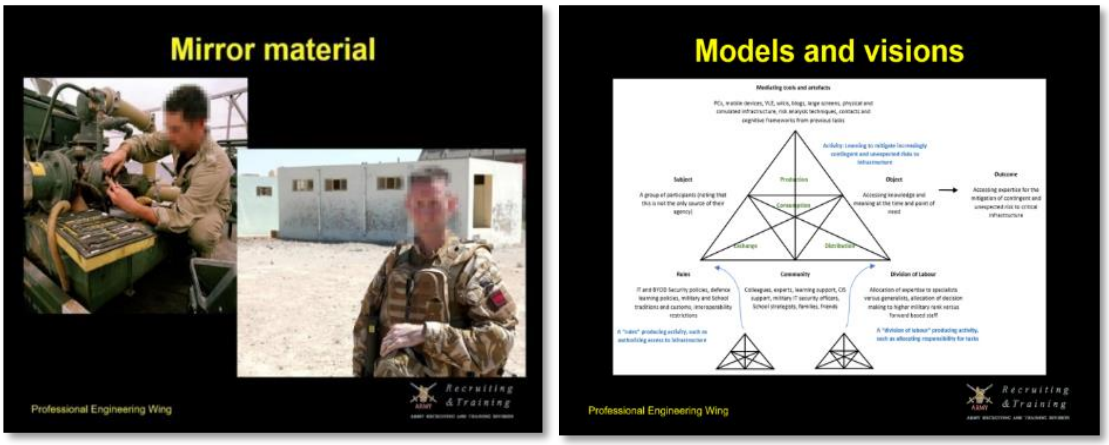
What? The ZPD is a term used in learning; the Zone of Proximal Development. It can define the difference between what we can learn alone and what we can learn with others. In our specific case, "others" likely includes our managers, lecturers, reservists, hosts on CNI sites, medics, logisticians, NGOs, asset managers and peers.

So what? We've examined "artefacts and tools" and their roles in mediating subjects with their objects. In our activity we are purposefully intervening in the redesign of boundary learning. We ought to assess how our activity is holding up to its object, how its holding up to the artefacts, and make any adjustments that are necessary to these or other elements.

Now what? Firstly, we need to assess how we're comparing with our previous model of activity, almost a health-check in case we've drifted or we have different opinions which haven't been captured. When we've done so, we'll review our entire activity now that we've had a trial period with it, and we'll think particularly about the contradictions, including between new and old and between different activities.

When we've assessed where we are on the model (there is a larger one overleaf), we need to compile answers to the following:
- How do our previous proposals and ideas contribute to the new activity? Is there anything we proposed that has been missed or ignored?
- Are there any "residual disturbances" between our own work and the broader collaborative activity, and if so then how do they relate to the *object?*
- Are there any "residual disturbances" between our own work and the broader collaborative activity, and if so then how do they relate to the *artefacts?*
- From our trial of the new activity, is there anything that you expected to change which hasn't?
- From our trial of the new activity, is there anything that you did not expect to change which has?

Figure 4.14. Extracts from mirror data and templates used for the modelling of activity



4.5.5 Session eight: examining activity

Designed intent. Examining and testing the newly modelled activity was predicted to be the most contingent of the sessions. It was predicted to diverge from the design as the group navigated the potential and limitations of their proposals for activity and negotiated their own counteractions for problems (Virkkunen & Newnham, 2013d). A significant dilemma was deemed to be between expansion and regression, as participants looked toward sustainable concretisation of modelled proposals whilst avoiding reversion to entrenched and familiar habits (Virkkunen, 2006: 59). It intended to elicit transformative agency's expressions of envisioning and committing.

Task stimuli. Double stimulation tasks were designed to encourage discursive activity on relationships between old activity and new activity. First stimuli were relatively straightforward questions regarding trialling and sustenance: how the previously constructed model would be tested; who would hold responsibility for curation; and effects of time and changing social circumstances. Designed second stimuli such as those at Figure 4.15 included: external contradictions; four-field models of sustenance through time; and support requirements (Virkkunen & Newnham, 2013d: 75).

Illustrating problematic aspects of activity. Mirror data such as Figure 4.16 were designed to promote intersubjective ownership of models, including: AV data of participants negotiating activity systems; re-presented interactions in sessions; and AV interviews with other stakeholders. The figures include examples of stakeholder interviews which took place with previous cohorts during boundary-crossing TEL tasks in the South Atlantic.

Figure 4.15. Templates and tasks from individual workbooks on the examination of activity

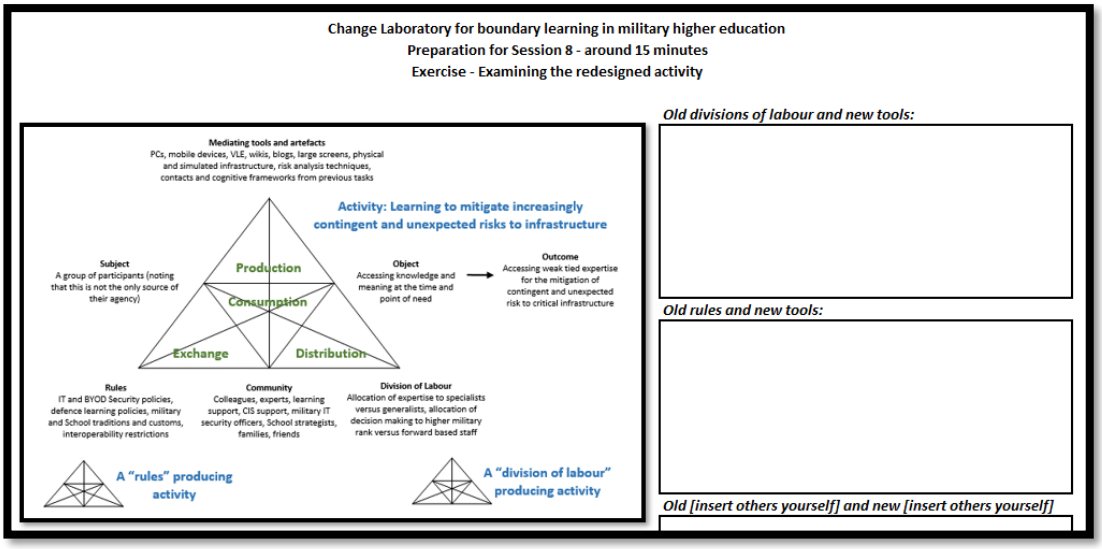
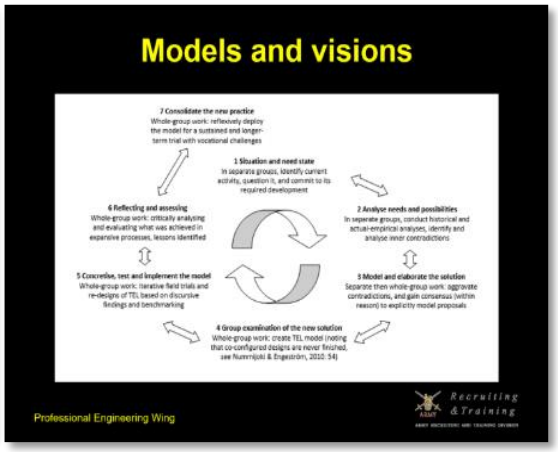


Figure 4.16. Extracts from the mirror data and models used for the examination of activity



4.5.6 Sessions nine to twelve: implementing new activity

Designed intent. Acts of implementation were considered to be long-term, and wholly subject to the volition and ownership of participants. My intended role at this point was predicted to be assisting participants, in their attempts to implement new activity "in such a way that it does not remain as a separate one-time change but becomes a first step in overcoming the central inner contradiction in the activity system and creating the new form of the activity" (Virkkunen & Newnham, 2013a). The ninth to eleventh sessions were intended to be conducted in discrete sub-groups, with the twelfth as a plenary. It was predicted that implementation would take place predominantly outside sessions, with supplementary work inside sessions to: track and correct modelling; identify lessons for future expansive work; and record residual and stubborn disturbances identified in concretisation (ibid.). Notable dilemmas were relevant for the design: natural systems and individual lives; systemic and local impacts; and understood and effective motives (Virkkunen, 2006: 49-52). These sessions were predicted to engender transformative agency's expressions of committing and taking action.

Task stimuli. Double stimulation tasks were intended to promote the participants' ownership of enriching and sustaining the concretisation of proposals. First stimuli were designed to directly encourage the exposure of otherwise latent problems in concretisation, provoking expansive activity to identify further iterations of modelling. Second stimuli were intended to be wholly developed by participants; the salient outcome was to ensure that participants took ownership of generating and examining further mirror data (Bligh & Flood, 2015: 160). Participant data from workbooks were designed to include: prevalent and stubborn disturbances; unresolved and under-exploited dialectics of change; and locating

progress on the expansive cycle with specific, personal and reflective evidence of highlights, with examples at Figure 4.17.

Illustrating problematic aspects of activity. Mirror data such as those at Figure 4.18 were intended to be sourced and provided by participants, gathered to suit consequential findings of problems to prepare for wider interventions, including: re-presented models of activity for iterative adaptation during concretisation; re-mediation of activity with comparisons of modelled and real contradictions; and expansive cycles, with iteratively edited data on disparities between modelled and realised progress. Of note, this was designed to be an intensive period for *gathering* future mirror data for subsequent re-presentation in Change Laboratory sessions (Virkkunen & Newnham, 2013a).

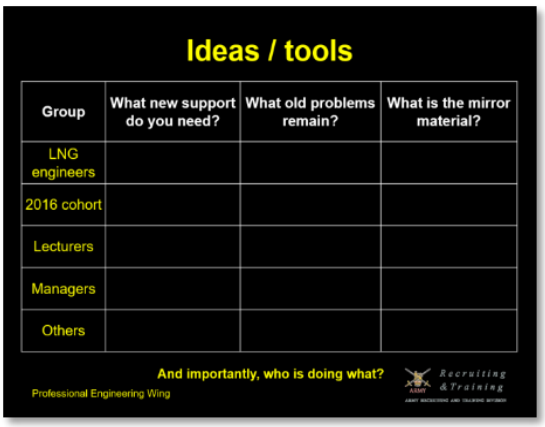
Figure 4.17. Templates and tasks from individual workbooks to inform implementation

Change Laboratory for boundary learning in military higher education
Preparing for Session 9 (2016 cohort), Session 10 (Tech Trg Branch Lecs E&M) and Session 11 (SMIs and QMSIs) - around 15 minutes
Exercise - experimental implementation

What?	In our separate groups we ought to conduct an experimental implementation of our new model of activity. We can then identify and log things that we still need to work on, including anything that other stakeholders may need to look at. We have some useful techniques to use, but we need to prepare them for our individual sessions before we bring them back to our central plenary...
So what?	There is an interested agent in the PEW's "boundary learning" who is used to working with us and is interested in assisting with this particular project. We're going to consider a number of likely contradictions and steps. Then, in our individual groups, we're going to use the new model to engage with the agent and see what happens. Before that, we'll try to make some predictions...
Now what?	Imagine that we're using the new model of activity to engage with the LNG Security Engineers and NG Grain LNG. The scenario is that forward based SNCOs need to immediately request advice on GOSP on a MENA deployment. Can you answer your own stakeholder group's questions, and predict how other groups will respond to their questions...

Group	What new support do you need?	What old problems will remain?	What might the mirror material look like?
LNG engineers			
2016 cohort			
Lecturers			
Managers			
Others			

Figure 4.18. Extracts from mirror material and ideas / tools for the designed implementation



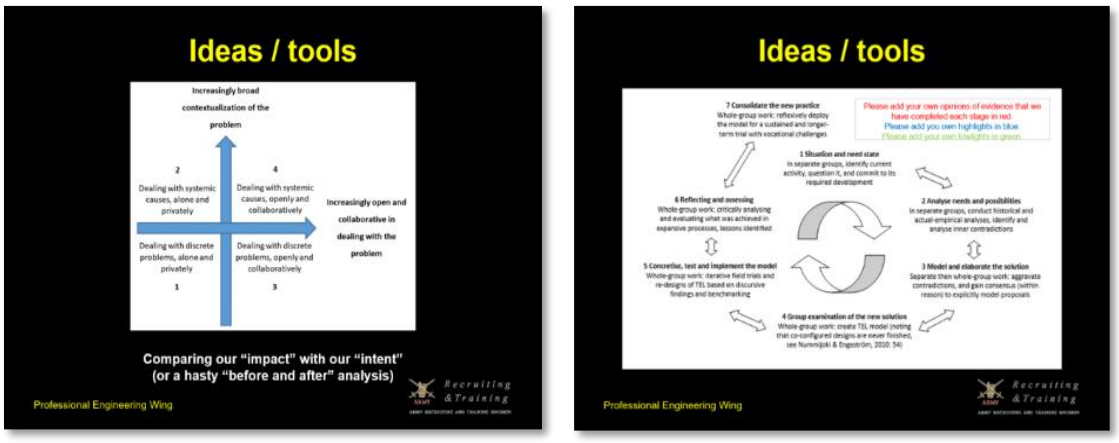
4.5.7 Sessions thirteen to fourteen: reflecting and consolidating

Designed intent. The thirteenth and fourteenth sessions were designed for the iterative actions of reflection and consolidation as an assembled group; "looking backwards to prepare for moving forward" (Virkkunen & Newnham, 2013a). Sessions were predicted to align with *all* of the expressions of transformative agency described in Haapasaari et al. (2016: 243) as participants revisited expansive acts to consider sustaining achievements.

Task stimuli. Double stimulation tasks were designed to capture reflexive recommendations and to discuss explicit evidence for expansive activity having taken place. First stimuli were designed to engender consideration of sustenance for future-oriented activity, including: ongoing support requirements; maintaining transformative agency; and challenges for further consolidation of the findings. Second stimuli included templates of future timelines to agree commissive actions, and four-field analyses to be compared with previous predictions. Data from workbooks intended to inform tasks on surfaces such as those at Figure 4.19, designed to include: perceptions of viable ways to sustain expansive activity and transformative agency; lessons identified during the intervention; and a gap analysis of what was not learned (Virkkunen & Newnham, 2013a). These were considered likely to become enduring second stimuli, for use in follow-up workshops and future interventions.

Illustrating problematic aspects of activity. The design of mirror data to supplement those at Figure 4.19 were entirely contingent upon the participants' expansive actions and their concretisation, and at the design stage merely included limited technical preparation for: retrieving mirror data; archiving proposals and models; and evidence of concretisation. They included four-field and activity system models to compare their evolution at different points during the intervention, and expansive cycles for historical comparison.

Figure 4.19. Templates and tasks on the reflection and consolidation of activity



4.5.8 Follow up workshops

The methodological design included arrangements for additional follow-up workshops, planned to take place three months and five months after the last session. The planning for these workshops at the design stage was minimal, since they were entirely contingent on the outcomes of concretisation and consolidation. Broadly, follow-up sessions intended to identify support requirements and lessons for further expansion across other units. Whilst concretised changes to boundary-crossing TEL were important to the design, of more importance for my empirical work in these follow-up workshops was the sustenance of transformative agency through new social structures (Virkkunen, 2006: 60). These potential changes to social interaction were assessed at the design stage to be significant challenges for historical and cultural sensitivity; dialectical outcomes were predicted to make the design different from contact with social and cultural reality. Findings are described in later chapters, whilst the next section discusses limitations of the Change Laboratory methodology and specifically my instantiation of it.

4.6 Limitations, challenges and risks

The Change Laboratory methodology is specifically for formative interventions, and can be described as an activity itself "whose object is to create other activities" (Bligh & Flood, 2015: 141). It is commensurate with collaborative endeavour (Peim, 2009: 167) and agentic development of activity in conflictual social circumstances (Cole & Engeström, 2007: 502). Importantly for my intervention's design, it was anticipated that participants' transformative agency could be engendered through the methodology's collaborative exposure and aggravation of contradictions (Engeström & Sannino, 2011b: 368). Despite these strengths it has residual limitations, which close the chapter. The following sub-paragraphs summarise methodological risks and their management: those identified as low-risk and therefore tolerated; those identified as avoidable risks which were methodologically mitigated; and unavoidable risks which were monitored to constrain my conclusions.

4.6.1 Toleration of low risks

During the design it was challenging to bound an activity system which was complex enough to have meaningful impact and provoke transformative agency, yet simple enough for that meaningful impact to be achievable and sustainable. This is similarly recognised by many authors of the wider corpus of literature including Ellis (2011: 192) who expresses it as an "… urgent need to understand the relationship between conceptual growth of activity systems

in the mediating social space of Change Laboratory-type situations and conceptual growth in the activity settings over time." On a related note, there are concerns that the alignment of double stimulation and conflicting motives may be presented as fragmented in seminal literature (Sannino, 2015a: 12). These fragmentations raise some doubts of the validity of analysing transformative agency as a collaborative quality, by analysing double stimulation tasks which have traditionally been theorised as individual (ibid.).

These concerns were tolerated at the design stage, in an attempt to better understand how such disjoints between individual actions and social activity may relate to transformative agency; disjoints between actions and activity were actually designed to be aggravated by double stimulation tasks, to capture valuable data on how future-oriented and collaborative agency related to identifying and overcoming double binds. In this way the oscillating moments to negotiate both locally meaningful activity, and its broader sustenance through time and new social structures, were deemed to be a lucrative source of trouble and innovation. The importance of this dialectical rather than dualistic conception is also implied by Engeström (2011: 609) who states that "qualitative transformations [are] driven by an expansive reconceptualisation of the object and motive of the entire *activity.* But such transformations are both initiated and implemented in daily work *actions …* The crucial issue is movement between these two levels …" (italics in original).

4.6.2 Mitigation of avoidable risks

Other risks for my instantiation were managed by deliberation and mitigation at the design stage. An early risk to mitigate was that of assuming that participants would positively engage in exposing and aggravating contradictions (Avis, 2007: 153). Without mitigation, this could have been exacerbated by my own partiality to CHAT and the Change Laboratory methodology, particularly with its Marxist and Vygotskian notions of social and subjective change. The naïve assumptions that participants would share my value judgements also relate to a concern from Sannino (2011: 594), "The strong focus on activity in the case of the Change Laboratory is, however, not only a strength. This can also represent a significant limitation if the study of activity is not systematically intertwined with a study of the transformative actions that generate new forms of activities". Promoting transformative agency thus implies my duty to prevent imposing my own well-meant, yet also potentially hegemonic, intent for change. This was mitigated through designing double stimulation tasks to explore contradictions whilst empowering resistance towards myself and the intervention.

The design began with the normalisation and legitimisation of subjectivity, critique and resistance, extended to both problematic TEL activity and the intervention itself; these were qualities which, during the daily reality of the RSME, would never normally be exhibited by these sub-groups in the presence of each other. Legitimisation further informed the design of double stimulation tasks, to counter the tendency for Change Laboratory interventions to over-socialise individuals (Langemeyer, 2012: 807). Examples include coupling tasks on individual workbook reflection with the tasks on collaborative surface-based concretisation. Task design intentionally sought an "agentive layer of causality" for change in troublesome collective learning (Daniels, Cole, & Wertsch, 2007: 17; Blackler, 2009: 33), amplifying marginalised voices and balancing power relationships whilst avoiding accusations between participants of irrationality. In mitigating these challenges my designed double stimulation tasks specifically set out to encourage equitable and multi-voiced participation, including through the fair allocation of time and fair access to shared artefacts such as surfaces.

4.6.3 Acknowledgement of unavoidable risks

A number of risks remained prevalent and unavoidable for design. The most significant for my instantiation were associated with the implied homogeneity of the collective subject, likely to result in difficulties for collecting and analysing individuals' subjective data. This presented empirical and theoretical dilemmas, some of which are described by Virkkunen (2006: 47) such as methodological difficulties during movement between scientific concepts "from above" and everyday concepts "from below". For my collective subject of three sub-groups, this was likely to result in highly varied forms of elaborating troublesome circumstances, due to varied experiences of activity and political disparity. Important differences would likely prove too complex to capture and analyse, driven by the very diversity which was necessary for dialectical movement. Unavoidable risks thus included: learners and lecturers with less opportunity than managers to elaborate on "systemic relationships" (Langemeyer & Roth, 2006: 36); managers with less understanding than learners and lecturers of activity's potential to be "modified on the basis of local knowledge" (Virkkunen, 2006: 48); and all participants with restricted aspects of agency, limiting my ability to generalise (Peim, 2009: 168).

To compound these risks, the agency of individuals would likely develop in varied ways, some of which could not be captured (Yamagata-Lynch, 2010: 77). This resulted in my need to declare caveats, most importantly that subsequent claims to have answered research questions would be at some collective level (Kontinen, 2013: 113). This intensified the

potential for other risks to be realised, such as the activity concurrently evolving during its examination. Changing rules and the promotion of participants in rank were among changes to be faced during the intervention. These could de-value findings beyond the short term and immediate context (Sannino, Engeström, & Lahikainen, 2016: 248) paradoxically driven by my intentions to imbue transformative agency. Importantly, the successful outcomes of that transformative agency would include the empowerment of participants to redesign their activity, and to drive such evolutions themselves. Yet, also importantly, the composition of the activity system would be unstable which could further curb applicability elsewhere. In summary, and to close this chapter, my time-bound and parsimonious setting was likely to result in a positive local impact but would also restrain the generalisability of my findings. These risks will be foregrounded when presenting and analysing data, which begins in the next chapter.

CHAPTER FIVE – DATA PRESENTATION

5.0 DATA PRESENTATION

This chapter summarises the empirically gathered data for the intervention, portrayed here in relatively raw and unanalysed forms. In presenting coarse data this way I intend to allow readers to form their own assessment of "transparency concerning the nature of the data before analysis" (Trowler, 2014: 33), enabling a personal judgement before reading my own analyses and claims in subsequent chapters. In Trowler's (ibid.) terms, data are presented in their raw forms before relating them to my claims of evidence. The chapter opens with the chronological progress of sessions, illustrating participants' exhibits from various double stimulation tasks. These chronological descriptions allow a comparison between my intent in the previous chapter and participants' concretised reality. Descriptions are then supplemented with notable extracts of thematic data: interactions and speaking turns; engagements with artefact-stimuli; expansive actions; expressions of transformative agency; references to activity's elements; and evidence of concretisation.

Data were initially captured and analysed hastily, during the intervention's sessions. Initial analyses searched for overt evidence of: contradictions in social conditions; progress in double stimulation tasks; concretisation of abstract notions; and expressions of transformative agency. They aimed to inform subsequent interactions, frequently re-presenting data in that same session. Analyses comprised relatively expedient techniques: manual notes; digital images and voice recordings; and points of interest on surfaces. On completion of each session amassed data were collated, transcribed and examined in detail including: individual speaking turns and collaborative episodes; expansive engagement with stimuli and artefacts; and expressions of transformative agency. I personally transcribed, curated and coded data with the assistance of computer aided qualitative data analysis software (CAQDAS), namely ATLAS. ti™ 8.1.28, with an example in progress in Appendix 2. In the subsequent chapter these data are called upon to answer the research questions.

5.1 Conduct of sessions

A total of 14 sessions were conducted in the intervention, with a total of 29 hours 36 minutes spent in all of them. With the exceptions of two individuals having 20-minute absences for personal appointments, all participants were present for the duration of all

sessions. The Change Laboratory rooms were visited by various groups and individual participants around twenty times between sessions; these visits were reported anecdotally, with no AV data captured. The majority of sessions took place within these intended spaces; the exceptions are described below. Extracts of data gathered from the sessions is in subsequent sections, whilst a summary follows:

- Sessions one to four involved participants expansively questioning boundary-crossing TEL and its problems. Initially in separate groups, which culminated in a plenary for the fourth session, participants studied AV media of irrefutable evidence of failure on contemporary global military engineering tasks. They shared subjective opinions using disturbance diaries, populated prior to sessions in their workbooks and collaboratively aggravated in sessions.

- Session five involved the historical analysis of activity, in ways which participants slightly modified from my designed intent. Towards the end of the fourth session participants had actively influenced the arrangements and intent for the fifth, proposing 'live disturbance diaries' on surfaces where each sub-group responded to other sub-groups' disturbances. In the fifth session, participants took control of identifying and exhibiting their own mirror data.

- Session six involved actual-empirical analysis, which further diverged from my designed intent. At the request of learners, all sub-groups conducted double stimulation tasks for actual-empirical analysis using their own mirror data from the recent design and construction of humanitarian relief hospitals in Sierra Leone and South Sudan. This provided them with a contemporary, familiar and irrefutably relevant example of failing in boundary-crossing TEL.

- Session seven involved modelling activity. It differed from my designed intent in how participants controlled their equitable participation, using live disturbance diaries to attribute unassailable ownership of activity's problems. They curated these artefact-stimuli and used them to control equitable participation, to denote the transferral of leadership for the plenary's discussions and to record authorship of disturbances, models and proposals.

- Session eight examined activity, differing significantly from my design as participants personalised and increasingly rejected their given stimuli. Their activity system was

re-presented as a familiar model of a bridge, with nodes and functions analogously described as building, trafficking, and demolishing the structure. The rules and division of labour were analogous to structural elements as the subject used the bridge to reach the object.

- The ninth of the sessions, intended for implementation with the learner sub-group, was conducted at the UK's Cinque Ports Training Area, some 55 miles from the RSME. This location was selected at the request of learners who stated that they could more effectively aggravate contradictions and generate mirror data by deploying remotely, seeking to inject realism into double stimulation tasks. The tenth, eleventh and twelfth sessions were contingent upon the outcome of the ninth, and therefore also differed significantly from my designed intent.

- The thirteenth and fourteenth sessions were to reflect and consolidate, which self-evidently differed from my intent although my initial designs for these closing sessions were scant. My preparation was generally limited to administrative arrangements and assuring access to appropriate mirror data, with participants designing their intent and conduct themselves.

Details of each of these sessions are presented in later sections of this chapter. In the next section I summarise the pan-intervention data for speech turns, followed by a summary of data on the timings in each session for engagement with various task stimuli.

5.2 Speaking turns

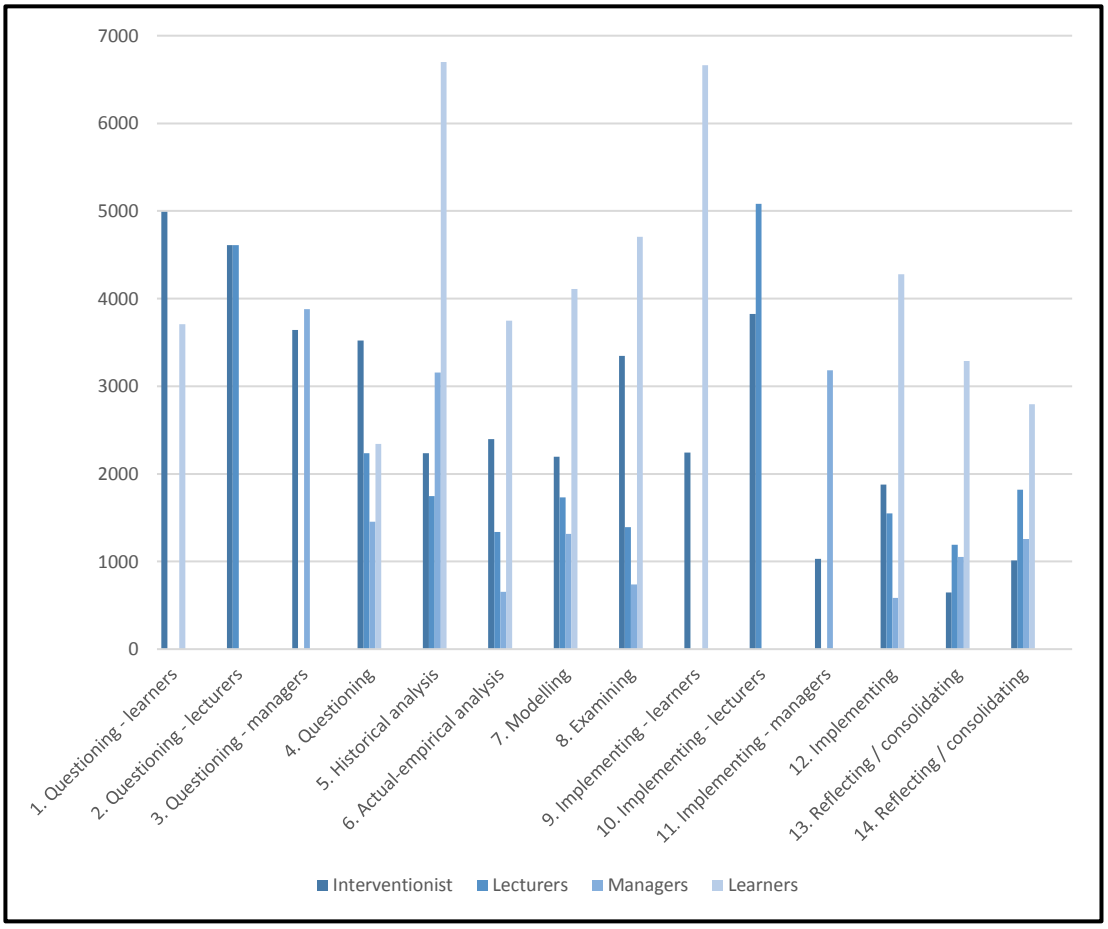
Across all 14 sessions, the total time on speaking turns was a little over 16 hours 35 minutes, around 56% of the total session time. All participants engaged in speaking turns during every session in which they were present, with Table 5.1 showing totals for the intervention (the names are pseudonyms from an online random name generator, with cross-references to real names encrypted). The collated data of the 14 sessions totalled 1139 expansive turns of speech and 119,895 words. Figure 5.1 shows the word count data sub-totalled for sub-groups in all sessions. It should be noted that the session titles used in these presentations of data and throughout the remainder of the thesis reflect the original designed intent of the session, irrespective of the participants' concretised reality within that session. This decision on retaining the original names of sessions was made for ease of cross-referencing of their data between Chapters 4, 5 and 6 of the thesis.

Table 5.1. Turns of speech, words, and mean words per turn across the intervention

	(Researcher)	Lecturers						Military managers		
		Emil	Heywood	Carbree	Paderau	Finlay	Hunter	Gerard	Percey	Carlton
Turns of speech:	(292)	41	40	34	34	29	30	58	50	59
Total words:	(37575)	4199	4113	3432	4608	3107	3239	6572	5451	5256
Words per turn:	(140)	79	79	78	104	82	83	87	84	69

	Learners									
	Barnabas	Allyn	Rhet	Brandt	Lancelot	Irvine	Arden	Warwick	Jared	Felix
Turns of speech:	53	41	48	40	43	44	45	43	56	59
Total words:	5206	3121	3579	2578	5276	4105	4744	3588	4457	5689
Words per turn:	77	64	55	49	109	75	95	62	63	74

Figure 5.1. Word counts for sub-group turns of speech, sub-totaled for each of the sessions



5.3 Use of surfaces and workbooks

The session timings for surfaces and workbooks, collated for participants, are in Table 5.2.

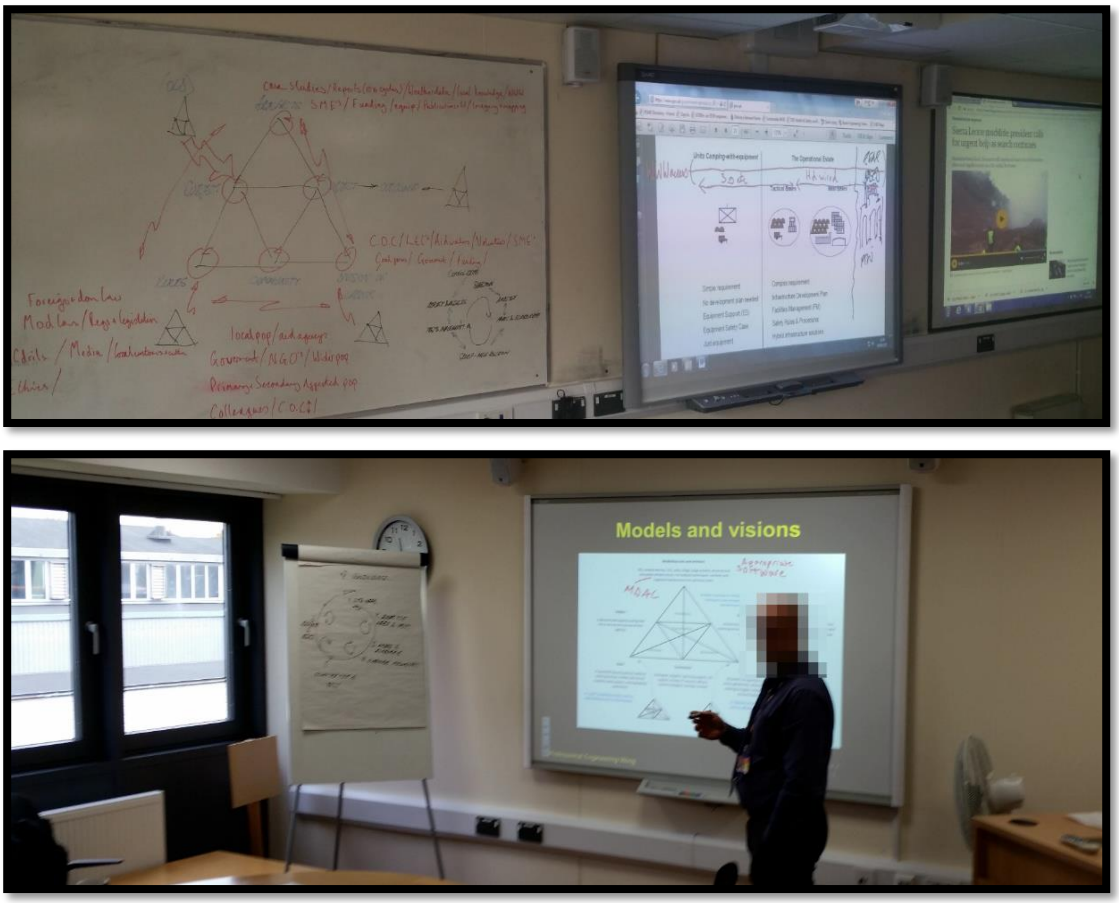
Table 5.2. Collated timings for participants' engagements with surfaces, workbooks and speaking turns

Sessions	Timings shown in hours: minutes: seconds				
	Time on mirror data	Time on models / visions	Time on ideas / tools	Time on workbooks	Time on speaking turns
1. Questioning - learners	00:07:06	00:01:15	00:04:15	00:06:55	01:13:29
2. Questioning - lecturers	00:04:54	00:01:33	00:03:33	00:04:20	01:07:40
3. Questioning - managers	00:05:36	00:02:27	00:03:11	00:04:55	01:01:22
4. Questioning	00:12:31	00:04:40	00:01:17	00:06:02	01:11:07
5. Historical analysis	00:17:03	00:09:22	00:07:43	00:11:19	02:14:47
6. Actual-empirical analysis	00:04:56	00:07:15	00:06:15	00:02:55	01:09:29
7. Modelling	00:12:40	00:08:33	00:05:50	00:12:15	00:53:20
8. Examining	00:14:41	00:03:12	00:03:22	00:03:15	01:21:08
9. Implementing - learners	00:08:20	00:09:12	00:08:13	00:10:59	01:18:18
10. Implementing - lecturers	00:13:10	00:10:40	00:12:10	00:01:37	01:08:35
11. Implementing - managers	00:18:45	00:04:10	00:02:10	00:01:55	00:33:20
12. Implementing	00:04:10	00:06:40	00:03:10	00:04:37	01:17:35
13. Reflecting / consolidating	00:17:06	00:04:44	00:02:15	00:09:55	01:01:22
14. Reflecting / consolidating	00:11:20	00:09:10	00:01:11	00:09:22	01:04:00
TOTAL TIME	**02:32:18**	**01:22:53**	**01:04:35**	**01:30:21**	**16:35:32**
% of TOTAL	**10.99%**	**5.98%**	**4.66%**	**6.52%**	**71.85%**

The principal space used for most sessions was the room shown in the top image at Figure 5.2, set up by the participants themselves during Session Zero. To the right is their surface for mirror data, where they used a whiteboard as a screen for a projector, and a non-defence laptop using the site's social and welfare internet access, rather than defence's infrastructure. This decision was intended to ease access to non-defence mirror data, which would be blocked by the defence gateway to the world-wide web (blocked media included non-defence videos, news feeds and search engines). At the centre of the same wall is their surface for ideas / tools, in this case an interactive smartboard with access to: double stimulation material and intended plans for sessions; electronic libraries of defence doctrine and policies; the RSME's virtual learning environment; and a desktop PC connected to the Defence Intranet. To the left of the same wall is the surface used for their models / visions; here another whiteboard shows their models of activity systems and expansive cycles. Out of view of the image, resources elsewhere in the room included flip charts and hard copy

libraries of policies and task documents. The lower image shows the alternative Change Laboratory room, which was set up for concurrent sub-group work and as a breakout room.

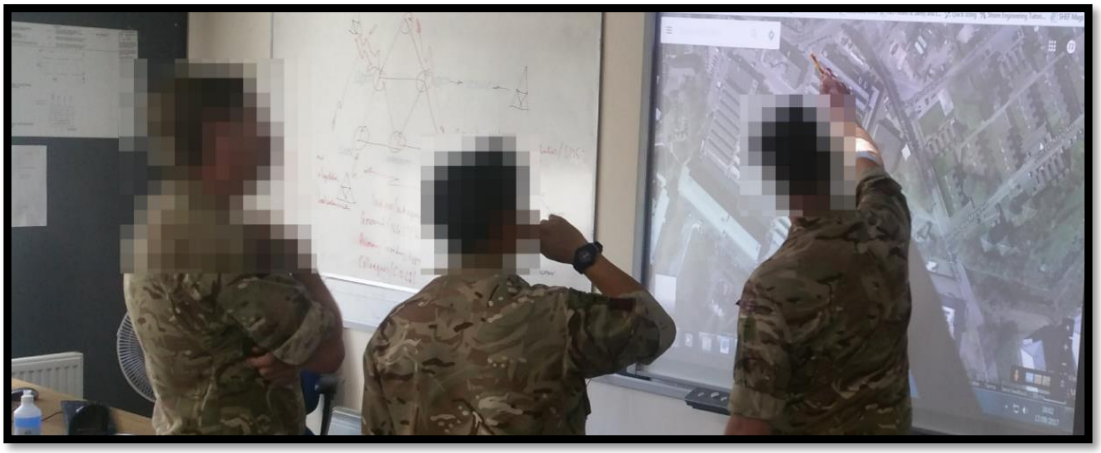
Figure 5.2. The surfaces and rooms in use during sessions, set up by participants during Session Zero



The surfaces were used by all of the participants in and between sessions. Figure 5.3 shows three members of one sub-group developing ideas / tools in the form of calculations and data for infrastructure in Carribean hurricane-prone areas, which required boundary-crossing TEL to interpret hydrogeological data. The surfaces were being used to model and discuss problematic challenges for a vertical military task organisation, when demands for specialist knowledge drove problematic horizontal forms of divisions of labour. Participants here are alternating between surfaces: their mirror data to the right (out of view) held AV of failing communication and problematic divisions of labour in disaster relief missions. The white board to the left held iterative work on models / visions, here showing a speculative activity system. The interactive board in the centre was used for ideas / tools in considering potential side-effects of proposals to resolve secondary contradictions; in the image they are

considering engaging with civilian experts in hydrogeology, and relating secondary contradictions from a vertical division of labour and rules.

Figure 5.3. Three members of the learner sub-group engaging with the surfaces

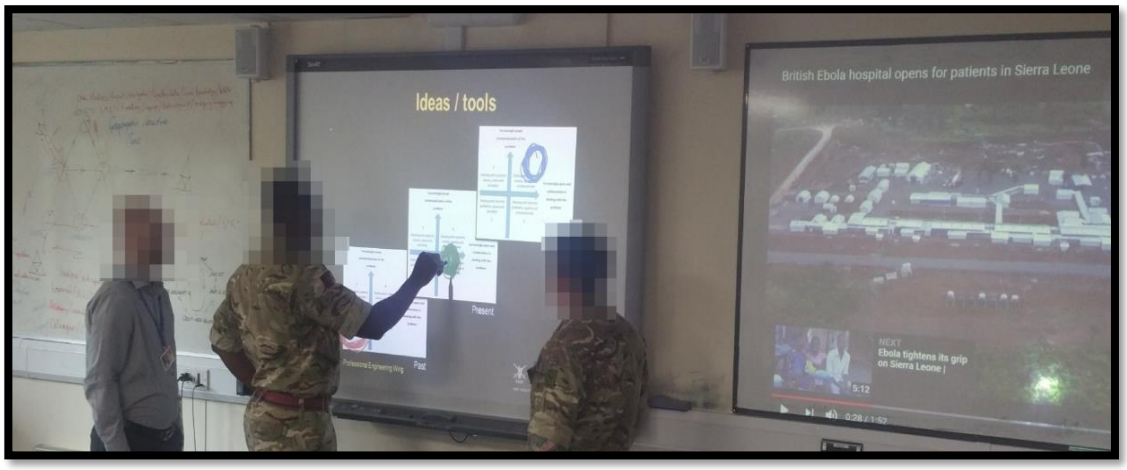


Surfaces generally combined exhibits of work on engineering infrastructure, calculations, defence doctrine and policy, along with mirror data and second stimuli in varying stages of completion. Partial forms of abstraction seemed to expose options for their concrete work and learning tasks and the further development of stimuli artefacts, which were usually adapted alternately and side-by-side. The iterative development of models and their concretised TEL activity was enabled by this movement back and forth: from theoretical-genetic proposals and their concrete application; exploring and analysing the underpinning theoretical principles themselves; re-applying the theoretical-genetic proposals; and updating models. Movements between surfaces appeared to be helping the groups to first understand and then to expansively break away from established practices (Virkkunen & Ahonen, 2011: 230), as double stimulation techniques encompassed both their artefact-stimuli for expansive learning and their infrastructure engineering task at hand.

A further example of an interaction in progress is at Figure 5.4, which concurrently shows how double stimulation tasks were undertaken in small mixed groups. In this example a member of each sub-group embellishes a four-field organisational model to capture perceptions of past, present and future boundary-crossing TEL activity and its social need. The X-axis of this four-field model represented increasingly open and collaborative ways of dealing with problems, whilst the Y-axis showed increasingly broad contextualisation of problems, adapted from Virkkunen and Newnham (2013e: 249). Here the participants were identifying historically embedded problems in TEL, using examples of Ebola treatment units in Sierra Leone on the mirror surface to the right, and embellishing the visionary activity

system on the models / visions surface to the left. With the four-field model on the ideas / tools surface, they were discussing the deployment of their newly modelled activity system for its application to an ongoing contingency task for defence, which was being undertaken by their colleagues from the previous year's cohort who were deployed concurrently with this intervention.

Figure 5.4. A member of each sub-group engaging with the surfaces



The majority of participants completed their workbook tasks individually, recording findings and questions to inform their subsequent social and collaborative tasks on surfaces in the following session. All participants were observed to trace their own contributions and reflections in workbooks, and all participants were observed to refer to workbooks, using their previous work to refer to their recorded data and to generate ideas for subsequent sessions. Workbook exercises were intended to take around 15 minutes of preparation prior to each session, with participants claiming to have spent between 20 and 30 minutes preparing them, generally completing tasks during their preceding work break on the same day (mid-morning breaks were 1000 hrs to 1030 hrs with sessions commencing at 1330 hrs).

Workbooks were also used to record private manifestations during sessions and reflective statements after sessions; apparently these were undertaken alone. Participants claimed to have spent around 10 to 30 minutes reflecting on sessions, usually during their personal physical training on the evening after that session. An example workbook exercise is at Figure 5.5, with notes clarified in text boxes. It shows preparatory tasks for the fourth session, to consider operations, actions and activity to inform subsequent collaborative tasks to problematise activity. Figure 5.6 shows participants maintaining and calling upon stimuli from their workbooks.

Figure 5.5. Extracts of workbook tasks, with clarification of handwritten notes in text boxes

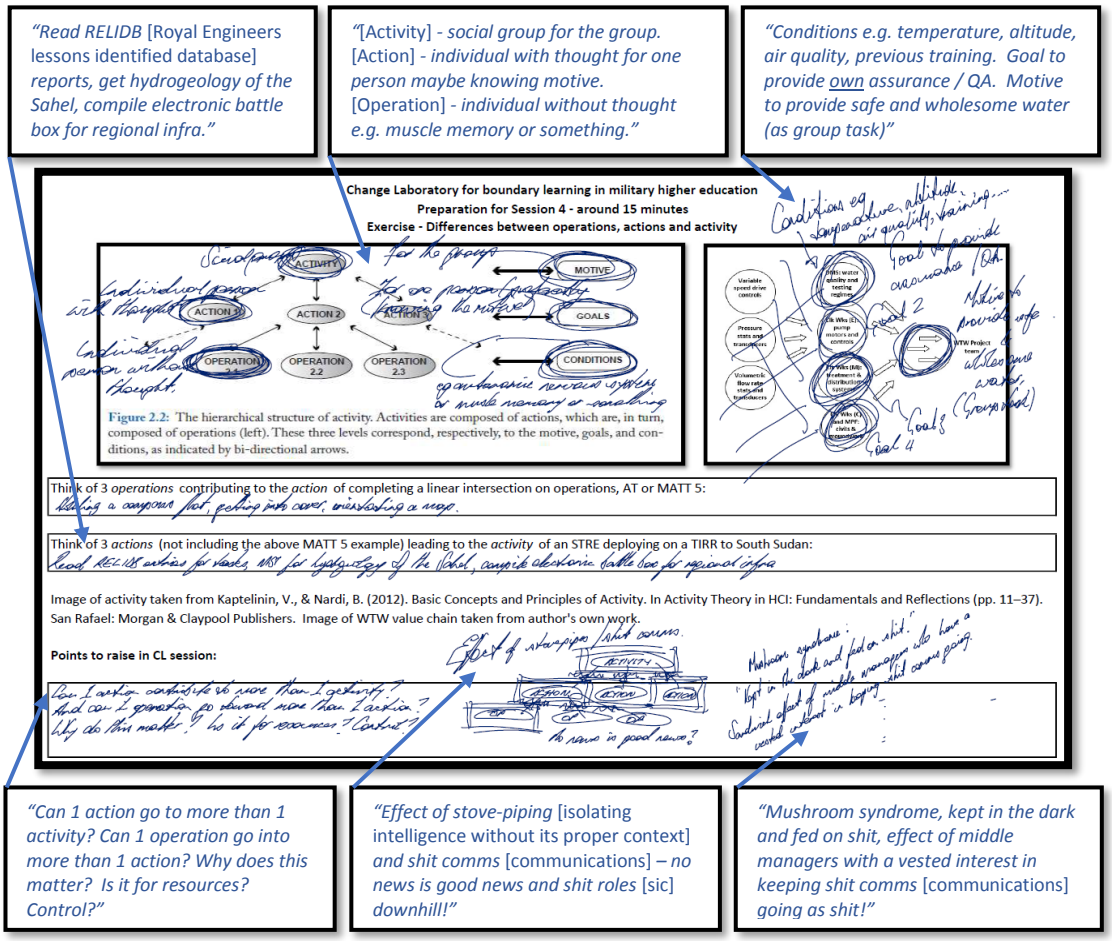


Figure 5.6. Participants maintaining workbooks between sessions

Roughly half of all participants curated their workbooks electronically, using interactive portable document formats, whilst roughly half completed them on paper. Figure 5.6 shows one of the three participants maintaining a workbook on an iPad (visible on the bench, with the red cover stand), and two others maintaining workbooks on hard printed copies with pens. They are visible on the bench with technical documents and calculations pertaining to

their boundary-crossing TEL tasks on the water distribution systems in the background. Irrespective of the format, all participants were observed to share and discuss contents of their workbooks with other participants, although all appeared to complete their workbook exercises individually and alone.

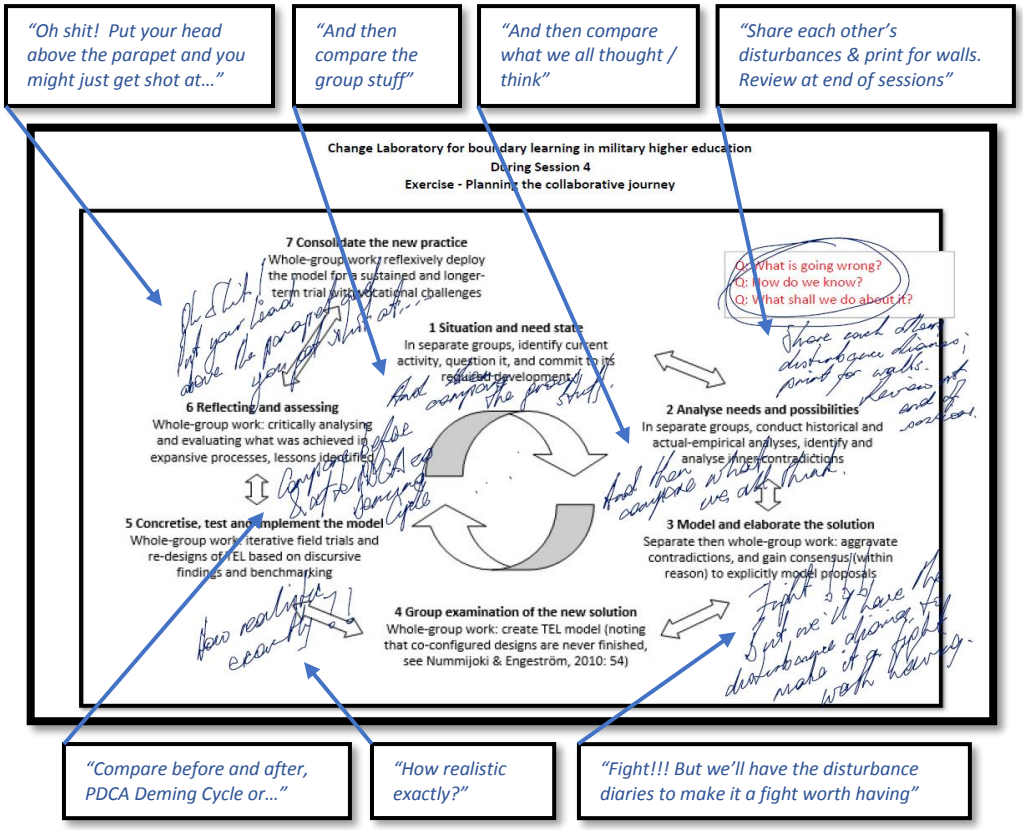
5.4 Selected double stimulation exhibits from sessions

Exhibits of double stimulation tasks below provide data on how the intervention appears to have engendered and sustained transformative agency. Double stimulation was theorised in Chapter 2 as a process for the emergence of transformative agency when participants reframe or reconceptualise a problem situation to break out of conflicting motives (Sannino & Laitinen, 2015: 6). Primary stimuli, such as questions or statements, present participants with a problematic situation. Secondary stimuli, such as conceptual models, provide support with conflicting motives. Both stimuli are discursively combined to collaboratively build agency; double stimulation tasks may thus provide critical resources for expressing transformative agency (Sannino, 2015a: 2). The exhibits below show typical task stimuli used by participants. Some were extracted from two participants' workbooks, one of which was maintained electronically and one of which was maintained on hard copy. Some are shared digital and analogue task stimuli, from collaborative work on surfaces.

5.4.1 Sessions one to four: questioning activity

In questioning activity, the first stimuli presented to participants were problematic questions regarding boundary-crossing TEL and its problems. Second stimuli included: disturbance diary templates; expansive cycles; conceptual models of operations, actions and activity; and models to highlight the artefact mediation and cultural mediation of TEL. Workbook exercises included subjective disturbances in 'old' boundary-crossing TEL activity. Figure 5.7 shows an extract from a participant workbook, on a double stimulation exercise entitled 'planning the collaborative journey'. A combination of this exercise and the early entries into disturbance diaries initiated the idea from participants to publish live disturbance diaries for the whole group. During the plenary in session four, participants collated their subjective disturbances from prior sessions, tabulating them with proposals for solutions and for mirror data. These stimuli were then exhibited on the walls of the room and on the centre surface in the session, for responses by other sub-groups which were discussed as the plenary. Live disturbance diaries were updated and displayed by participants on the walls adjacent to the centre surface.

Figure 5.7. Extract from a participant workbook on questioning, with clarification in text boxes



Sub-group diaries were made electronically available to all participants as illustrated in Figure 5.8, an extract from the managers' diaries with responses from learners. Figure 5.9 shows an extract from the learners' sub-group diary, with managers' responses shown tabulated next to the diary. Hard copies can be seen to the left of the surface in Figure 5.8.

Figure 5.8. Live disturbance diaries, showing entries and responses with paper copies on the wall

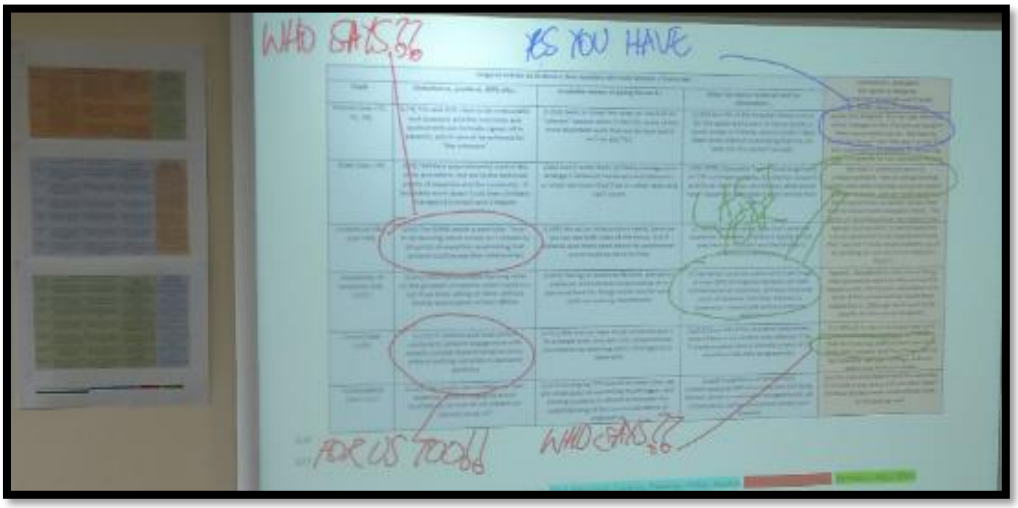


Figure 5.9. Live disturbance diaries curated in questioning sessions, this example showing managers' entries in amber and learners' responses to them in green

Original entries by managers, line numbers are from session 3 transcript				Comments – learners Q1 agree or disagree Q2 reasons proposal won't work Q3 better ideas or comments
Topic	**Disturbance, problem, difficulty…**	**Available means of going forward…**	**Ideas for mirror material and for elimination…**	
DIRLAUTH [see L77, 114, 120]	[L77] Difficulties of authorizing direct contact with unknown sources. There is a risk that people outside the RSME do not understand the importance of us producing the goods; we're the nation's insurance policy and the nation has to know that we can keep going and deliver when others can't. What if external providers let us down and in the meantime we've eroded our own capability?	[L114] What we do with attachments is we use ex-Corps people just to make sure we've got somebody who knows the score. We also visit externals before they get involved in delivery, just so that we know what we're dealing with, and we can run SC [security clearance] checks if we feel that we need to. But we know what we need from those people a year in advance.	[L120] Examples of things that have been done during attachments. We can then look at whether we could have done those things without going to sources of external expertise. Can we maintain some kind of sanctioned contact list for the wing?	Q1, 2 and 3 Agree, fair one, we never thought of it that way. BUT how will we learn about tackling our unforeseeable problems from ex-Corps people, who are really just like us but a bit older? The problem with sanctioned contacts is that they are predictable, and our future problems aren't, so it's a start but it really won't solve the problems that we didn't see coming.
ITSO [see L90, 125, 129]	[L90] We assume quite a high level of risk so that we can provide the training we need. We know a lot of security is quietly bypassed, and we'd be strung up if anything went wrong but there aren't really workable alternatives, which is why we can't access all of the JSPs [joint service publications] we need	[L125] When we go on the final Ex LEADING EDGE we take a networking switch and external hard drives, so maybe we should set up the classrooms on the same lines, and take them off the defence network?	[L129] AV of the working teams during Ex LEADING EDGE so that people can see how we work when we go away, as the truth might make them feel a bit better.	Q1, 2 and 3 Also agree which is why we use our own stuff. The rules we bend and break are much more than these, we'd be happy to go off the LAN as it's what we do on projects anyway, we set up our own switch or pass around pen drives. Maybe all of the projects should be off site so that we don't have a choice?
R2 [see L102, 134, 141]	[L102] We'd need to provide reports and returns for boundary learning, and then there are budgets too, so we'd need to find a source of funding for whatever we propose	[L134] If we can find a source of funding away from J8 [the defence communications systems] then nobody would even ask what we were up to, we could just locally manage things.	[L141] The images of the technology we use on tasks when we deploy are powerful because we'd just say "well you think of a better way then". AV will show them, and as opposed to hearing about it they can't deny it with the evidence is staring them in the face.	Q1, 2 and 3 Also agree and we thought that was your job really, chin up. We can provide you with loads of images of us working away because we use it in our portfolios, which we thought you had read?

Questioning activity in these sessions was expected to align with two expressions of transformative agency; resisting and criticizing. These appear to be evident in the disturbance diaries shown in Figures 5.8. and 5.9, and it is notable that military managers would never normally be resisted or criticised in these ways, particularly using the tone and language code in Figure 5.9 which shows learners' responses to managers' disturbances. The following turn of speech by Barnabas was an early example of a learner enjoying the legitimisation of resistance and criticizing, here aimed at his frustration with policies that regulated the group's boundary-crossing TEL:

> "… they're [defence TEL policies] **not fit for purpose** beyond stripping a weapon and using a radio … during my dad's national service {criticizing} but if they [managers] ask, we'll still go 'yes these training policies are the best fucking thing ever, **did you come up with them, well fucking nice one good on you**' [apparent sarcasm]…". [*Barnabas, Session 1, questioning*].

5.4.2 Session five: historical analysis

The double stimulation tasks for historical analysis began with first stimuli in the form of questions to encourage participants to establish: what or who were the main problems with activity; and how did the activity involving the collective subject get to that point. Second stimuli included timelines to chart historically evolving operations, actions and activity to supplement historically evolving activity systems and expansive cycles through time. These stimuli artefacts were initially worked on alone in workbooks, then collaboratively enriched to identify relatively objective evidence of historical evolution through mirror data showing

boundary-crossing TEL activity in recent decades. Figures 5.10 and 5.11 show extracts from a workbook, on double stimulation exercises entitled "from activity to historical analysis".

Figure 5.10. Extract from a participant workbook on historical analysis, with clarification of handwritten notes of the timeline added in text boxes

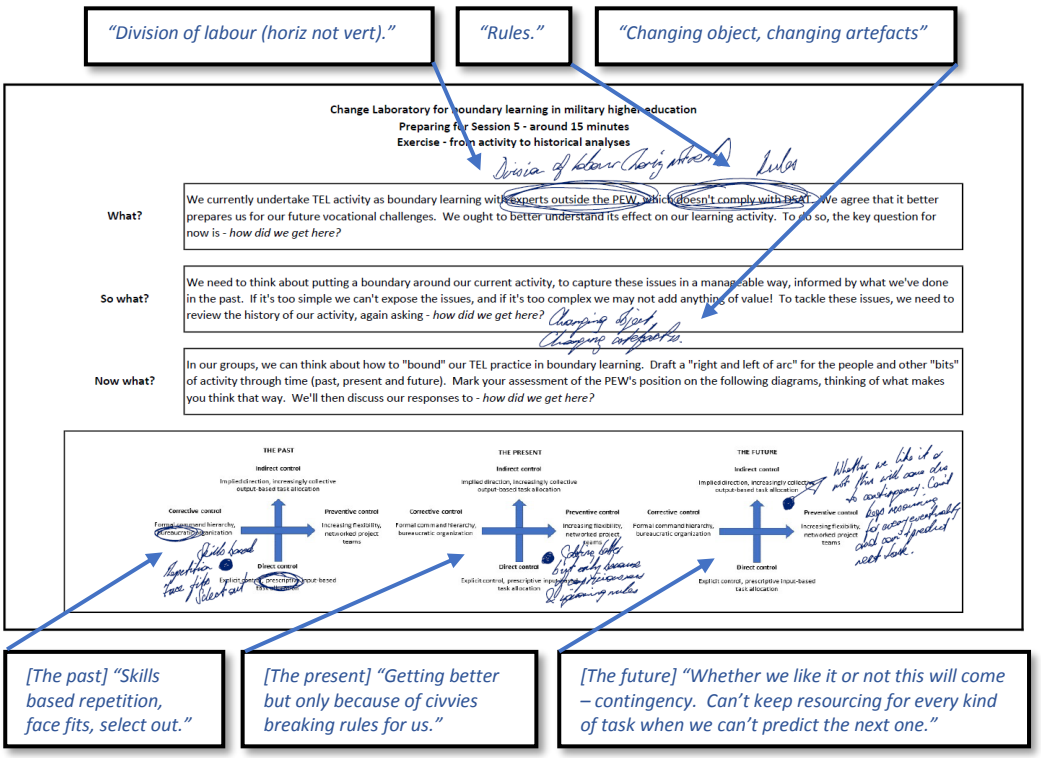
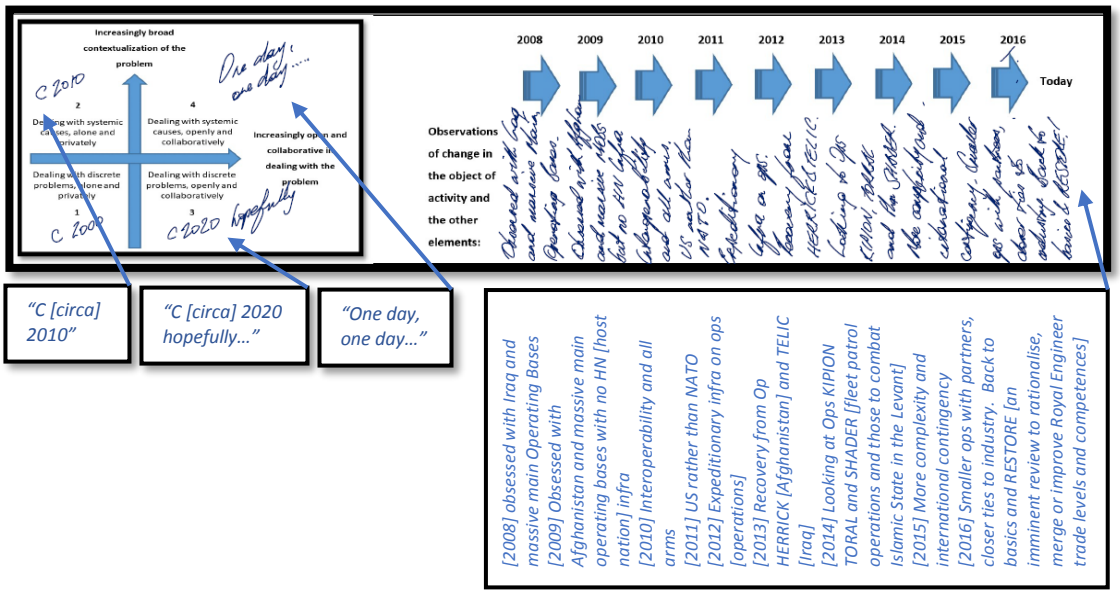


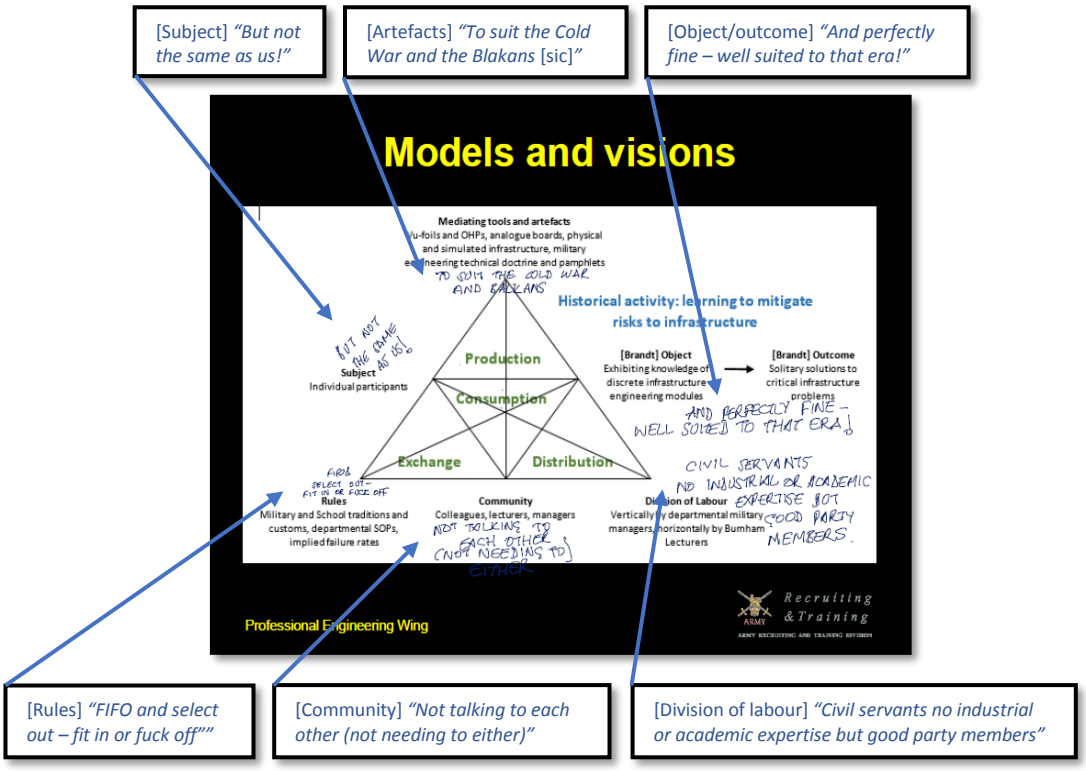
Figure 5.11. Extract from a participant workbook on historical analysis, with clarification of handwritten notes added in text boxes



The task in Figure 5.10 asked participants to consider generally how defence's requirement for boundary-crossing TEL had changed during the last decade, with particular relevance to

TEL activity's object. The task in Figure 5.11 comprised a four-field exercise adapted from Virkkunen and Newnham (2013d), in which participants located the control of boundary-crossing TEL in the past, present and future, with some justification to inform subsequent collaborative discussions. In this model the X-axis represented increasing flexibility of work and organisation, with the Y-axis representing increasing collectivity of work and organisation. These informed the session's collaborative tasks where participants constructed the model of historical activity in Figure 5.12.

Figure 5.12. Extracts from tasks on the models / visions and ideas / tools surfaces used for historical analysis, with clarifications of board work in pen added in text boxes



Historical analyses were expected to align most notably with two expressions of transformative agency, criticizing and explicating, since participants called upon mirror data and stimuli to relate historical problems and explicate new potential. An example was this episode involving Carlton and Barnabas, a manager and learner respectively. They were interacting with the historical activity system in Figure 5.12 and mirror data from operations in Iraq which took place around a decade before the intervention, to propose and model ideas for problematic and historically embedded secondary contradictions. Here Carlton is addressing his manager colleagues:

> "… well, he [Barnabas] was saying **we do what we've always done it like we've always done it, and we pretend we're keeping up with the rest of the world and we pretend**

we're doing something else because we lost our way with just about all of this [motions to old activity system] **so we pretend it's fine** {criticizing current activity} because of JSP 440 [the Joint Service Publication regulating security for defence communicative technology], so **we've been using our own IT and WhatsApp** … even though all that's against those [motions to rules] … we've done it ourselves, been stuck with our own kit, software, phones … **there's no-one else we've got to do it to suit us, the future us, whoever the fuck that is** {effective motive} … **it was us we made it work here** [motions to mirror data] **and we can again** [motions to ideas /tools] {explicating} **but it'll be with IT you don't like** [motions to old artefacts] **and people you don't like** [motions to old division of labour] **and shove your rules up your arse** [motions to old rules]." [*Carlton, session 5 – historical analysis*].

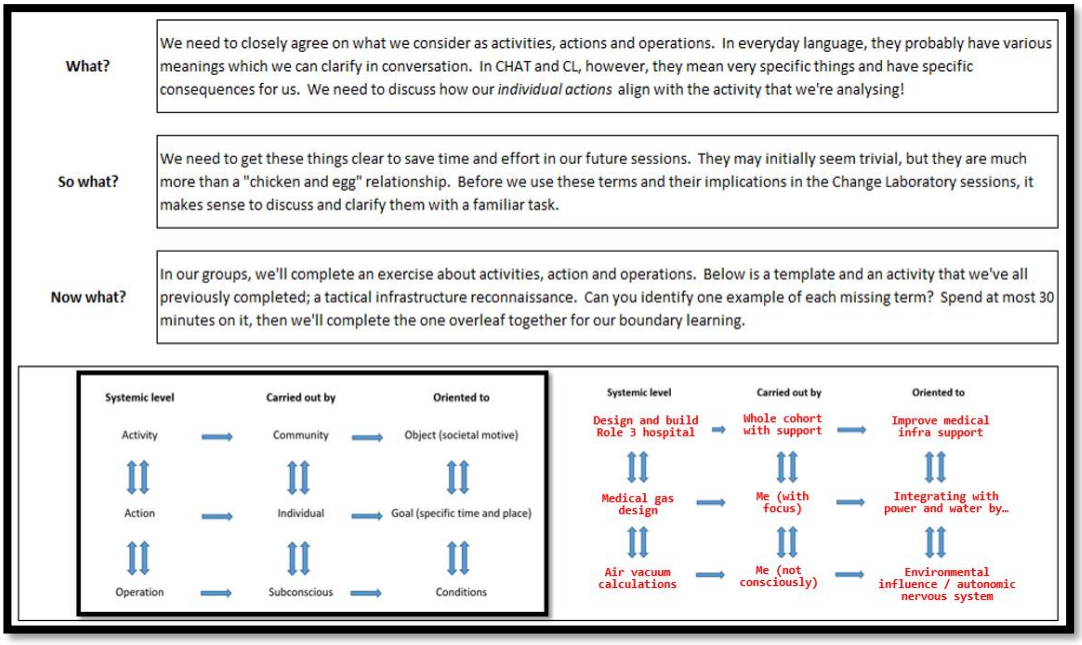
5.4.3 Session six: actual-empirical analysis

The double stimulation tasks for actual-empirical analysis began with first stimuli, as questions which encouraged participants to consider requirements for change and how individual actions would align with activity. Mirror data and second stimuli included AV data of participants contributing to failing activity, which they had identified themselves, and models to assist with identifying contradictions. At the request of the learner sub-group, participants agreed to focus on the same activity for actual empirical analysis, assisted by live disturbance diaries as instrumental stimuli artefacts. The activity was TEL for the designing and building of military hospital infrastructure for humanitarian operations in the Middle East and Africa; tasks which the previous learner cohort were deployed on as these sessions proceeded. Participants deemed that examining such real and contemporary tasks, which they were themselves likely to deploy on within months of completing the intervention, provided irrefutable 'acid tests' of the need for change and the responsibilities for delivering it.

Figure 5.13 shows related extracts from a participant workbook, on a double stimulation exercise entitled 'from historical analysis to actual-empirical analysis'. The task in Figure 5.13 asked participants to revisit activity and elaborate on associated actions and operations, with the motives, goals and conditions of each. In the session a comparison of actions and operations was then conducted to discuss alignment with activity and to expose problems for collaboration. The session then turned to analyse problematic effects on collaborative boundary-crossing TEL activity, for participants who may be temporally and geographically isolated from each other whilst collaborating. Anecdotal evidence was introduced from

deployed colleagues, sourced by learners themselves and curated as mirror data. The participants' disturbance diaries were again revisited and revised in the session with problematic aspects made personal, and participants curated their live disturbance diaries with their amendments negotiated as issues arose.

Figure 5.13. Extract from a participant workbook on actual-empirical analysis



Actual-empirical analyses had been predicted to align with expressions of explicating and envisioning, both of which seem apparent in the exhibits generated by participants such as those in Figures 5.13 and 5.14.

Figure 5.14. Extracts from mirror data involving operations to build military hospitals in Sierra Leone and South Sudan, used during actual-empirical analysis

As with the questioning of activity, it is notable that this type of discursive activity would never normally take place between military managers and those whom they manage, whether lecturers or learners. The latter sub-groups would normally have top-down

direction for pre-ordained change, evidenced by the impetus for this intervention. Subjective difficulties of voicing problematic concerns of explication and envisioning were not the reserve of learners. The importance of double stimulation to identifying and voicing problematic tensions, and the related explication and envisioning of possibilities, can be seen in these turns of speech by Gerard, a military manager:

> "… we've said before **we can fuck it off if we don't like it, but then nothing, absolutely nothing will change, instead we need to think about all the good stuff we've done in the past and put it in here'** [motions to activity system] {explicating}, and we need to change a lot of this [motions to activity system] so it kind of focuses you without making you think it's [intervention] something that's done to you, instead no it's done by you … these [activity system and expansive cycle] help you ID [identify] things you wouldn't have the bollocks to just say **but it's hard to avoid when it's staring you in the face …** here's **our own bosses** [circling community node] … so that's **between here and here I reckon** [drawing lines between community and division of labour, and artefacts and division of labour] **we need to bring in tech and the way we worked from Herrick** [Afghanistan], **bits that worked well … use it for contingency like South Sudan** {envisioning} **…"**. [*Gerard, session 6 – actual-empirical analysis*].

5.4.4 Session seven: modelling activity

The first stimuli for modelling asked participants to consider what their object of activity needed to be, and what their mediating artefacts needed to be in response. Second stimuli encouraged participants to then consider: the cultural mediation of activity; its exchange, distribution and consumption rather than solely production; comparing new and old activity; and the effect of tertiary contradictions on modelling. Workbook exercises were conducted to allow participants to form reflections on previous TEL experiences, particularly those related to 'old rules and new tools' contradictions, which were then collaboratively aggravated in sessions.

Figure 5.15 shows extracts from a participant workbook, on a double stimulation exercise entitled 'modelling new activity and exposing contradictions'. In the session, the collaborative work to model activity and its contradictions comprised individual participants in turn populating elements of the modelled activity system and leading the plenary in discussing proposals and negotiating responses. The initial and iterative stages of modelling were conducted on the whiteboard as illustrated in Figure 5.16, with the model then

maintained electronically as it was further embellished and neared completion. This model in turn identified further requirements for mirror data, informing likely outcomes of their iteratively modelled proposals and resulting contradictions.

Figure 5.15. Extract from a participant workbook on modelling activity

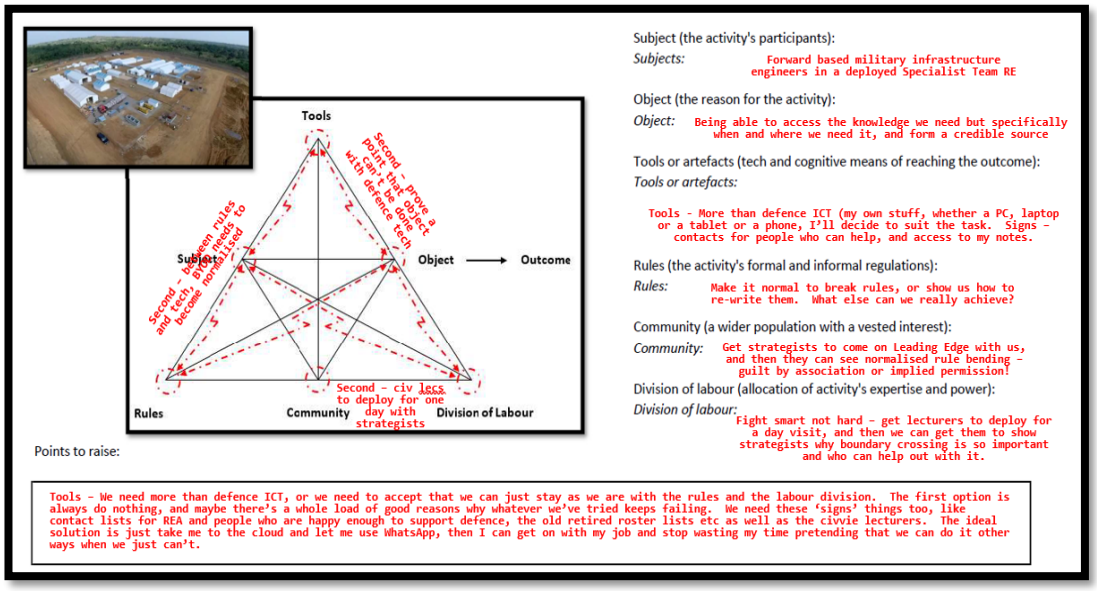
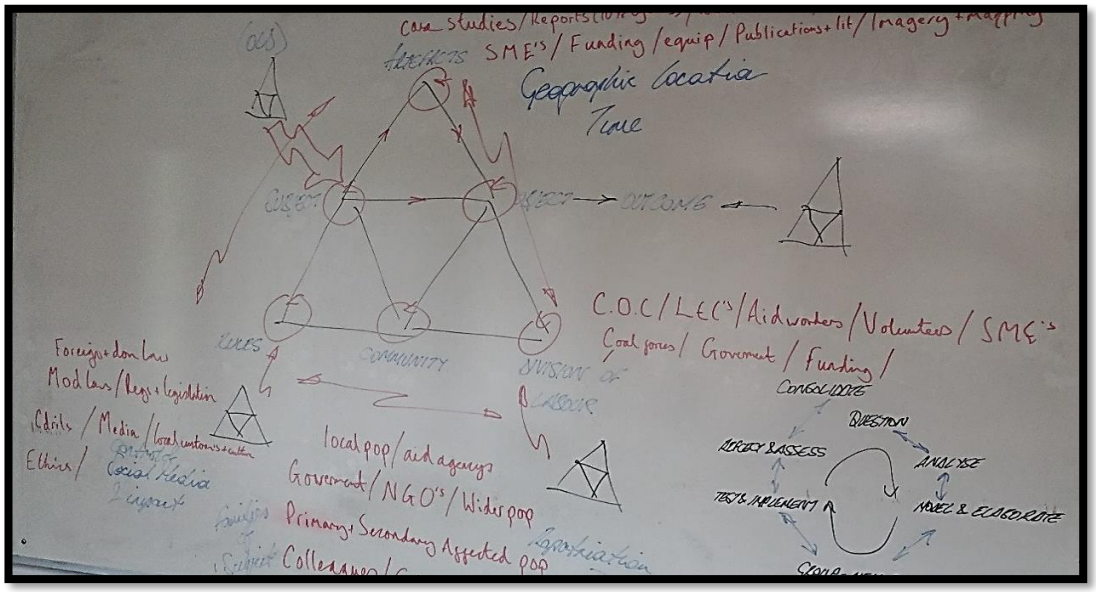


Figure 5.16. Extract from the models / visions surface on modelling activity

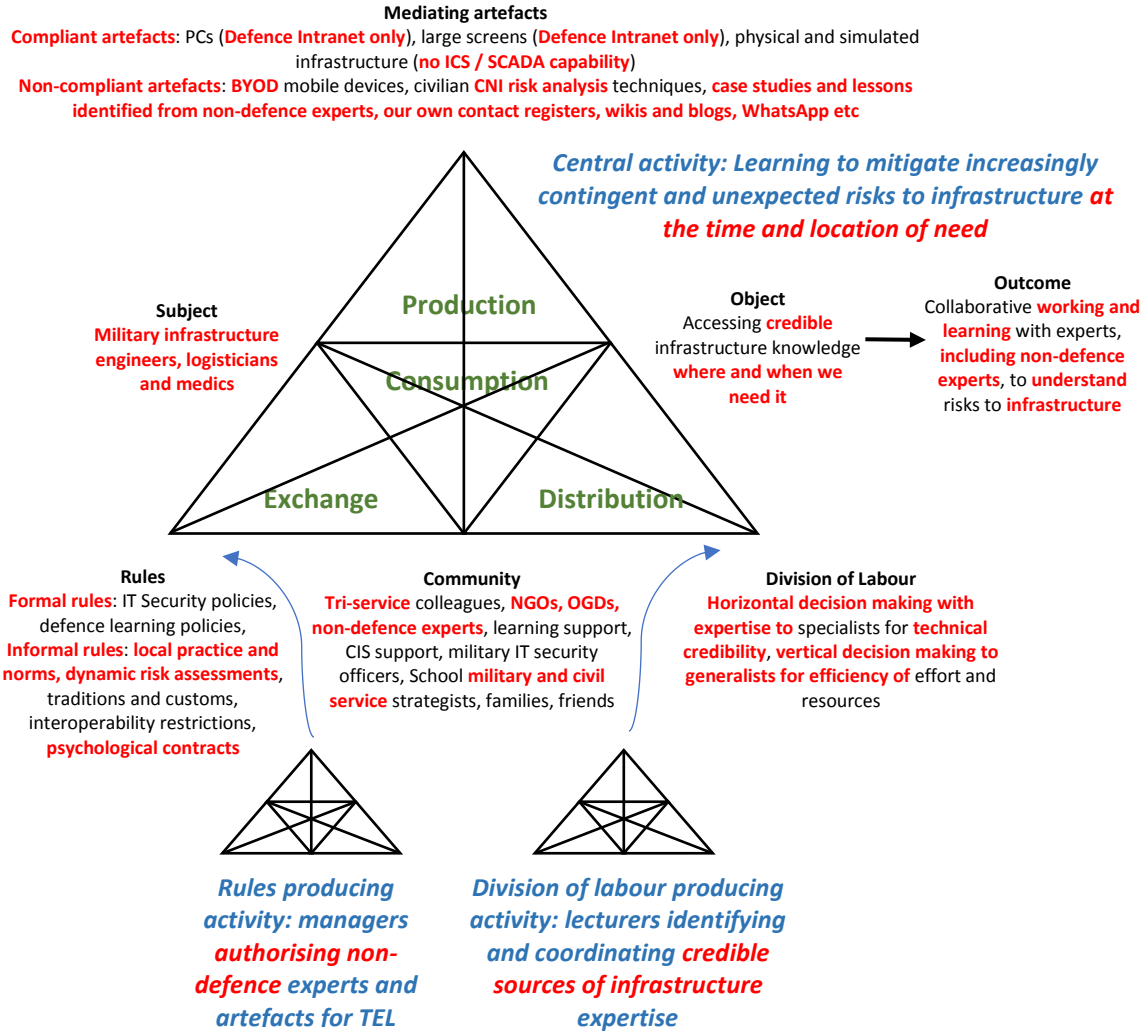


To supplement the mirror data provided to participants, they again sourced and analysed data on vocational tasks being conducted by their deployed colleagues. The most frequent tasks for mirror data were those described previously on humanitarian operations in Sierra Leone and South Sudan, which were taking place concurrent with the intervention and which many of these members of the learner sub-group were likely to deploy on after graduating, some months later. Their data included interviews conducted via online platforms, assisting

participants with assessing the viability of their proposed models and identifying further contradictions.

The initiatives to source and curate their own mirror data was identified as a potential turning point of the intervention, qualitatively changing "the nature of the participants' discourse and a jump in the quantity and quality of their expressions of transformative agency" (Haapasaari, Engeström & Kerosuo, 2016: 243). Figure 5.16 shows the addition of interacting rules-producing and division of labour-producing activities conducted by the learner sub-group, much of which was in reaction to curating their own mirror data. The agreed activity system on cessation of modelling is shown at Figure 5.17, with significant amendments from the previous model of historical analysis recorded in red.

Figure 5.17. The plenary's activity system on cessation of modelling, with significant amendments from historical activity shown in red



5.4.5 Session eight: examining activity

The designed intent for the examination of activity was to identify potential issues for trialling the new model and to discuss key areas of concern for its sustenance. Second stimuli turned from a focus on internal contradictions to include: interacting activities; iterations of earlier proposals for expansive cycles; tertiary and quaternary contradictions; and previous TEL experiences of "old division of labour and new tools" contradictions. Figure 5.18 shows extracts from a participant workbook, on a double stimulation exercise entitled "examining the redesigned activity". This invited participants to consider how their own proposals for a new model of activity may help to aggravate the contradictions that were identified in the previous session. The collaborative work to model activity and its contradictions was assisted by participants calling upon these individual exercises. In the plenary, five small mixed groups aggravated contradictions, and then added findings to a jointly constructed model.

Figure 5.18. Extract from a participant workbook on examining activity

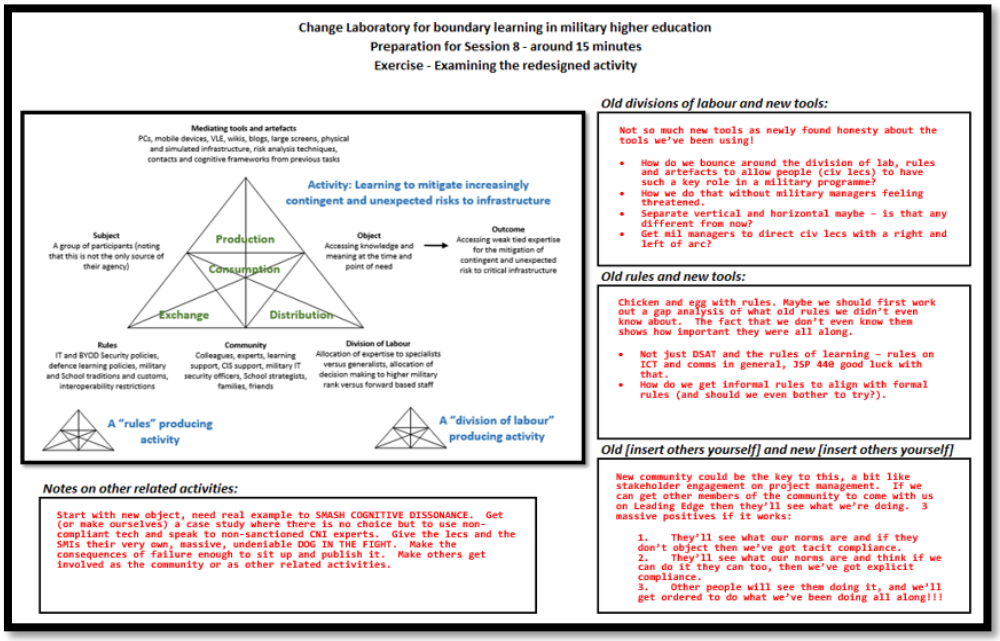
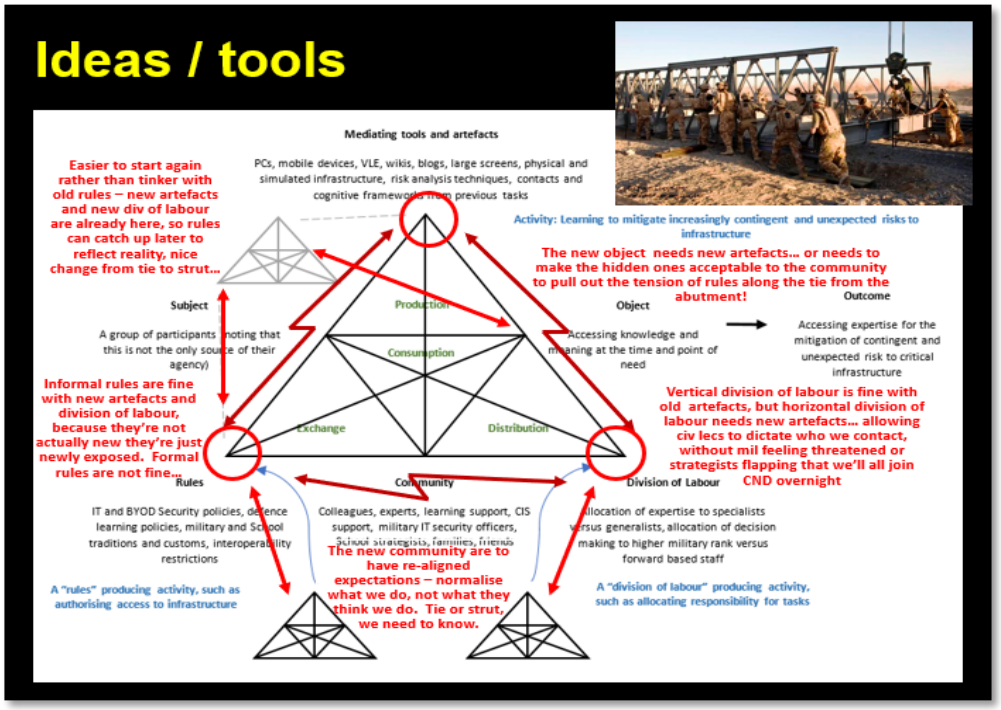


Figure 5.19 shows the collaboratively examined activity and its contradictions on cessation of session eight. The image of the military bridge in the corner of Figure 5.19 indicates a metaphorical representation of activity used by participants, where the activity system was likened to a bridge truss used in military gap crossing problems. This is a network of structural members, known as ties and struts, which distribute forces through a bridge into the members on the banks of the crossing point, known as abutments.

Figure 5.19. Interacting activity systems constructed by participants during examination



Such familiar forms of models were called upon by participants as they expressed transformative agency through envisioning and committing. Analogous terms used in double stimulation can be seen in artefact-stimuli and extracts from transcripts, such as this relatively long extract from an episode of examination involving Irvine and Gerard, a learner and manager. They debate and enrich the activity system shown in the main frame of Figure 5.19:

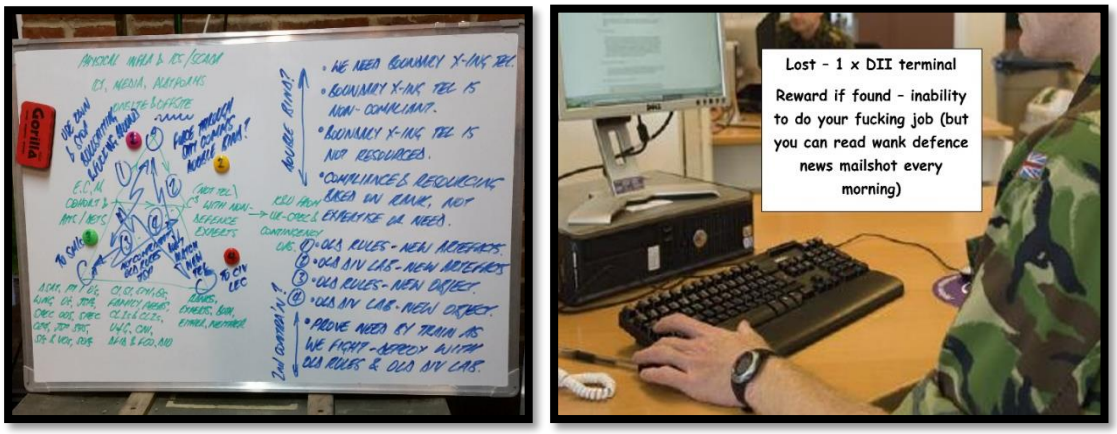
> "…we can't be expert at these things [motions to object] because we don't focus on one particular field … **we need to be able to access those** [experts] **who are willing to help us, who've done it before** {envisioning} so that we can tap into what they know … **holding this tie and strut together** … there's no way we can do that without changing all of the stuff that we've been looking at. **What I'd be concerned about is it just slipping back on the abutments** … **my biggest concern is when** [interventionist] **isn't working with those beams on the abutments any more in here** [motions to rules producing activity, then to a manager] **and even them** [motions to division of labour producing activity, then to a lecturer] **well us being able to easily access expertise "at the time and point of requirement**" [air quotes] [motions to the object] well we're just not going to be at the top of their priority list are we? In fact, **I doubt when you've gone we'll even be on their priority list, let alone top …".** [*Irvine, session 8 – examining].*

"… I'm just trying to think what old problems will stick, even after that {envisioning} … if the blokes in future just rod them [experts] off and then just don't want their advice? **This structure won't have any pins. We need to aim off for that, and do something today not just acknowledge it on a piece of paper** {committing} … this political shite with people like [civilian lecturer] who's getting proper precious about his contacts … that's a contradiction here and here [motions between community and division of labour] … **we've got to do something formal about that** {committing} in case someone doesn't know how to handle a prima donna … So **it could be a remaining problem** {envisioning} for maybe lecturers who aren't that proactive about helping, the ones who work to rule, **maybe we can't do much about them wearing down the abutments but we should try** {committing} … just **so we can design a backup plan today as well suppose** {committing} **maybe even a whole reserve gap crossing**…" [*Gerard, session 8 – examining*].

5.4.6 Sessions nine to twelve: implementing and testing activity

The designed intent of sessions nine to twelve was to implement the model and iteratively change it, initially in sub-groups and latterly as a plenary. In addition to the provided second stimuli of expansive cycles and activity systems, the participants called upon documentary policies and AV evidence of the intervention itself. Session nine was conducted off-site by the learner sub-group. A notable instrument generated by participants is at Figure 5.20, which shows a portable surface used to reconsider the object of their activity, and to aggravate its secondary contradictions in attempts to overcome their double bind.

Figure 5.20. A portable surface used by participants for testing activity remotely, with an image of a defence information infrastructure terminal that was fixed to the rear



An attempt to humorously summarise their double bind was fixed to the rear and is shown on the right. Their synopsis of the double bind is summarised in the area to the top right of the portable surface, above a summary of secondary contradictions for the model:

> **" · We need boundary X-ing [crossing] TEL.**
> **· Boundary X-ing TEL is non-compliant.**
> **· Boundary X-ing TEL is not resourced.**
> **· Compliance & resourcing based on rank, not experience or need."**

The learners' decision to conduct trials off-site was entirely unforeseen by other participants. The design and conduct of these sessions, and the generation of mirror data and stimuli by participants themselves, indicates that the objectives of sessions were being increasingly achieved in ways which were significantly different from my designed intent.

Surprising aspects of these turning points were exhibited in the episode below by Warwick, Barnabas and Jared, three learners, who discuss the value of double stimulation to their implementation and testing. Their intent with remote work was to mimic the conditions of their deployed works teams, with a task organisation to suit the realistic vocational outcomes and engagements with experts, rather than the organisation of learner cohorts located at their HEI. In this relatively long extract they retrospectively describe their preparation and deployment to implement and test the activity shown in Figure 5.20:

> "… **we needed these models so we knew what we were on about while we were on a proper job, more like real life instead of trying them at [the RSME site]** {taking action} … when we gave it [new activity system] a go well **it bounced around for us from the new object** [motions to object] but there was loads wrong on these other bits of the bridge down here [motions to lower triangles] these bottom bits of the bridge truss … so the rules down near here, the community … the divisional labour [sic] [motions to division of labour] … **we have to do it here** [remote site] **and see how it survives** {committing}, because just like the bridge truss you might not be able to see these things but if they're not there it'll fail … **if we deploy with more people and just keep a log of the way these** [contradictions] **come up in day-to-day stuff** … **we've got some evidence of what we've tried, what works, what doesn't work** … **we went out and did it and videoed it and it can't be argued with** {taking action} … so **other people can have a go now and see if they can keep it going**." [*Warwick, session 9 – implementing*].

"… **when we were putting it in and then testing it** {taking action} **a lot of people only care about this top bit** [motions to top triangle of production between subject, object and artefacts] **and aren't arsed about these bits** [motions to bottom triangles] … **if you said to them well feel free to drive over that bridge, by the way I might have took all these bottom pins out of the bridge truss** but don't you worry … they wouldn't do that would they ..." [*Barnabas, session 9 – implementing*].

"… **which is why we got the mirror material of our own** {taking action} … **models are great, but there's loads of people that just wouldn't even recognise these models that we're using,** and to be fair we took some convincing … they're [strategists] not going to spend [counting on fingers] nine or ten months with us so that we can explain these triangles, all that sort of shit to them, **but if we can show them hard evidence of why we need to change** {committing} **and what we did on a trial** {taking action}**, with loads of other people too, like a proper task team** [motions to subject], **then they can't deny that** … we can say instead **here's the video of the back-brief and here's what we couldn't do until we tried this look and we went and did it and here's what we needed** [motions to images of remote deployment] **to do to keep it going** [-] {taking action}." [*Warwick, session 9 – implementing*].

"But we need to prepare something hard hitting {committing} … In this then [division of labour] we need to include real people in future for real problems. Them [experts] too and **we need a "so what" so that people will sit up and go 'you're going to do fucking what'** with real implications {committing}". [*Jared, session 9 – implementing*].

Figure 5.21 shows the portable surface from Figure 5.20 being used and amended in the field, during discussions of implementation and testing which took place at a relatively remote infrastructure site for wastewater treatment. These remote trials generated contradictions in ways which reflected vocational tasks, contributing to mirror data and further changes to activity. Participants expressed that their progress in identifying and aggravating such contradictions was significantly higher when they were working remotely, attributing their increased success to the vocational reality of remoteness; this enabled them to expose contradictions which had lain dormant before deployment. During this remote work, participants generated their own mirror material for the subsequent plenary, examples of which are shown in Figure 5.22 and which they intended for use as cases of effective and ineffective practice. On return to the plenary all participants redesigned their

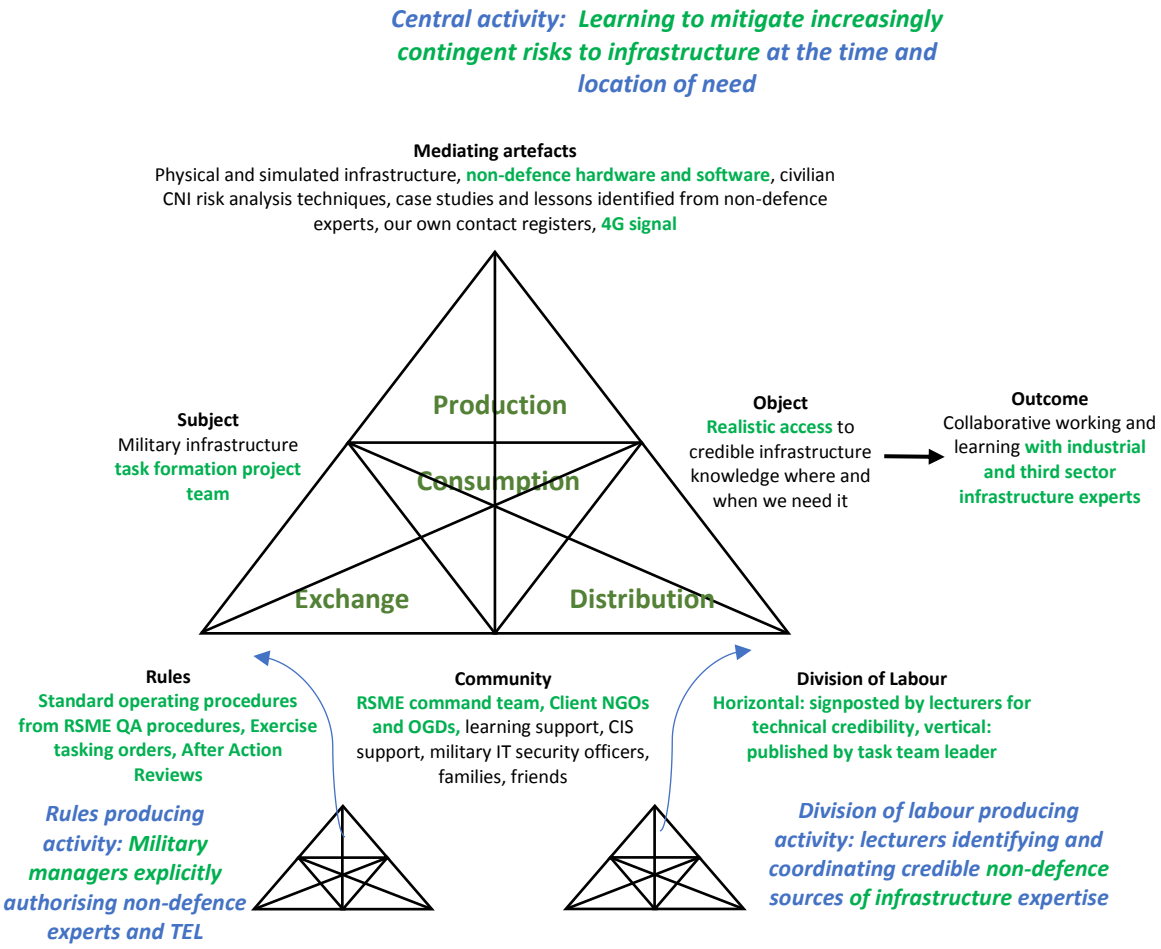
activity system, expansively designing further remote deployments; their intent was to expand remote work to other cohorts and further work units.

Figure 5.21. A portable surface in use during implementation and testing, with a model of Engeström's activity system on the board and on the floor constructed with sticks

Figure 5.22. Extracts from mirror material generated by participants during implementation of activity

The final iteration of the activity system for this intervention, as agreed amongst participants, is shown at Figure 5.23. Amendments from previously examined activity are shown in green.

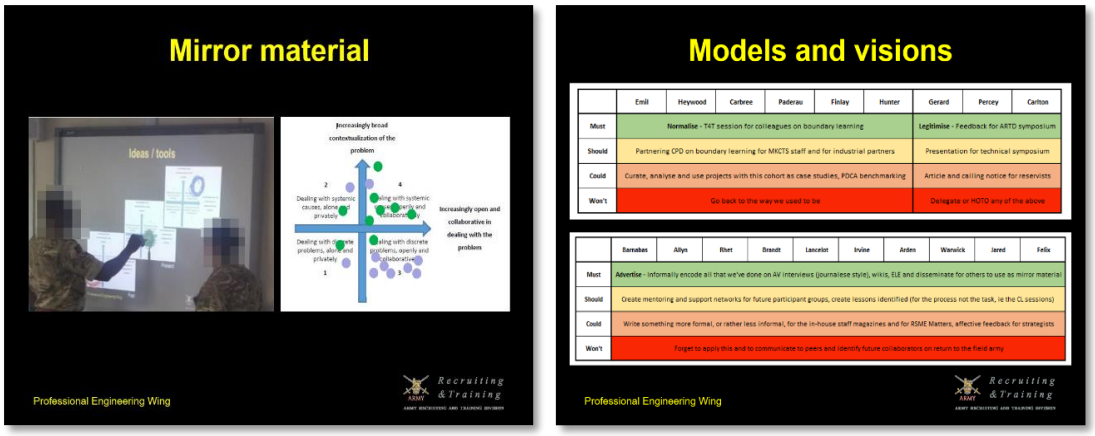
Figure 5.23. The participants' agreed model of new activity on cessation of implementation and testing, with significant amendments in green



5.4.7 Sessions thirteen to fourteen: reflecting and consolidating

The sessions to reflect on and consolidate expansive activity were intended to consider the sustenance of work and learning, as changes were taken forward in time and to further work units. Extracts from the plenary's surfaces on reflection and consolidation are shown in Figure 5.24, showing collaborative discussions of expansive learning and ongoing sustenance. The instruments constructed by participants include revisited four-field analyses from previous sessions on how organisations deal with problems, with collaboration on one axis and breadth of contextualisation on the other axis. Also shown are the participants' own ideas for consolidating 'must-should-could-won't' statements shown in red, amber and green boxes compiled by sub-groups, committing to ongoing sustenance and identifying areas requiring additional effort for further consolidation. These commitments are revisited in the next section which discusses the follow-up workshops.

Figure 5.24. Extracts from mirror material constructed by participants during reflection and consolidation



5.4.8 Follow-up workshops

Two follow-up workshops took place, at three months and five months after the reflection and consolidation sessions. They were voluntarily led by the learner sub-group, who compiled agendas directing attendees to prepare a number of contributory tasks. Participants provided and discussed evidence of boundary-crossing TEL from corporate magazines and social media which purported to show support and sustenance of the new form of activity. Examples are shown at Figure 5.25.

Figure 5.25. Extracts of mirror data consolidating boundary-crossing TEL, legitimised in corporate magazines and social networking (images from Holdfast Training Services, 2018a)

Further consolidation included six-week attachments to civilian engineering infrastructure organisations and collaborative four-week deployments to remotely test their boundary-crossing TEL, and to iteratively remodel their activity system with other participants as a result of remote tests. Tasks were designed to be increasingly complex and increasingly geographically distal, to further identify and aggravate contradictions which on-site TEL

would not yield. These follow-up Change Laboratory sessions were deemed to be an ongoing commitment described by Warwick:

"… this [Change Laboratory] is **a journey, not a destination**" [*Warwick, session 12 – reflecting and consolidating*].

5.5 Summary of data presentation

In terms of observed realisation and expansive learning processes, Tables 5.3 and 5.4 tabulate summaries of the data presented in this chapter. Table 5.3 presents a summary of the role of double stimuli in the development of boundary-crossing TEL activity. Table 5.4 presents a summary of the participants' concrete outcomes for boundary-crossing TEL activity. These formats were designed to be compared to the case studies of other formative interventions in Virkkunen and Newnham (2013f). Whilst this chapter presents an edited and condensed summary of data, my aspiration is that it conveys sufficient richness to bridge my methodology and subsequent analyses. In the data's raw and reduced forms, there are clearly no references to my arguments nor to the research questions, which is where the subsequent chapter turns.

Table 5.3. Notable examples of expansive learning processes in the intervention, formatted for comparison with example cases in Virkkunen and Newnham (2013f: 213)

Phase of the development of the activity	First stimuli	Central internal contradiction	Created instrumental second stimuli
In turning from questioning to analysing in Session 4 and 5, participants began to take control of identifying and re-presenting their own historical mirror data and stimuli.	Questions in workbooks about participant experiences of main problems with old activity systems. Planning the collaborative journey of expansive learning; annotating an expansive cycle for the intervention.	Historically embedded internal secondary contradictions between: rules and division of labour; and rules and artefacts.	Live disturbance diaries fixed to walls of Change Lab rooms, with each sub-group responding to each other sub-group's diaries. These were than analysed as a plenary to identify and further aggravate contradictions.
In moving from examining to implementing in Session 9, participants' experiences of aggravating secondary contradictions and a double bind resulted in remote trials.	Double bind between competing obligations: on one hand, military rules on communication and security; on the other hand, the need to complete tasks through rule bending and breaking.	Daily reality of TEL's horizontal division of labour v formal rules which were designed for a vertical division of labour.	New model on a portable surface of boundary-crossing TEL based on resolving secondary contradictions and rewritten object of activity "Realistic access to credible infrastructure knowledge where and when we need it". Trialled remotely.
In reflection and consolidation, and follow-up workshops, participants proposed and then concretised their own instrumental second stimuli for use in future interventions.	Concerns for sustenance, specifically that the changes to the new activity could revert back to historically established rules and divisions of labour when individuals ceased to be involved.	The potential for regression driven by concerns of stubborn practices; contradictions between rules and division of labour.	Imagery to legitimise and normalise boundary-crossing TEL in corporate documents and social network accounts. Used as future mirror material for further consolidation of boundary-crossing TEL and further aggravation of contradictions.

Table 5.4. Practical realisation of the intervention, formatted for comparison with example cases in Virkkunen and Newnham (2013f: 210)

Initiative and starting point	Researchers', practitioners' and managers' collaboration	The number and focus of sessions and duration of the intervention	Concrete outcomes of the intervention
The unit's initiative and the unit's motivation.	Three party collaboration between insider researcher, practitioners and middle managers. Strategists briefed a-posteriori by researcher.	Six separate sub-group sessions for learners, lecturers and managers, and eight joint plenary sessions. Total of 14 planned sessions conducted over 12 months, with follow up workshops ongoing and ad-hoc follow-up support by interventionist (generally providing advice on theoretical matters when requested).	New model of boundary-crossing TEL with new object; live disturbance diaries; new rules, artefacts and division of labour agreed by middle managers; implementation of new practice through remote work to aggravate contradictions; consolidation of new remote work and learning practice to other units at the time of writing.

CHAPTER SIX – DATA ANALYSES

6.0 DATA ANALYSES

In this chapter I provide a synopsis of my analyses of the data, focusing narrowly on transformative agency: to provide some insight into how the intervention seems to have engendered transformative agency; to better understand its methodological sustenance; and to modestly contribute by "talking back" to theory (Bennett & Oliver, 2011: 179). The chapter first describes expressions of transformative agency as the whole intervention played out. For each expression I then describe four or five sub-expressions which emerged during my inductive analyses. To exemplify these sub-expressions I borrow Kerosuo's (2011: 388) notion of a transitional episode, noting qualitative changes of interaction during which "new possibilities are raised, articulated and acted upon" (Kerosuo, 2017: 331). I therefore deemed episodes to be transitional when they resulted in proposals for change, through participants' subsequent engagements with each other or with their task stimuli.

6.1 Expressions of transformative agency in sessions

Table 6.1 and Figure 6.1 show how expressions of transformative agency identified by Haapasaari et al. (2016: 242) were exhibited in the intervention's episodes. The most frequent expressions were those of explicating possibilities, evident in 192 episodes. The least frequent were expressions of taking action, evident in 82 episodes.

Table 6.1. Episodes relating to expressions of transformative agency in sessions

Session	Resisting	Criticizing	Explicating	Envisioning	Committing	Taking action
1. Questioning - learners	20	36	15	0	0	0
2. Questioning - lecturers	21	23	12	1	0	0
3. Questioning - managers	17	14	15	1	1	0
4. Questioning	21	9	13	1	0	0
5. Historical analysis	6	16	33	17	3	0
6. Actual-empirical analysis	0	3	29	13	4	0
7. Modelling	0	5	34	35	5	2
8. Examining	2	8	26	34	19	0
9. Implementing - learners	1	1	5	21	18	17
10. Implementing - lecturers	0	0	1	6	7	10
11. Implementing - managers	0	0	0	0	11	19
12. Implementing	0	0	0	4	22	20
13. Reflecting / consolidating	0	7	9	16	17	3
14. Reflecting / consolidating	0	0	0	0	10	11
TOTALS	**88**	**122**	**192**	**149**	**117**	**82**
PERCENT OF TOTAL	**11.72%**	**16.25%**	**25.57%**	**19.84%**	**15.58%**	**10.92%**

Figure 6.1. Episodes with expressions of transformative agency (Y axis) in sessions (X axis)

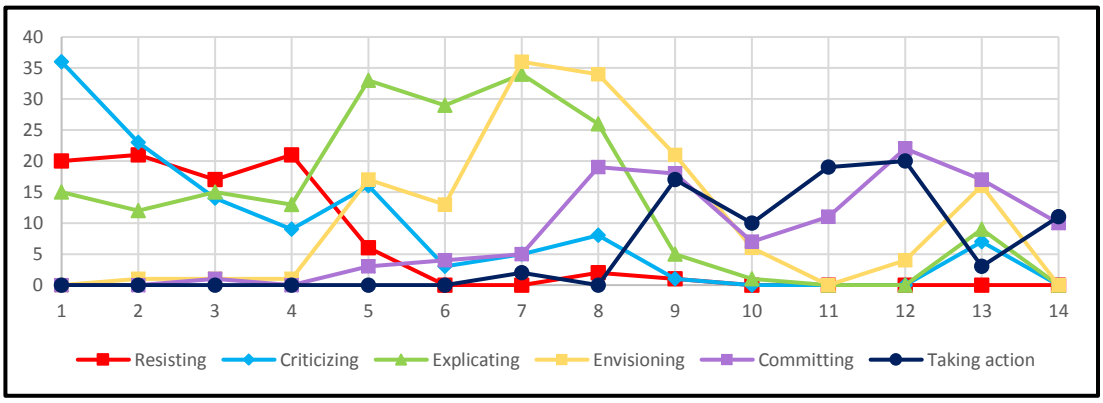
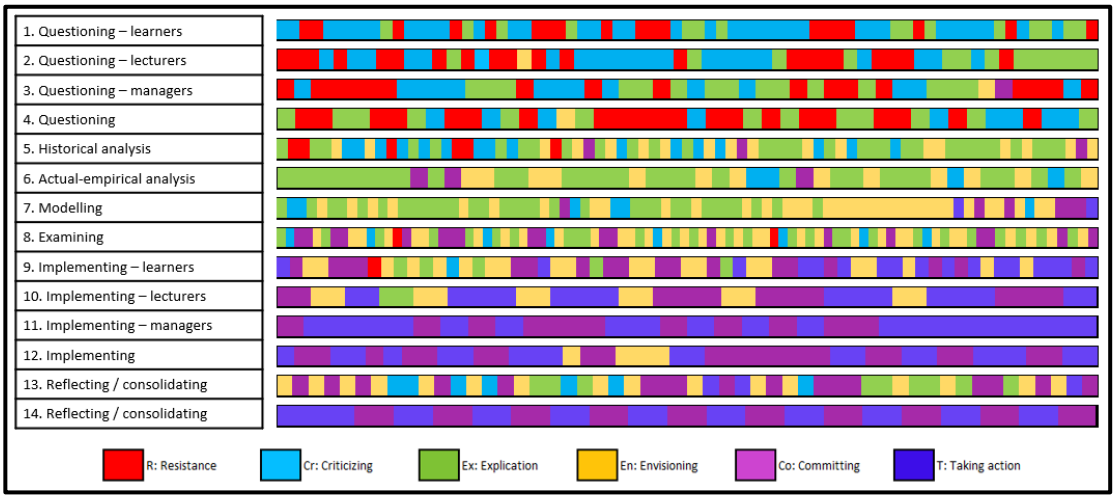


Figure 6.2 illustrates how episodes emerged in turn. It is a dense illustration, showing all of the collated expressions of transformative agency. In later sections, each expression's emergence is illustrated with its relationships with nodes of activity. Figure 6.2 will therefore be deconstructed for each expression, also showing how four or five noticeable and discrete sub-expressions were identified during inductive analyses. Each sub-expression was relatively distinct, in that each time it was manifested it was with a certain shared level of future-orientation and collaboration. For example: sub-expression R1, exhibiting resistance through change fatigue, was expressed by individuals describing here-and-now consequences; whilst sub expression R4, resisting change through social practices, was expressed through collaborative negotiations of future consequences.

Figure 6.2. Episodes with expressions of transformative agency emerging in each session



Dedicated sections will now discuss the qualitative impact of expressions and sub-expressions, with their disruption and destabilisation of social, cultural and structural norms (Virkkunen, 2006: 58). Each section begins by summarising and graphing the frequencies of the main expression, illustrating relationships with nodes of activity. Sub-expressions are then described by tabulating data, illustrating their emergence, and providing examples.

6.2 Resisting the proposed change

Figure 6.3 isolates expressions of resistance, which emerged fairly constantly at around 20 transitional episodes per session until the fifth, when they dropped to low or negligible levels. Figure 6.4 shows that resistance was the least expression to be directed at activity's subject, object and outcome, although statements of low frequency mask the importance of resistance to qualitative transformation, discussed in the analyses of sub-expressions. Four types of resistive sub-expressions emerged in inductive analyses: change fatigue; personal roles; competing obligations; and social practices. Their frequencies are in Table 6.2, with their emergence illustrated in Figure 6.5 followed by examples and discussions.

Figure 6.3. Episodes with expressions of resistance (Y axis) in sessions (X axis)

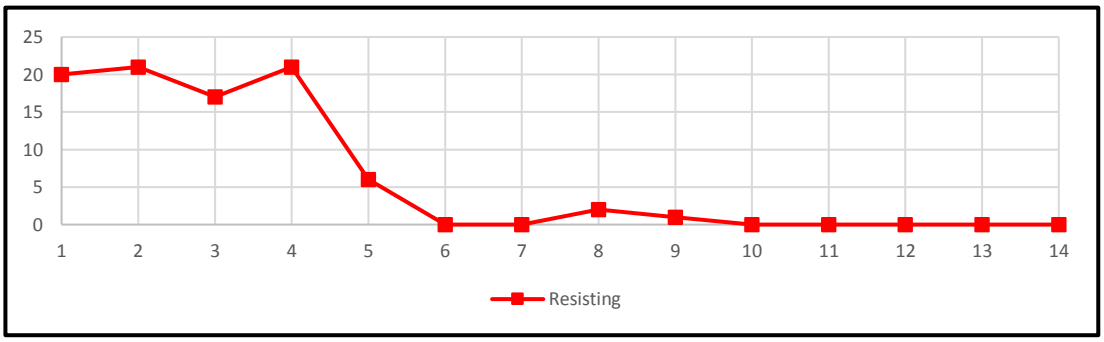


Figure 6.4. Episodes of resistance (in red) related to activity's nodes

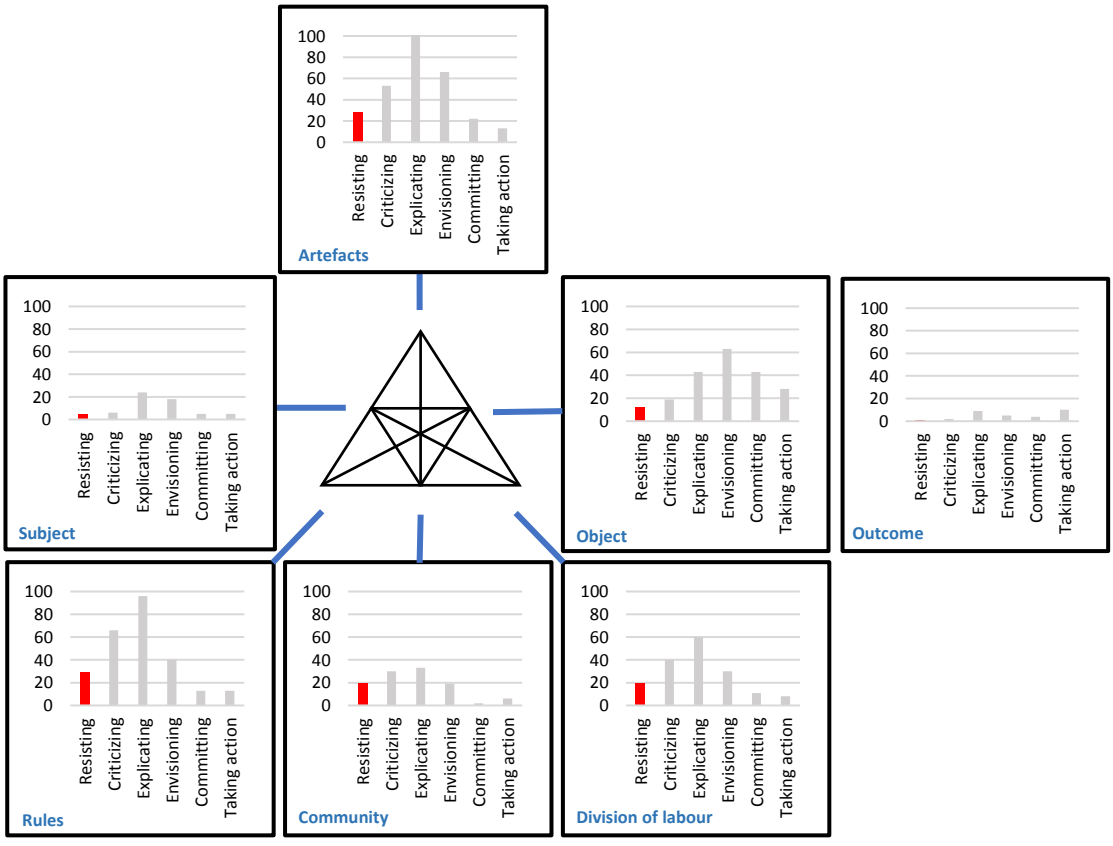
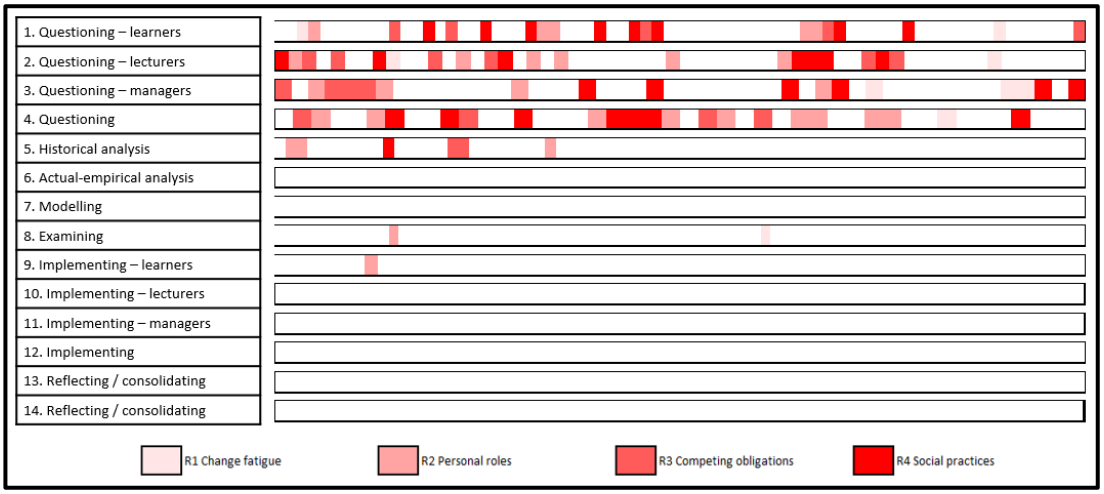


Table 6.2. Episodes with resistive sub-expressions

		R Resisting	R1 Change fatigue	R2 Personal roles	R3 Competing obligations	R4 Social practices
Session	1. Questioning - learners	**20**	2	5	5	8
	2. Questioning - lecturers	**21**	2	6	6	7
	3. Questioning - managers	**17**	3	4	4	6
	4. Questioning	**21**	1	9	4	7
	5. Historical analysis	**6**	0	3	2	1
	6. Actual-empirical analysis	**0**	0	0	0	0
	7. Modelling	**0**	0	0	0	0
	8. Examining	**2**	1	1	0	0
	9. Implementing - learners	**1**	0	1	0	0
	10. Implementing - lecturers	**0**	0	0	0	0
	11. Implementing - managers	**0**	0	0	0	0
	12. Implementing	**0**	0	0	0	0
	13. Reflecting / consolidating	**0**	0	0	0	0
	14. Reflecting / consolidating	**0**	0	0	0	0
Sub Total:		**88**	**9**	**29**	**21**	**29**
% of Total Episodes:		**11.72%**	**1.20%**	**3.86%**	**2.80%**	**3.86%**

Figure 6.5. Episodes with resistive sub-expressions emerging in each session

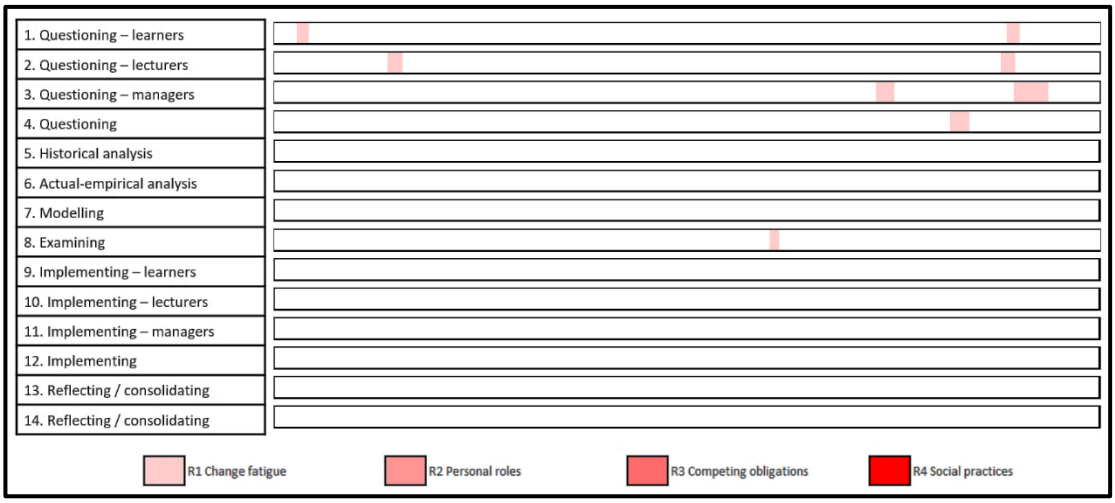


6.2.1 Resistance through change fatigue – R1

Nine episodes with resistive sub-expressions were articulated through change fatigue, with perceptions that change efforts were repetitive, tokenistic and unsustainable. Their emergence is illustrated in Figure 6.6. Episodes commonly referred to historical failures of change, in the RSME's environment which prioritised institutional predictability and top-down cultural reproduction. In this early example Allyn, a learner, consults a disturbance diary workbook exercise whilst reacting to my proposal that participants would lead elements of their formative intervention:

> "… **it just makes you think 'not again'** … **no-one will listen to us anyway** we're always getting asked for opinions and then we get told they're the wrong ones when they don't match what they wanted to hear, **it's all been tried before, and it'll nosedive** {resisting} …". [*Allyn, session 1 – questioning*].

Figure 6.6. Episodes with sub-expressions of resistance through change fatigue – R1

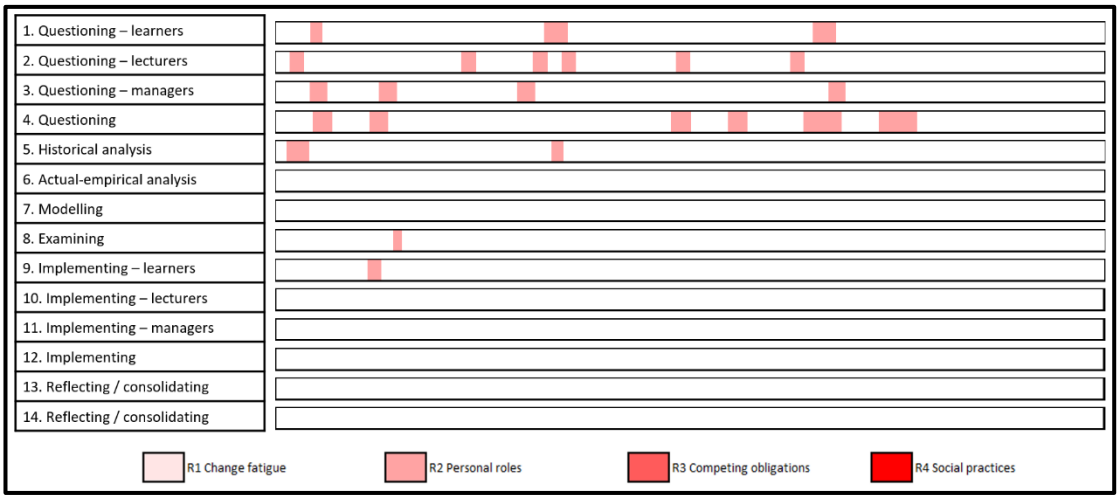


6.2.2 Resistance through personal roles – R2

A total of 29 episodes with resistive sub-expressions were directed at resisting personal roles in change, including: social comparison, where other parties were claimed to hold responsibility; techno-salvation, where emerging technologies were claimed to be reducing the necessity for personal roles; and political disruption, with claims that the sanction of other people such as managers would prohibit active roles. Their emergence is illustrated in Figure 6.7. In this example Arden, a learner, uses stimuli on surfaces to resist an active role, concurrently hedging his involvement through imminent technological change:

> "… you [interventionist] know **we can't do much about it** [problematic activity] … **why you're looking at this stuff** [motions to models / visions surface] and asking us to **is beyond me** {resisting the interventionist} … and **MODNet's** [MOD information network] **coming so it'll all change anyway** …". [*Arden, Session 1, questioning*].

Figure 6.7. Episodes with sub-expressions of resistance through personal roles – R2

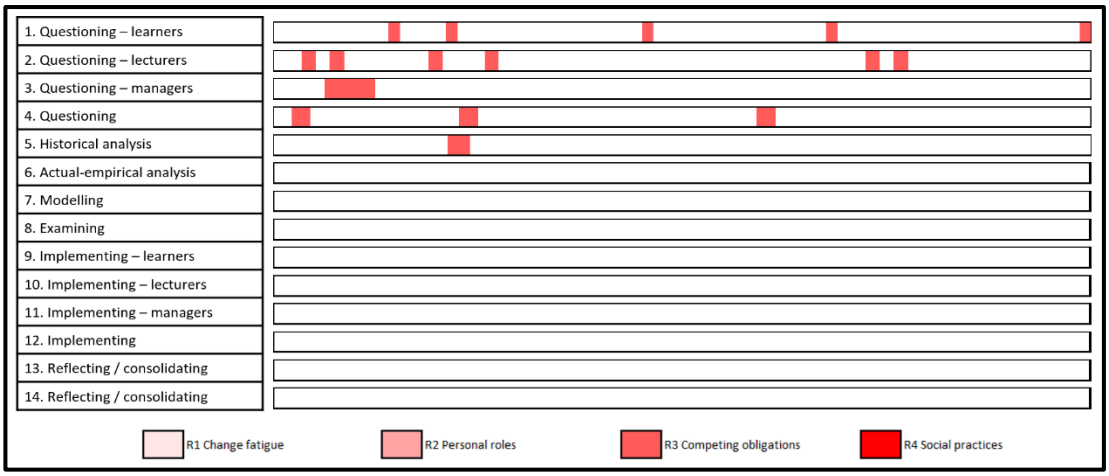


6.2.3 Resistance through competing obligations – R3

In total 21 episodes with resistive sub-expressions described competing obligations, where other commitments called upon participants' effort, will or availability for being involved in change endeavours. They are illustrated in Figure 6.8. Obligations outside the intervention included: finite personal capacity which could be applied to lower risk work and learning commitments; career implications of being perceived as subversive; and the need to meet family and social commitments rather than participate in change efforts. In this extract Brandt, a learner, expresses competing political obligations to the current status quo:

> "… **them rules …** it's **like a double-edged sword fucking around with them** {resisting the intervention} **… breaking them** [is] **like a career safety catch** … **we've got to go back to normal after it** [intervention] …". [*Brandt, Session 1 - questioning*].

Figure 6.8. Episodes with sub-expressions of resistance through competing obligations – R3



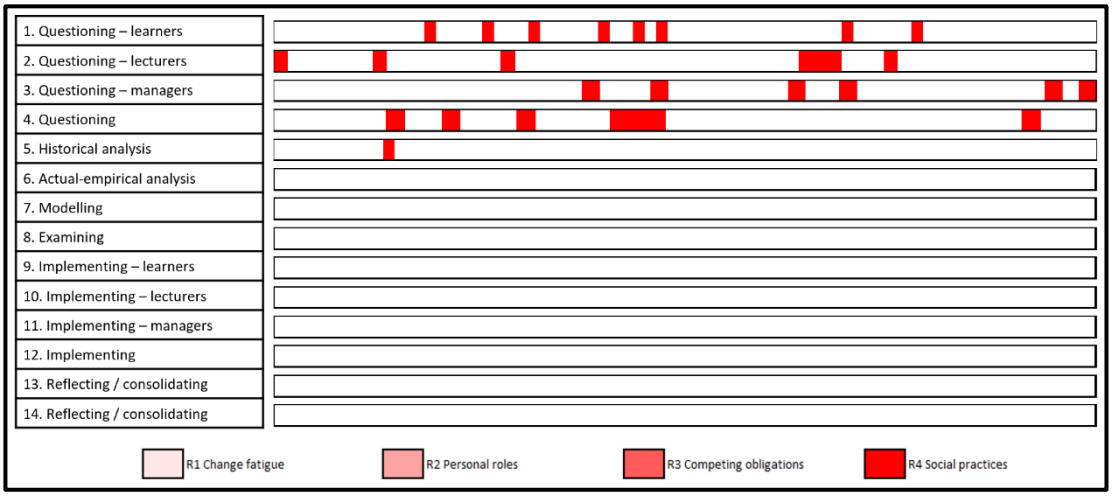
6.2.4 Resistance through social practice – R4

The most collaborative and future-oriented resistive sub-expressions were directed at the inertia of military social practices, totalling 29 episodes illustrated in Figure 6.9. These arose through dissonance of the RSME's hierarchical military bureaucracy being perceived as inconducive to bottom-up initiatives. In this example between two lecturers, Paderau and Gerard, social resistance is related to task stimuli:

> "… **we've tried it** [changing TEL] **before, a few of us changing the world** … **we got worn down with the bureaucratic stuff, we ended up just churning out the same old shit** … I don't know that what we do here will make any difference {resisting} **though this lot** [stimuli in workbooks and on surfaces] **looks different to what we've tried** …" [*Paderau, session 4 – questioning*].

"… [we can] **push against it, that's our prerogative** … **fuck it off if we don't like it, but the problem is we won't change anything** … **they** [task stimuli] **bring things out that otherwise we wouldn't have the bollocks to …**". [*Gerard, session 4 – questioning*].

Figure 6.9. Episodes with sub-expressions of resistance through social practice – R4



6.2.5 Summary of resistance

Figure 6.2 at the opening of this chapter shows how expressions of resistance, illustrated in red, emerged alongside other expressions. Figure 6.5 isolates resistive sub-expressions, whose darkness illustrates their increasing future-orientation and collaboration. In the initial three sessions, conducted by sub-groups, resistive sub-expressions tended to alternate with criticizing and explicating sub-expressions. Initially individual and focused on the present day (R1), they coalesced into strings of episodes, becoming increasingly future-oriented and collaborative (R4). The exception is the initial session for lecturers, which began by resistance through social practice (R4). By the fourth session, conducted as a plenary, resistive sub-expressions were increasingly adjacent to other resistive sub-expressions which became inter-related and protracted. Isolated resistive sub-expressions were rare after the fourth session's plenary, when resistance was the dominant main expression and resistance through social practice was the dominant sub-expression.

In analysing resistance, a notable principle of Activity Theory was that of multi-voicedness and trouble as a source of innovation; this may seem paradoxical unless resistance is accepted as a positive agentic act (Kindred, 1999: 201). The emergence of resistive sub-expressions indicate the importance of legitimizing resistance in task stimuli, showing its significance to engendering further expressions of transformative agency and to promoting responsibility, initiative and authorship (Sannino, 2010: 840). Explicitly normalizing multi-

voiced and troublesome enquiry, through task stimuli, appeared to be epistemically valuable for resistive internalisation and externalisation, with various artefact-stimuli used for sharing concepts (Lemos & Engeström, 2018: 38) and negotiating both internal and external conflicts (Sannino, 2010: 844). Resistive internalisation seemed mainly through workbook tasks in private, with resistive externalisation mainly through collaborative tasks on surfaces.

6.3 Criticizing the current activity and organisation

Figure 6.10 isolates expressions of criticizing, showing its peak in the first session followed by a steady decline, with minor resurgences in some sessions, relatively spaced throughout the intervention. Figure 6.11 illustrates that criticizing was mainly expressed at activity's rules, artefacts and division of labour, for which it was the second or third most frequent.

Figure 6.10. Episodes related to expressions of criticizing (Y axis) in sessions (X axis)

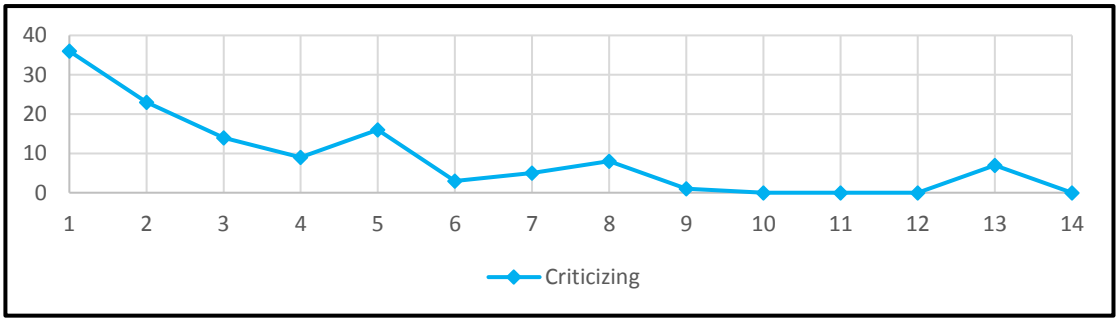


Figure 6.11. Episodes of criticizing (in turquoise) related to activity's nodes

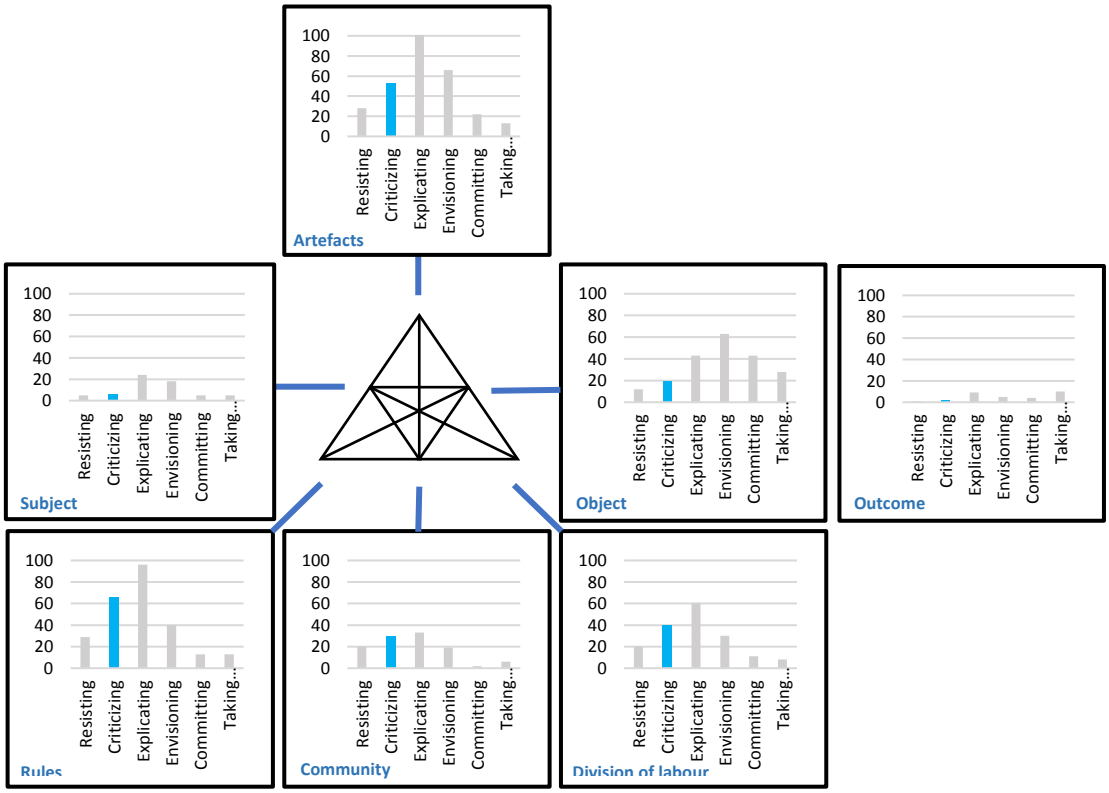


Table 6.3. Episodes with criticizing sub-expressions

		Cr Criticizing	Cr1 Proscribed control	Cr2 Societal misalignment	Cr3 Social disorientation	Cr4 Sociotechnical expectations	Cr5 Loci of social control
Session	1. Questioning - learners	**36**	6	6	10	5	9
	2. Questioning - lecturers	**23**	8	5	2	5	3
	3. Questioning - managers	**14**	2	1	3	5	3
	4. Questioning	**9**	1	1	2	4	1
	5. Historical analysis	**16**	3	5	7	0	1
	6. Actual-empirical analysis	**3**	0	0	1	0	2
	7. Modelling	**5**	2	1	1	0	1
	8. Examining	**8**	0	2	1	4	1
	9. Implementing - learners	**1**	0	1	0	0	0
	10. Implementing - lecturers	**0**	0	0	0	0	0
	11. Implementing - managers	**0**	0	0	0	0	0
	12. Implementing	**0**	0	0	0	0	0
	13. Reflecting / consolidating	**7**	0	0	3	1	3
	14. Reflecting / consolidating	**0**	0	0	0	0	0
Sub Total:		**122**	**22**	**22**	**30**	**24**	**24**
% of Total Episodes:		**16.25%**	**2.93%**	**2.93%**	**3.99%**	**3.20%**	**3.20%**

Five sub-expressions of criticizing emerged during my inductive analyses of the intervention's data: proscribed control; societal misalignment; social disorientation; sociotechnical expectations; and loci of social control. Their frequencies are shown in Table 6.3, with their emergence in each session illustrated in Figure 6.12. Each sub-expression is described in the sub-sections below.

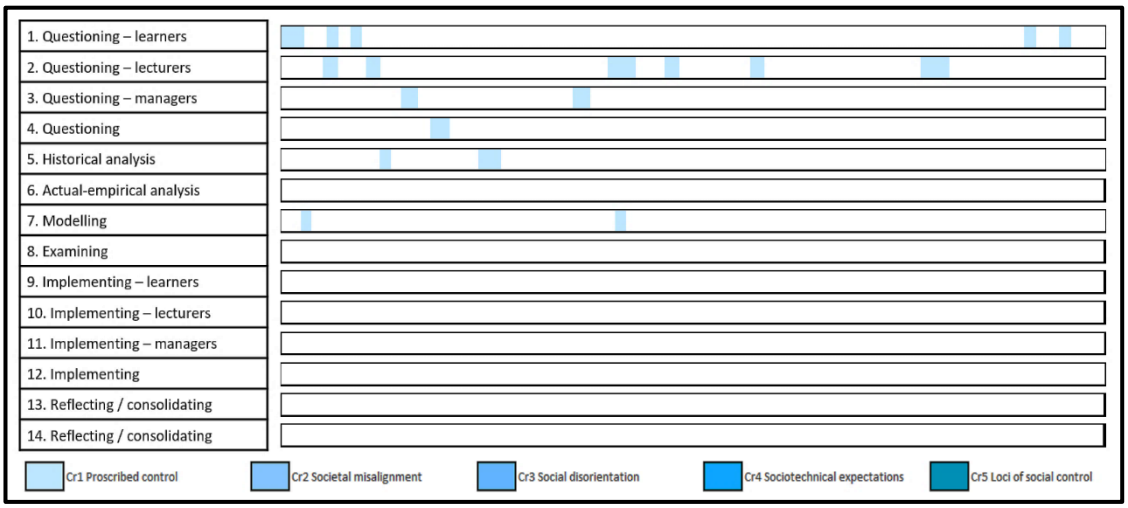
Figure 6.12. Episodes with criticizing sub-expressions emerging in each session

6.3.1 Criticizing proscribed control – Cr1

22 criticizing episodes were directed at the top-down proscription of local control. They referred to frustration with compliance requirements, directives and policies which were felt to stifle creative and innovative TEL. They emergence in the intervention's sessions is shown in Figure 6.13. An example is provided by Heywood, a lecturer, relating personal use versus exchange value contradictions, and secondary contradictions between division of labour and rules:

"… **a lot of us aren't in it for money** {primary contradiction in division of labour} **… and we could do more but there's some clause in the JSP** [Joint Service Publication for defence policy] stopping us being spontaneous, bringing up new people, new stuff {secondary contradiction} … they [strategists] think **going outside exposes some kind of weakness** … nothing's changed other than … buying superficial stuff {criticizing} {primary contradiction in artefacts} … **if it wasn't for them** [policies] **we could make things better**". [*Heywood, Session 2 - questioning*].

Figure 6.13. Episodes with sub-expressions of criticizing proscribed control – Cr1

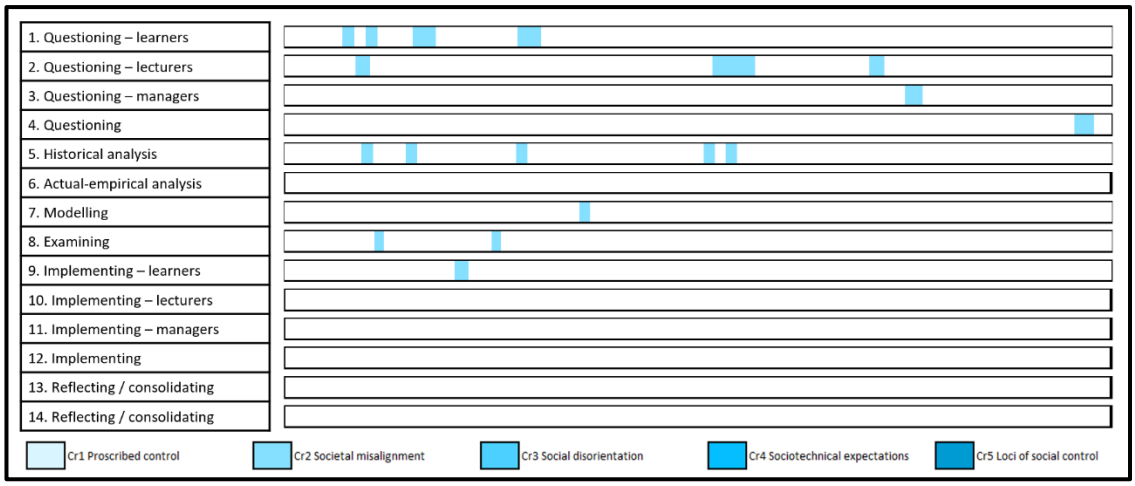


6.3.2 Criticizing societal misalignment – Cr2

In 22 episodes participants criticised societal misalignment of TEL, expressing concerns that 'real' societal problems were being ignored in the 'artificial' context of learning. Their emergence throughout the intervention is shown in Figure 6.14. Participants felt that political systems were insulating their TEL from contemporary societal challenges, which could be lucrative for learning. Here Barnabas, a learner, describes frustrations with these isolationist policies:

"…they're [defence TEL policies] **not fit for purpose** beyond stripping a weapon and using a radio … but if they [managers] ask, we'll still go 'yes these training policies are the best fucking thing ever … good on you' [apparent sarcasm] but **nobody ever thought about aligning us all with the rest of the world** … **I need to be able to talk to civvie** [civilian] **experts … not email my own boss who I'm stood next to** {criticizing}." [*Barnabas, Session 1, questioning*].

Figure 6.14. Episodes with sub-expressions of criticizing societal misalignment – Cr2

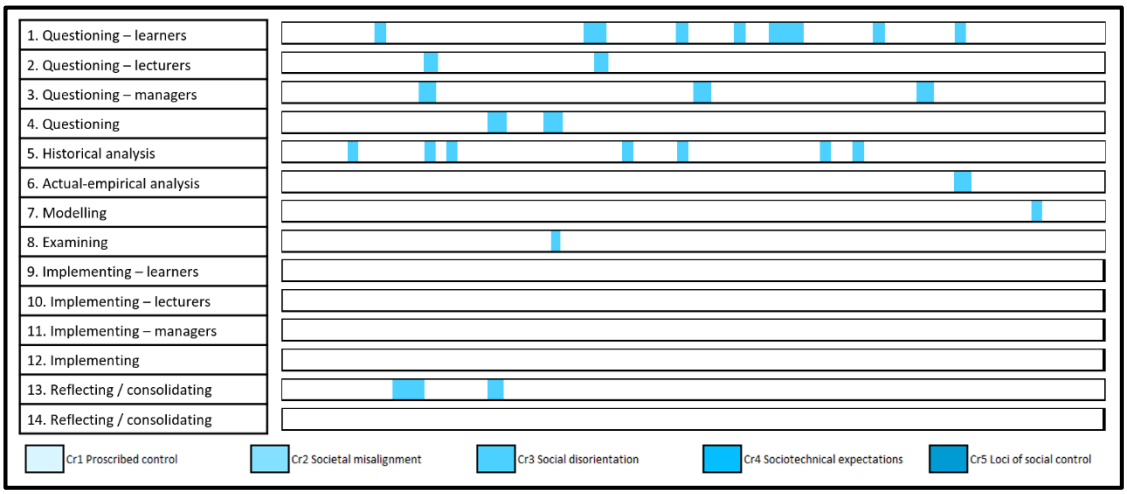


6.3.3 Criticizing social disorientation – Cr3

In 30 episodes participants criticised a lack of social orientation to understanding problems. They described shortfalls of collaborative problem solving in TEL, which had retained disproportionate foci on individual outcomes considered to be vocationally unrealistic. Their emergence is shown in Figure 6.15. In this example Felix, a learner, criticises individualist learning scenarios which he believed to be dated and fixed by prescriptive curricula. He calls upon task stimuli to criticise the ongoing reproduction of individualist practice:

> "… they [managers] get a proper sad on **when we use tech or SME** [subject matter expert] **they've never heard of** [motions to artefacts] **… they don't keep up with things in the real world** … **You can't sit on your own for three hours in** [examination] **with a pen and calculator to be an engineer** … **we need proper help and real-life projects**, not solo exams and assignments …". [*Felix, session 1 – questioning*].

Figure 6.15. Episodes with sub-expressions of criticizing social disorientation – Cr3



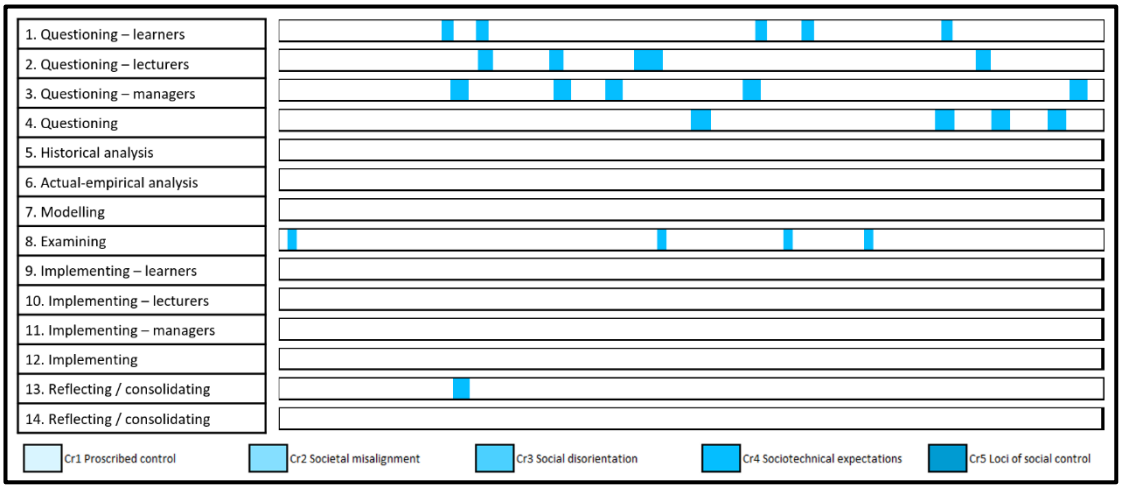
6.3.4 Criticizing sociotechnical expectations – Cr4

24 episodes included sub-expressions directed at sociotechnical expectations, describing blurred distinctions of the roles of technologies and people, including: misappropriating the MOD's secure ICT for teaching and learning; military managers being appointed to supervise TEL with no expertise; and deterministic beliefs of technology's improvement of learning. They emerged as shown in Figure 6.16. In this episode Rhet and Hunter, a learner and lecturer, criticise phenomena which they relate to technological determinism:

> "… **it's just the default setting for us** using DII [Defence Information Infrastructure] and Outlook and MOSS [Microsoft Office SharePoint Server] to try and learn … **ask someone about TEL and they'll say 'you've got the ELE** [enhanced learning environment] **and PowerPoint what more do you want you dicks …'** {criticizing} …". [*Rhet, Session 4 – questioning*].

> "… but **the** [ICT] **rules this place has had to follow** … **we can't pick the tech and the teams we need** [we're] **always starting with the tech we've been saddled with and deciding what we can achieve with it** … the tail wags the dog {criticizing} …". [*Hunter, Session 4 – questioning*].

Figure 6.16. Episodes with sub-expressions of criticizing sociotechnical expectations – Cr4



6.3.5 Criticizing the loci of social control – Cr5

The most future-oriented and collaborative criticizing sub-expressions, numbering 24, were directed at unclear loci of social control of TEL. They were particularly related to rule-bending and rule-breaking, which were accepted by managers, and informally encouraged, yet were not overtly endorsed. These conditions resulted in social uncertainty, with the

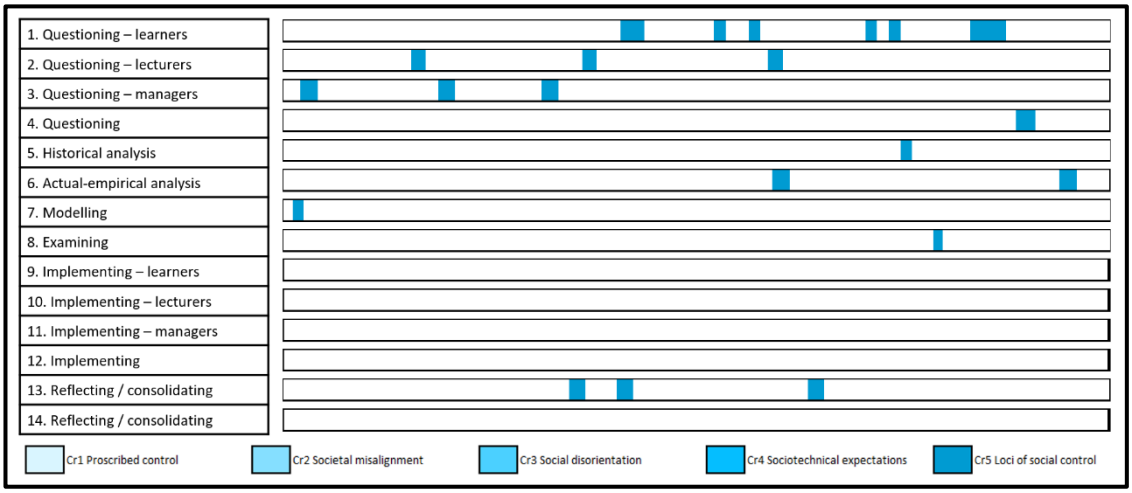
tolerance and loci of control for non-compliance dependent on the personal dispositions of managers. They emerged as shown in Figure 6.17. In the example below Hunter, Gerard and Carlton, a lecturer and two managers, use task stimuli to aggravate related contradictions:

> "… **for as long as we remember we worked around these** [circles rules] … **we've done this for years in spite of them** [circles rules and community]. As for NCs [non-compliances], it's fucking guesswork {criticizing} …". [*Hunter, Session 4 – questioning*].

> "… we'd need to fail something to prove how fucked up this is [rule bending] {criticizing} … **we'd never let it fail …** [irrespective of] **how shit and stuck in the past all of this is** {criticizing} …". [*Gerard, Session 4 – questioning*].

> "… **we can do different going forward, own these** [circles rules] **…** let's **put something in writing about our own non-compliance** …". [*Carlton, Session 4 – questioning*].

Figure 6.17. Episodes with sub-expressions of criticizing loci of social control – Cr5



6.3.6 Summary of criticizing

Figure 6.2 at the opening of this chapter shows how criticizing expressions, in bright blue, emerged along with other expressions. Figure 6.12 isolates the exhibition of each of these criticizing sub-expressions in different shades, whose relative darkness illustrates sub-expressions' increasing future-orientation and collaboration. The initial three sessions of the intervention, conducted by each of the participant sub-groups, began with short episodes including varied criticizing sub-expressions, which tended to alternate with resisting and explicating sub-expressions. As each session progressed these initial staccato episodes tended to coalesce into sequences which became increasingly protracted, future-oriented

and collaborative (from Cr1 to Cr5). The exception to this observation was in the third session, involving the managers' sub-group, whose first exhibited sub-expression criticised activity's loci of control (Cr5). In some contrast to resistance, from the fourth session onwards criticizing sub-expressions became dispersed and isolated from other criticizing sub-expressions. From the fifth session onwards, criticizing sub-expressions were exhibited rarely and in isolation.

In criticizing activity and its historically embedded organisation, participants shifted their collaborative dialogue through shared dilemmas of old ways of solving problems and new problems (Virkkunen, 2006: 57). Prior to the intervention they had invested personal time and effort in the success of their activity, yet in the intervention they collaboratively faced irrefutable evidence of new problems, which threatened those previous investments of time and effort. The shift in dialogue seemed to take them from *acknowledging* conflicting motives through internalisation, towards *exploring* their conflicting motives and negotiating their meaning through externalisation (Sannino, 2010: 840).

In earlier episodes of criticising their current activity, participants were neither wholly accepting of proposals to intervene nor wholly rejecting of them. Instead, through collaborative criticism, the group moved about moments of conflict, using their artefact-stimuli to criticise and negotiate in ways which could be described as dialectical development (Virkkunen & Newnham, 2013b: 30). Criticizing thus joins resistance, as an expression which yielded neither direct proposals for change nor concretised forms of change, but which did appear to change the participants themselves. This seems particularly noticeable in the engendering of subsequent expressions, which were legitimised through social acts of collaborative criticism.

6.4 Explicating new possibility and potential for the activity

Figure 6.18 isolates episodes which included expressions of explication, showing fairly level frequencies at around 14 episodes per session for the first third, around 30 episodes per session for the middle third, and low or negligible episodes for the last third other than a moderate rise during collaborative reflection in session 13. Figure 6.19 shows that explication was the most frequent expression to be directed at activity's artefacts, subject, rules, community and division of labour.

Figure 6.18. Episodes with expressions of explication (Y axis) in sessions (X axis)

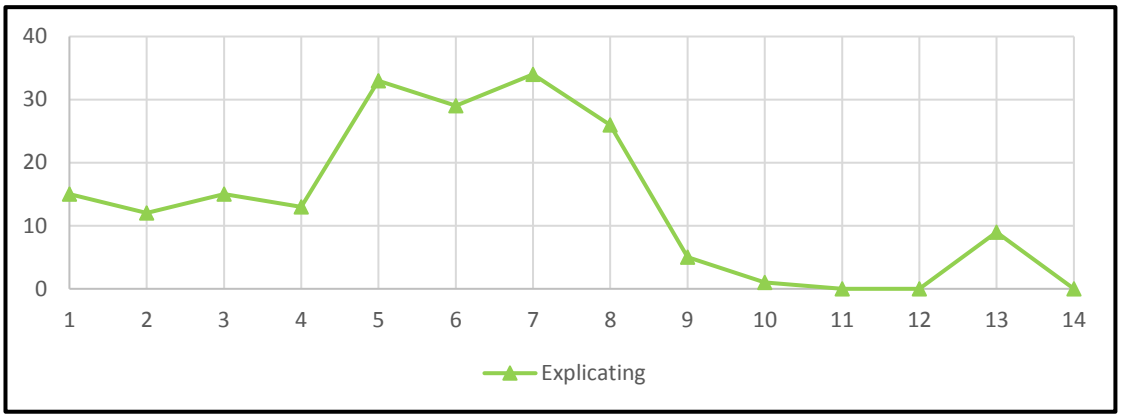
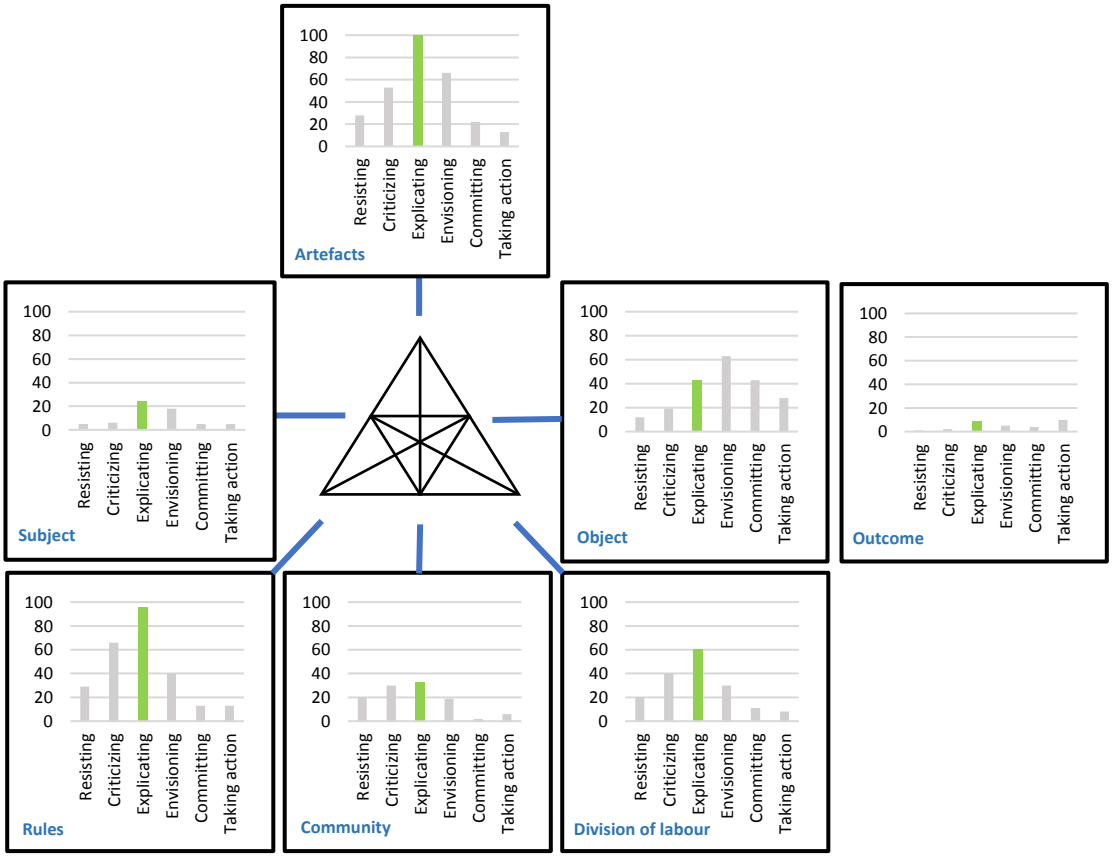


Figure 6.19. Episodes of explication (in green) related to activity's nodes

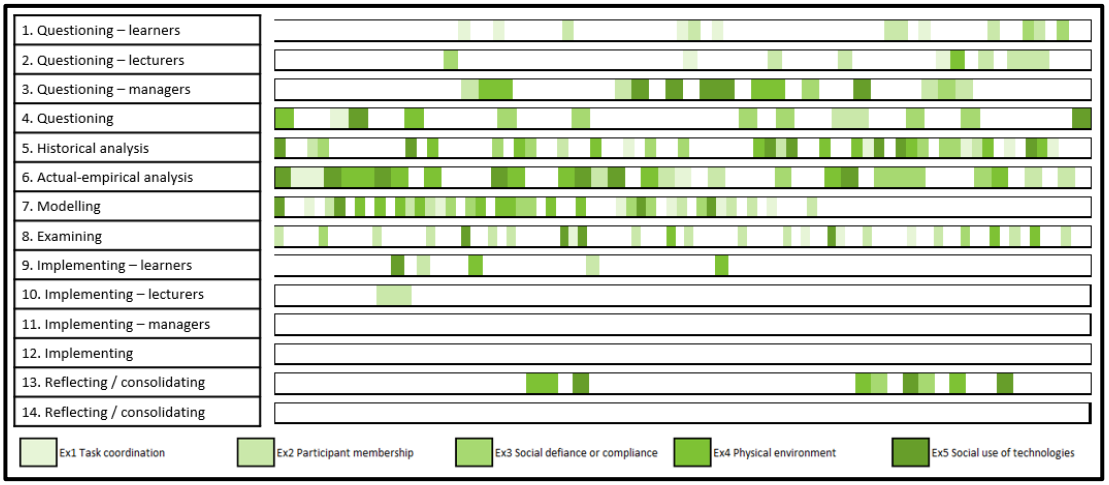


In total, 192 episodes across the intervention included expressions of explication. Five explicating sub-expressions were identified during inductive analyses: explicating potential for task co-ordination; explicating possibilities for changing participant membership; explicating the potential of social defiance or compliance; explicating potential for the physical environment; and explicating possibilities for the social use of technologies. Their frequencies are shown in Table 6.4, with their emergence in sessions illustrated in Figure 6.20. Each sub-expression is then described in some detail and exemplified in the sub-sections below.

Table 6.4. Episodes with explicating sub-expressions

		Ex Explicating	Ex1 Task co-ordination	Ex2 Participant membership	Ex3 Social defiance or compliance	Ex4 Physical environment	Ex5 Social use of technologies
Session	1. Questioning - learners	**15**	7	6	2	0	0
	2. Questioning - lecturers	**12**	2	6	2	2	0
	3. Questioning - managers	**15**	0	4	2	4	5
	4. Questioning	**13**	1	2	6	2	2
	5. Historical analysis	**33**	5	4	8	9	7
	6. Actual-empirical analysis	**29**	4	5	5	9	6
	7. Modelling	**34**	6	7	7	9	5
	8. Examining	**26**	4	12	2	4	4
	9. Implementing - learners	**5**	0	2	0	2	1
	10. Implementing - lecturers	**1**	0	1	0	0	0
	11. Implementing - managers	**0**	0	0	0	0	0
	12. Implementing	**0**	0	0	0	0	0
	13. Reflecting / consolidating	**9**	0	0	2	4	3
	14. Reflecting / consolidating	**0**	0	0	0	0	0
Sub Total:		**192**	29	49	36	45	33
% of Total Episodes:		**25.57%**	**3.86%**	**6.52%**	**4.79%**	**5.99%**	**4.39%**

Figure 6.20. Episodes with explicating sub-expressions emerging in each session



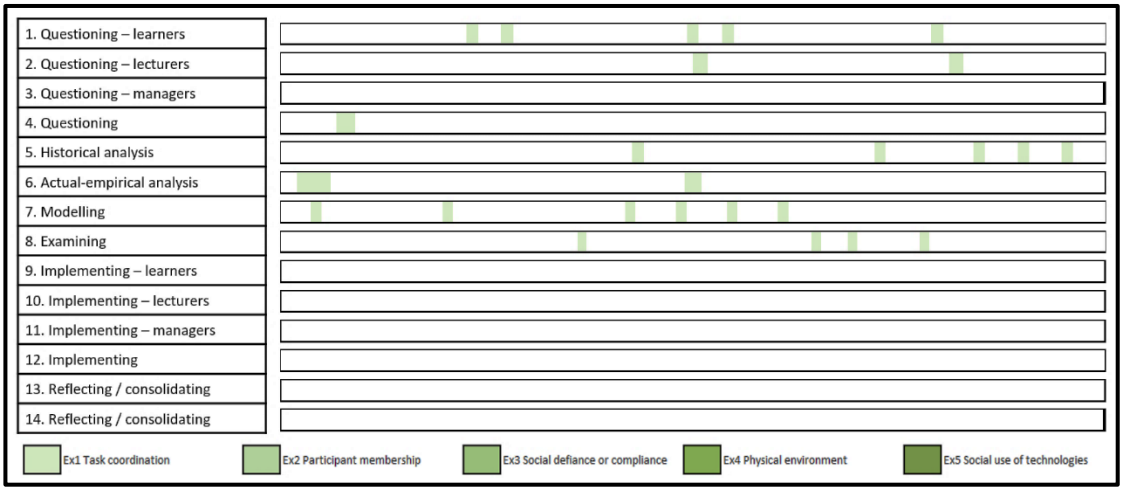
6.4.1 Explicating potential for task co-ordination – Ex1

Sub-expressions which explicated the possibilities for further task co-ordination numbered 29 and included prospective accounts of: co-ordination between current participants; engaging with stakeholders beyond the organisation; and asynchronous task co-ordination of project collaborators at different points in time and space. Their emergence is shown in Figure 6.21. In the example below Hunter, a lecturer with experience as an engineering practitioner on the defence estate, explicates potential for realistic co-ordination of work and learning with other stakeholders in defence:

> "… **we need to grow it** [co-ordination of work and learning] **massively** … this stuff [mirror data] could come from the FM [facilities management] work on [overseas Royal Air Force sites] … **we had to pass things around, freeze information, thaw it after a few years … I know they'd help us out,** show us how important it [co-

ordination] is on real jobs because they'll inherit the people who are better prepared to work there {explicating} …". [*Hunter, Session 4, questioning*].

Figure 6.21. Episodes with sub-expressions explicating potential for task co-ordination – Ex1

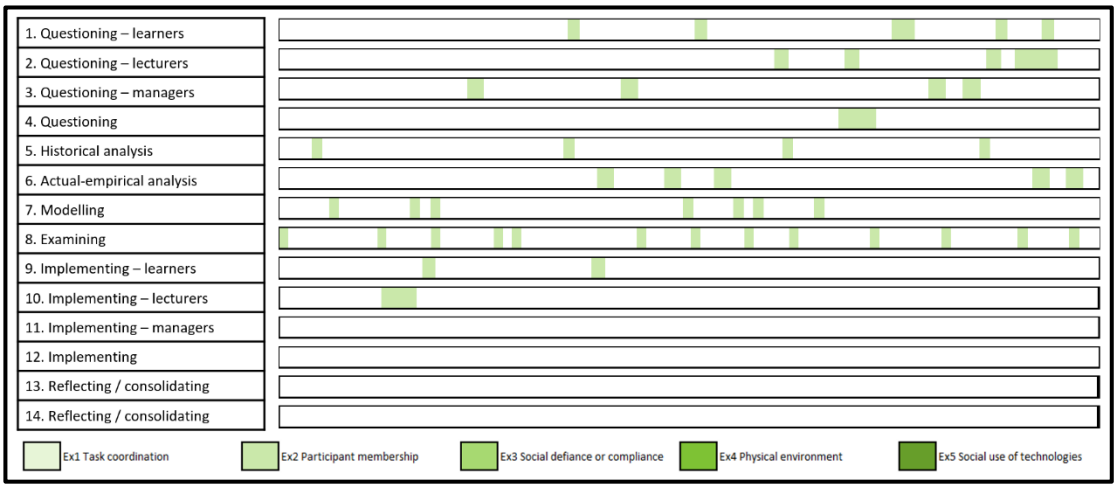


6.4.2 Explicating possibilities for changing participant membership – Ex2

49 episodes explicated potential to change participant membership of TEL activity. Proposed changes led to the aggravation of secondary contradictions through involving more, less or different direct participants (subject) or interested parties (community). Their emergence is shown in Figure 6.22. In this example Carlton, a manager, uses task stimuli to explicate engaging with civilian experts:

> "Can't the industrial attachment be extended … include CNI [Critical National Infrastructure] … **visit people running them** … see people do boundary-crossing with industry … **make it all normal** {explicating} **… talk to real experts out there** [motions to community and out of window]". [*Carlton, session 6 – actual-empirical analysis*].

Figure 6.22. Episodes with sub-expressions explicating participant membership – Ex2



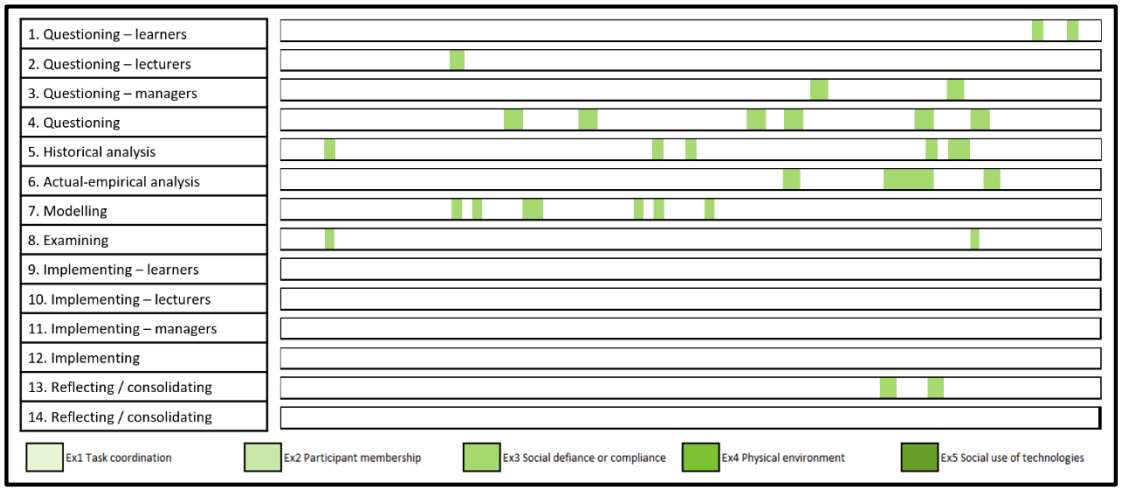
6.4.3 Explicating the potential of social defiance or compliance – Ex3

Sub-expressions explicating the potential for direct, co-ordinated and overt defiance or compliance were evident in 36 episodes. These acts were considered more enduring than individual acts, which were deemed effective only in the short-term and to those taking action. Their emergence is shown in Figure 6.23. The following dialogue with Carlton and Brandt, a learner and manager, exemplifies defiance by overtly rejecting rules, whilst they interact with their task stimuli on surfaces:

> "… **we lost our way with just about all of this** [motions to whole activity system] **so we pretend it's fine** {criticizing current activity} **why don't we just be honest they can't sack us all** [laughter] … **it** [activity] **needs to change beyond just us** {understood motive} … **but there's no-one else here to do it, we've got to do it to suit those of us who'll actually use it** {effective motive} …". [*Carlton, session 5 – historical analysis*].

> "… let's just get it done for us first {effective motive} **we'll publish this** [motions to object] **to suit reality …** rather than hiding non-compliance on principle … **prove the point about IT** [motions to artefacts] **and the work we'll be getting in down the road** [motions to division of labour] {understood motive} **… like you said they can't sack us all … let's do it even if it pisses people off** …". [*Brandt, session 5 – historical analysis*].

Figure 6.23. Episodes with sub-expressions explicating potential of social defiance or compliance – Ex3



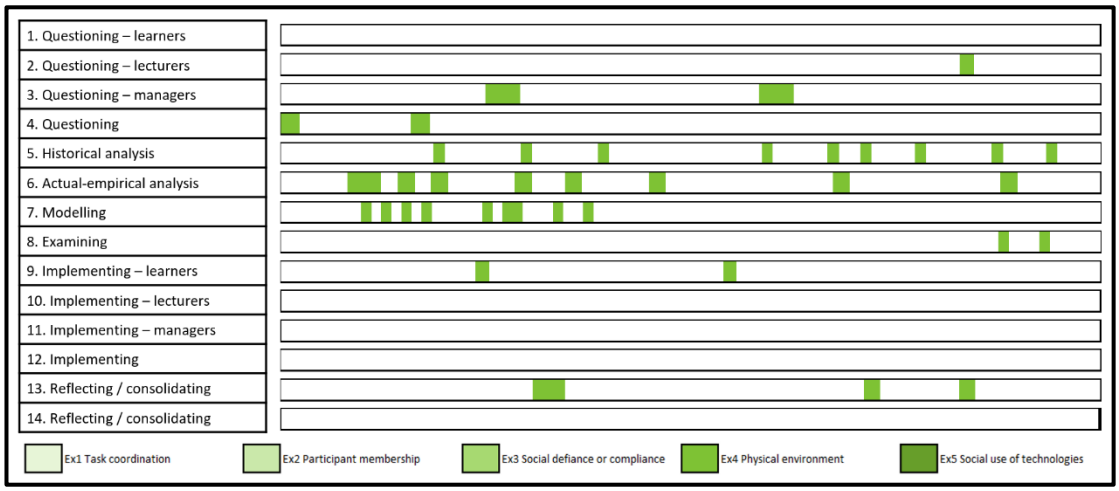
6.4.4 Explicating potential for the physical environment – Ex4

Explicating potential for adapting the physical environment totalled 45 episodes, proposing changes to work and learning spaces in terms of their layout, technological configuration,

permanence and geographical location. Their emergence is shown in Figure 6.24. The following comment by Rhet, a learner, includes springboards from other TEL to explicate physical environments becoming more vocationally realistic. He firstly proposes replicating a work area at the School, then proposes moving learning to an environment representing realistic, geographically distal and remote TEL:

> "… **the last job I was on at** [a UK overseas permanent joint operating base] **we did everything on our own kit and … uploaded it all to MOSS** [Microsoft Office SharePoint Server], maybe we could do that sort of thing here {explicating} … We had no PCs, no networking kit, no logins for their network {artefacts}, nothing … we wouldn't have done a fucking thing for six months if it was like here [motions to rules] {explicating} … **we should make this place look like and feel like it was there … real life … it'll highlight how we cope with real life problems** for working together and getting hold of people to help … actually **we can even get away from being here** [RSME site] **at all so we've got no choice to but do it realistic** …". [*Rhet, Session 4 – questioning*].

Figure 6.24. Episodes with sub-expressions explicating potential for the physical environment – Ex4



6.4.5 Explicating possibilities for social use of technologies – Ex5

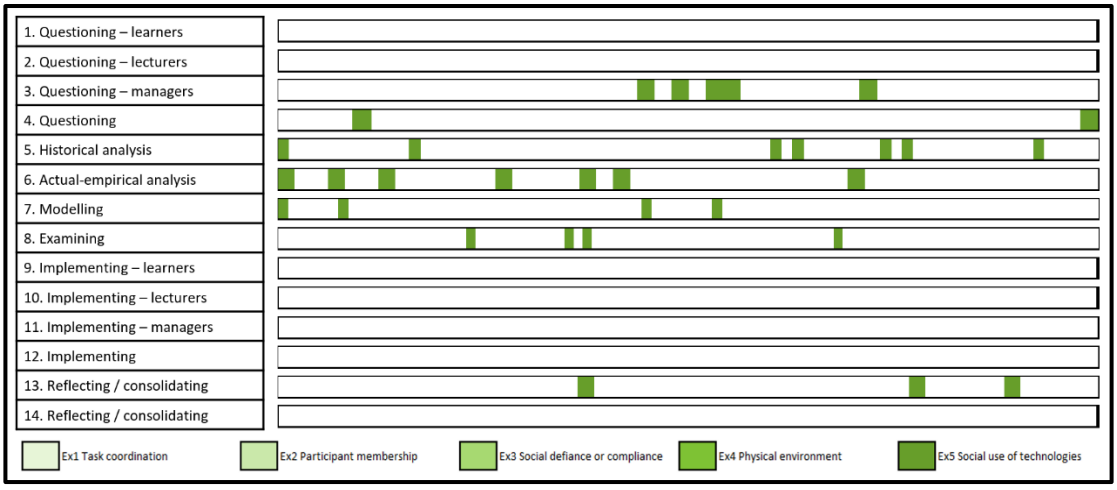
Explicating possibilities for social use of technologies were in 33 episodes. They described the potential to change TEL from historically embedded individualist tasks, to team-based collaborations. Possibilities were raised where participants contribute to social activity at different times and in different locations. Their emergence is shown in Figure 6.25. An important transitional episode involves Lancelot and Percey, a learner and manager

respectively, explicating potential for the object of their new activity, to assist them in recontextualising the activity's rules and artefacts:

> "… them rules [defence TEL policy] were left behind when all this [motions at object and outcome] moved on … **it might help if we try to think of this** [motions to object] **… changing and getting knocked about over the years but the other stuff not shifting, even though it's** [motions to object] **the reason for us being here … if I put as an object here** [motions to object] **… 'just enough to pass courses at the RSME' … it's fine** … **nothing in that about realism … no joint work with proper experts … so we've got to make that object fit** {explicating} … rather than it [object] just rumbling along …". [*Lancelot, session 6 – actual empirical analysis*].

> "… that's right … **you'd still suit that object** [motions to old object]**, but not today's** [motions to new activity] … **the object's got to be a bit future proof for changing teams** {explicating} ..." [*Percey, session 6 – actual empirical analysis*].

Figure 6.25. Episodes with sub-expressions explicating possibilities for social use of technologies – Ex5



6.4.6 Summary of explicating

Figure 6.2 at the opening of this chapter shows how explicating expressions, in green, emerged along with other expressions. Figure 6.20 isolates explicating sub-expressions in different shades of green, whose relative darkness illustrates their increasing future-orientation and collaboration. The initial three sessions, conducted by participant sub-groups, show explicating sub-expressions interspersed with resisting and criticizing sub-expressions. The third session, for managers, shows explicating sub-expressions fusing, becoming more future-oriented and collaborative and directed at the physical environment

(Ex4) and the social use of technologies (Ex5). In the subsequent four plenary sessions, all explicating sub-expressions were exhibited, amalgamating in historical analyses (the sequence alternating from Ex2 to Ex 5 in the latter third of that session) and in actual-empirical analyses (most notably alternating between Ex3, Ex4 and Ex5 in the first half of that session).

In modelling and examining, these explicating sub-expressions reverted to alternating patterns across the range of Ex1 to Ex5, mainly interspersed with envisioning, and then diminishing in the sub-group sessions for implementation. There were no apparent expressions of explication in the sub-group session of managers' implementation, nor in the twelfth session, which was the plenary for implementation. In analysing explication, the most prevalent characteristic of Activity Theory was the notion of collective and object-oriented activity, which may relate to explication diminishing after the sessions for modelling and examination of activity. This was evidenced in task stimuli for establishing how actions contributed to activity, edited individually in workbooks and collaboratively on surfaces.

The most qualitatively transformative dilemmas were between understood and effective motives (Virkkunen, 2006: 52), provoking negotiations which oscillated about moments. These provoked progressively social and future-oriented sub-expressions: at one pole lay participants' acceptance of the societal value and intent for their activity, intellectually understanding motives for development; at another pole lay their own effective motives, with their personal goals and interests. These dilemmas would normally be expected at the outset of an intervention (ibid.), yet this project's participants, with embedded shared histories of rule bending, already had a relatively developed shared understanding of individual and systemic motives. Perhaps that shared understanding suppressed their dilemmas of motives, to be resurrected when explication dominated the middle third of the intervention, illustrated by the peak in Figure 6.18.

6.5 Envisioning new potential for developing the activity

Figure 6.26 isolates expressions of envisioning which emerged in the intervention's sessions. Episodes with envisioning sub-expressions were evident in almost all of the sessions, with a fairly even rise and fall either side of a peak in the mid-point of 36 episodes, which was during modelling. Figure 6.27 shows that envisioning was relatively mid-range in terms of its frequencies for nodes of activity, other than the object for which it was the most frequent

expression. It was the second most frequent expression to be directed at the subject and artefacts.

Figure 6.26. Episodes with expressions of envisioning (Y axis) in sessions (X axis)

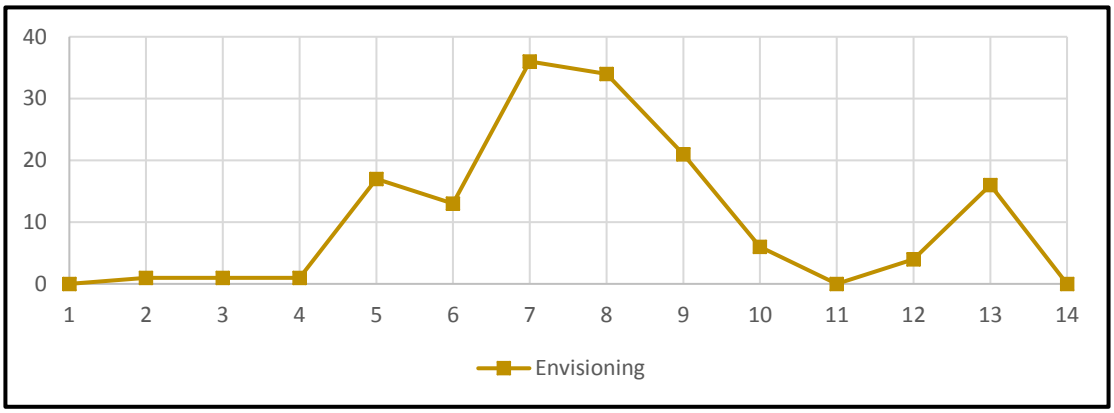
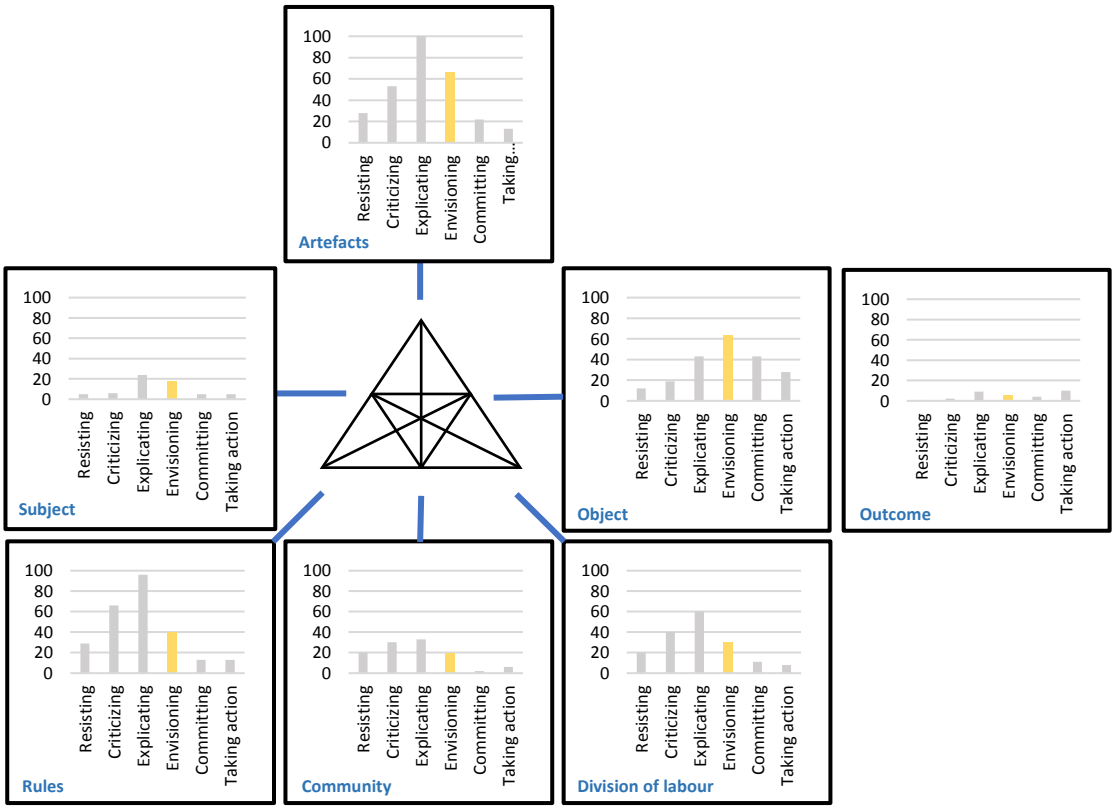


Figure 6.27. Episodes of envisioning (in golden yellow) related to activity's nodes



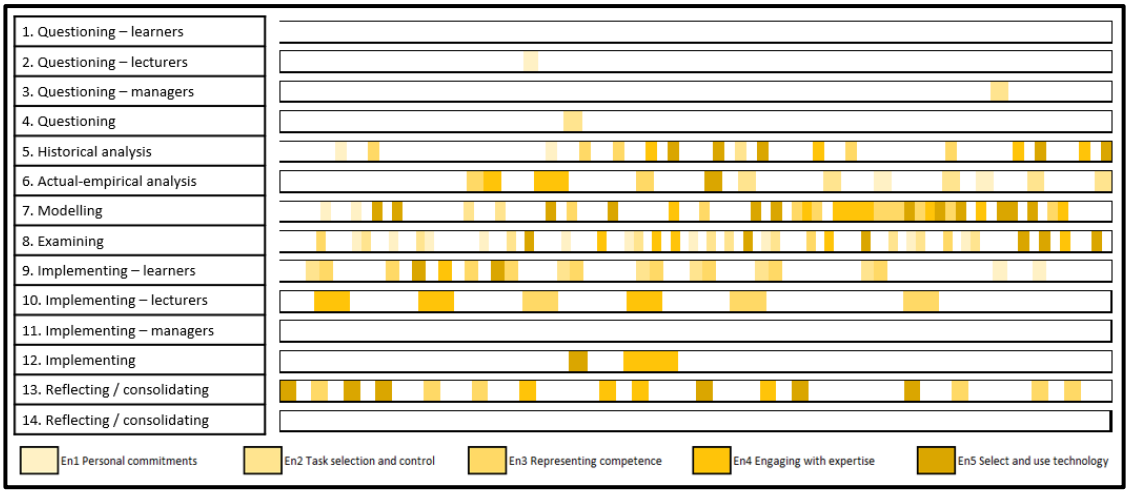
Modelled activity systems, expansive cycles and other tertiary artefacts were increasingly called upon as second stimuli, to assist participants' understanding of contradictions and to make envisioning proposals. Episodes became more protracted in the latter half of the eighth session and correspondingly these episodes contained more words per turn and a reduction in their frequencies. Figure 5.1 in the previous chapter illustrates escalating counts of words per turn from the sixth to ninth sessions, a rise which corresponds with

these sessions when envisioning began to gain dominance in the intervention. There were five sub-expressions of envisioning which emerged during inductive analyses of the data: personal commitment; task selection and control; representations of competence; engaging with expertise; and selecting and using technologies. A total of 149 episodes in the intervention included expressions of envisioning. Their frequencies for each session are shown in Table 6.5, with their emergence in each session in relation to other sub-expressions illustrated in Figure 6.28. Each sub-expression is then described and exemplified in some detail in the sub-sections below.

Table 6.5. Episodes with envisioning sub-expressions

		En Envisioning	En1 Personal commitment	En2 Task selection and control	En3 Representing competence	En4 Engaging with expertise	En5 Select and use technologies
Session	1. Questioning - learners	**0**	0	0	0	0	0
	2. Questioning - lecturers	**1**	1	0	0	0	0
	3. Questioning - managers	**1**	0	1	0	0	0
	4. Questioning	**1**	0	1	0	0	0
	5. Historical analysis	**17**	2	1	5	4	5
	6. Actual-empirical analysis	**13**	2	5	2	3	1
	7. Modelling	**35**	2	2	10	9	12
	8. Examining	**34**	10	10	3	5	6
	9. Implementing - learners	**21**	3	6	9	1	2
	10. Implementing - lecturers	**6**	0	0	3	3	0
	11. Implementing - managers	**0**	0	0	0	0	0
	12. Implementing	**4**	0	0	0	3	1
	13. Reflecting / consolidating	**16**	0	0	6	4	6
	14. Reflecting / consolidating	**0**	0	0	0	0	0
Sub Total:		**149**	20	26	38	32	33
% of Total Episodes:		**19.84%**	**2.66%**	**3.46%**	**5.06%**	**4.26%**	**4.39%**

Figure 6.28. Episodes with envisioning sub-expressions emerging in each session



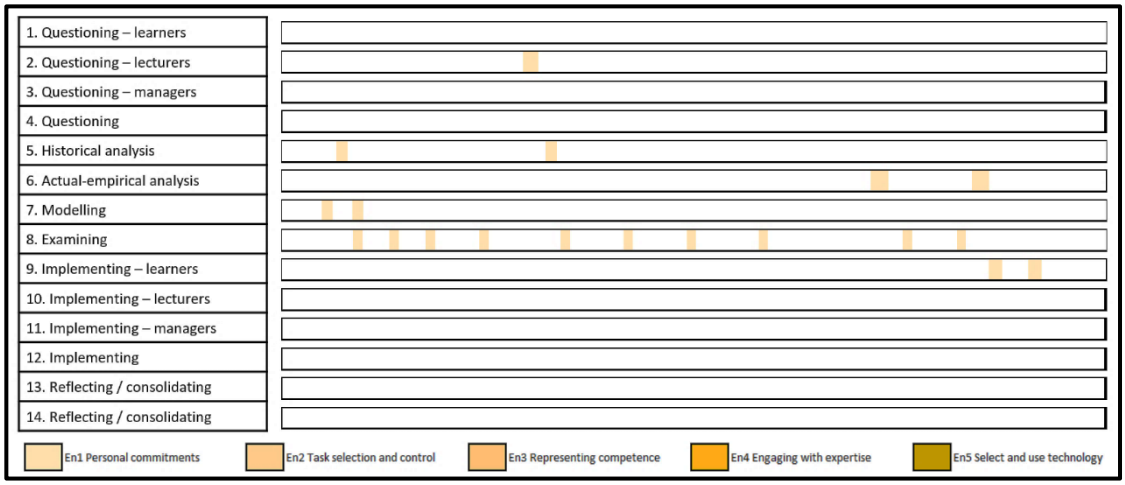
6.5.1 Envisioning personal commitments – En1

Sub-expressions which envisioned changes to personal commitments were in 20 episodes. They included relatively detailed suggestions to increase or reduce one's own involvement in problematic activity. Their emergence is illustrated in Figure 6.29. In this extract Percey, a

manager, envisions change with his manager colleagues, oscillating about moments between: contemplating his individual commitment to resolving problematic activity; and the comfort afforded by distanced intellectual reflection. Mere contemplation seems unsustainable if change is to succeed, yet attractive in avoiding personal responsibility:

> "… the way that it is here [newly modelled activity system] **… when we go public … we need to make sure that they're** [learners and lecturers] **protected** better than now {envisioning} **… we've been talking too long and not doing a fucking thing about it … but it also means that I've got to do the bits my name's next to, which means an own goal** … fuck it let's rip the plaster off and stop banging on about how shit and unfair everything is …". [*Percey, session 9 – implementing for managers*].

Figure 6.29. Episodes with sub-expressions envisioning personal commitments – En1



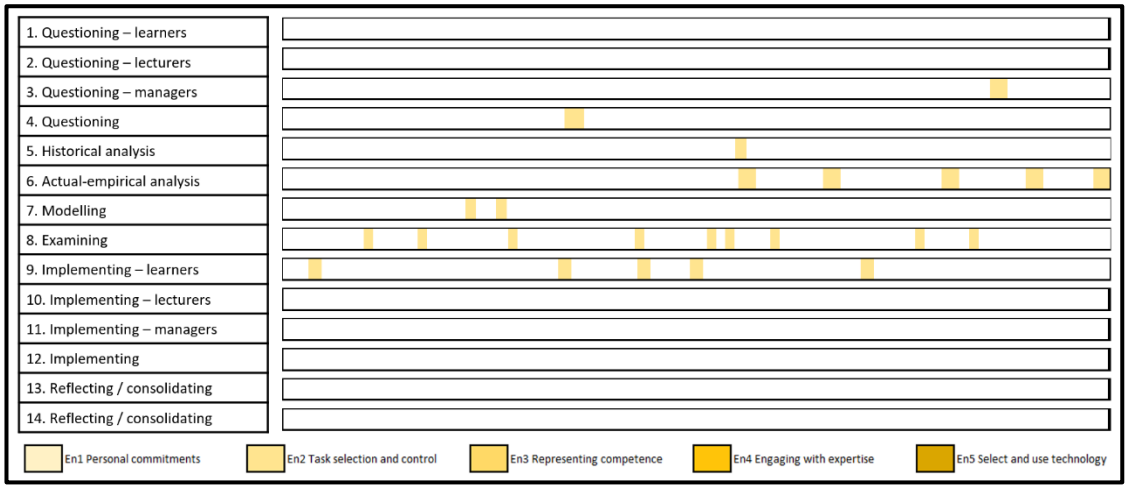
6.5.2 Envisioning task selection and control – En2

Envisioning changes to the selection and control of tasks were in 26 episodes. They related to perceptions that pre-ordained TEL scenarios could better prepare for vocational challenges, if they included qualitative value and realism. Envisioned changes included: contemporary societal scenarios, rather than dated individual tasks; validating the support of team learning, in addition to assessing individual performance; assessing the ability to meet end-user needs, rather than using pre-ordained rubrics; and including emerging technologies and practices, rather than rehearsing established practice. Their emergence is illustrated in Figure 6.30. This example from Warwick, a learner, envisions changes to the RSME's task specifications for its TEL programmes:

> "… that [model of activity] helped us work out **what we needed to change for people looking back on us one day** {envisioning} … we're fucked because we've done it so

long … but … **we need to be able to get into picking things** [circles artefacts] **ourselves that are real … defining real work problems … how we'll solve them and who needs to help us** [circles community]**, not just churn out something that's a bit different from what they did last year and the year before that, or what this lot** [points to participating managers] **did in their day, just to pass and escape from here** …". [*Warwick, Session 9 - implementing*].

Figure 6.30. Episodes with sub-expressions envisioning task selection and control – En2



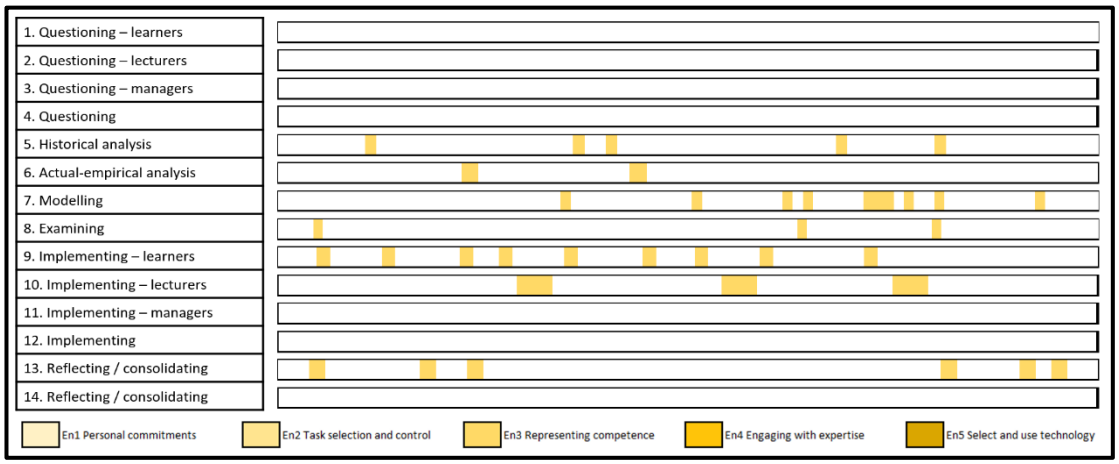
6.5.3 Envisioning the representation of competence – En3

In envisioning changes to representations of competence, sub-expressions proposed redefining notions such as proficiency and expertise, and how they ought to be exhibited. A total of 38 episodes, illustrated in Figure 6.31, proposed redefining competence from the established completion of prescribed tasks to the social negotiation of problems with diverse experts. Here Allyn and Jared, two learners, envision such changes:

"… **what being good at your job means is different now**, and will be again … **that old one** [motions to modelled old activity] … it's nothing like what we do now, **and we need to see where we don't want to be again** … **compare old and new** [activities] **side-by-side on here** [surfaces], so that'll be like watching the tennis, old against new [activity system] …". [*Allyn, session 7 – modelling*].

"… it's going to be future proof and not get fucked over by these rules coming back to bite us on the arse {secondary contradictions} … **now we've changed the object …** to reflect a proper task team … **good would look like being able to define a problem, and solve it in the most appropriate way, not an exam or copying out them old ideas** {envisioning} ...". [*Jared, session 7 – modelling*].

Figure 6.31. Episodes with sub-expressions envisioning representation of competence – En3

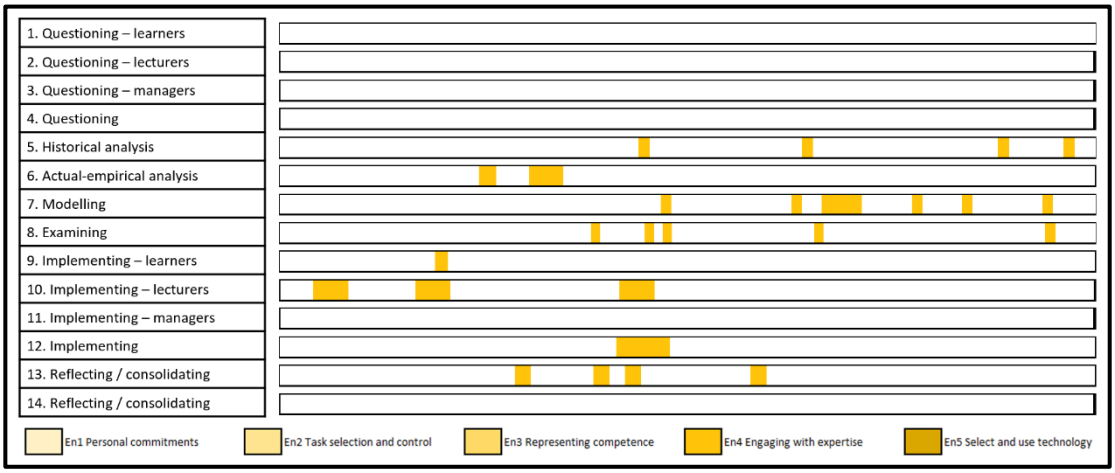


6.5.4 Envisioning engaging with expertise – En4

Envisioning potential for changes to engagement with experts was in 32 episodes. They included adapting the informal and formal rules of learning with people outside the RSME. Rules for regulating social practice were envisioned as lucrative for TEL's improvement, in how participants could identify, and engage with, external experts. Their emergence is illustrated in Figure 6.32. Here Gerard, a manager, envisions such change for managers:

> "… **I'm not really sure what we can actually do in terms of real change to these** [motions to rules] **going to outside experts …** we need to make it obvious and normal to everyone … **more acceptable, maybe even go public in a few case studies** {envisioning} … **risks are owned by us** [managers] **…** we know it happens and why, we're aware of the **shit storm between local practice and policy** [motions to rules] … and from not being able to use defence IT with civvie [civilian] experts [motions to artefacts] …". [*Gerard, session 9 – implementing for managers*].

Figure 6.32. Episodes with sub-expressions envisioning engaging with expertise – En4



6.5.5 Envisioning the selection and use of technologies – En5

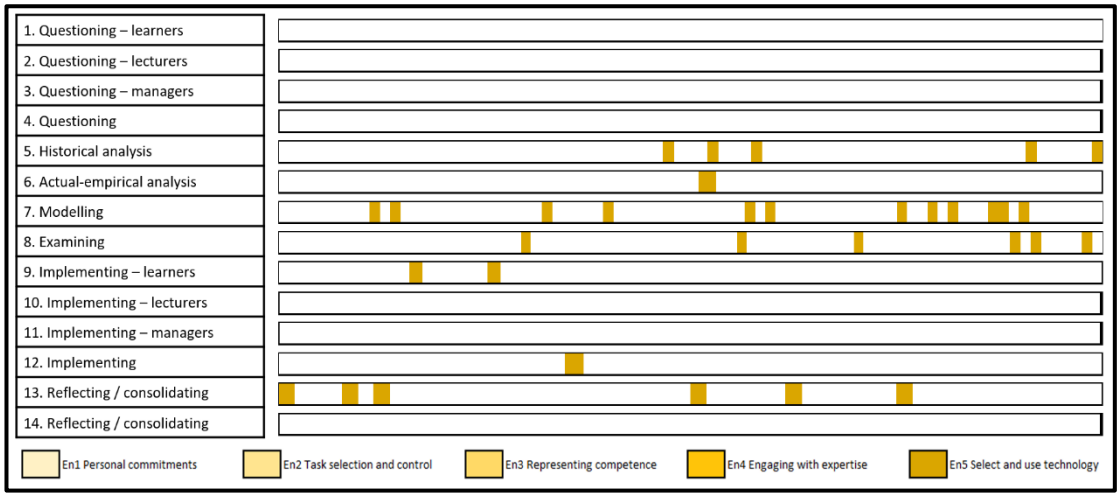
In envisioning their ability to select and use technology, participants foresaw their empowerment to accept, reject and adapt technologies and how they were used in TEL. In these 33 episodes, secondary contradictions were of particular epistemic interest to engendering and sustaining sub-expressions, as shown in the transitional episode below. Their emergence is illustrated in Figure 6.33. Here Jared, Felix and Paderau, two learners and a lecturer, engage with surfaces to collectively envision their influence over technologies:

> "… the point of all this … accessing expertise in CNI [critical national infrastructure] at the time and point of need … **that object** [circles object] **then booms … across the rest of these** [motions to nodes] … giving the rest of it more meaning but **it might also fuck things up … like that subject changing** {secondary contradictions} … **we really do need different tech … or we can't do any of it** {envisioning} …". [*Jared, session 7 – modelling*].

> "… **now you've done that with the subject … we'd need to see if we're using them** [technologies] **for work reports or to learn with** {primary contradiction} which could fuck up the rules [motions to rules then to division of labour] … **look at that subject … now this bit** [artefacts] **massively matters now the subject's changed** {secondary contradictions} …". [*Felix, session 7 – modelling*].

> "That was the same with this [community] changing, see **who you'll be using them** [artefacts] **with** {secondary contradictions} …". [*Paderau, session 7 – modelling*].

Figure 6.33. Episodes with sub-expressions envisioning selection & use of technologies – En5



6.5.6 Summary of envisioning

Figure 6.2, at the opening of this chapter, shows how envisioning expressions, in golden yellow, emerged along with other expressions. Figure 6.28 isolates envisioning sub-expressions in different shades of golden yellow, whose relative darkness illustrates increasing future-orientation and collaboration. Whilst some isolated sub-expressions of envisioning were exhibited in early sessions, they gained momentum from historical analyses onwards, with sub-expressions of representing competence (En3), engaging with expertise (En4) and technologies (En5) being prevalent. These three sub-expressions alternated in dominance across the seventh, eighth and ninth sessions, where envisioning was the prevalent main expression (see e.g. Figure 6.1). These three sub-expressions (En3, En4 and En5) coalesced and alternated, forming an extended sequence in the latter third of the seventh session. Occasional gaps were occupied by commissive sub-expressions. In some contrast, the subsequent session on examining returned to a steady staccato progression of envisioning sub-expressions, which alternated mainly with explicating and committing. They incrementally progressed from individual, here-and-now sub-expressions such as personal commitments (En1) and task control (En2) through to socially oriented sub-expressions of representing competence (En3), engaging with wider expertise (En4) and collaborative technologies (En5). Envisioning sub-expressions then lost their dominance, although they retained significance into the tenth session.

Turning points and transitional episodes in these envisioning episodes were characterised by multi-voiced disagreements of the object of activity and its effect on activity's other elements. These negotiations culminated in the social identification and aggravation of contradictions, visualising and modelling change and predicting repercussions. In my analyses I have somewhat over-simplified the related social endeavour of identifying the germ cell of the activity, which was a necessary precursor to envisioning activity's development; this abstraction of the germ cell seems apparent in the previous chapter's raw data. Transitional episodes of envisioning seemed to project the shared object and motives of the activity's germ cell, as attention turned to future-oriented proposals: on one hand, participants perceiving of themselves as analysts of problematic activity; on the other hand, seeing themselves as practitioners and the subject of the very activity they were envisioning changes to (Virkkunen, 2006: 54). Participants were assisted in these dilemmatic and emotive negotiations by the identification and curation of their own stimuli and mirror data.

6.6 Committing to concrete actions aimed at changing the activity

Figure 6.34 isolates transitional episodes in the intervention with commissive expressions. It shows a noticeable jump from occasional expressions (from zero to five per session) in the first half, to an M-shaped distribution of committing in the latter half of the intervention, peaking at 22 episodes in the twelfth session. Figure 6.35 shows that committing is directed most notably at the activity's object for which it was the second most frequent expression. For other nodes of activity, it was amongst the lowest of exhibited expressions.

Figure 6.34. Episodes with expressions of commitment (Y axis) in sessions (X axis)

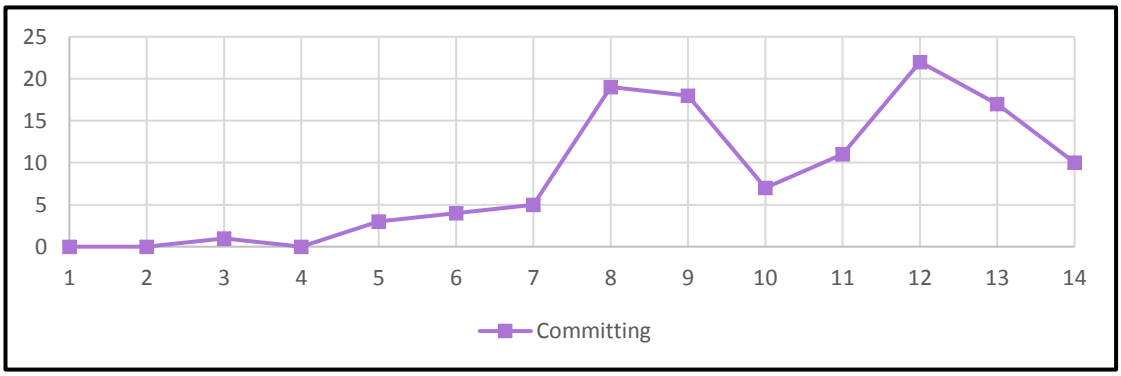
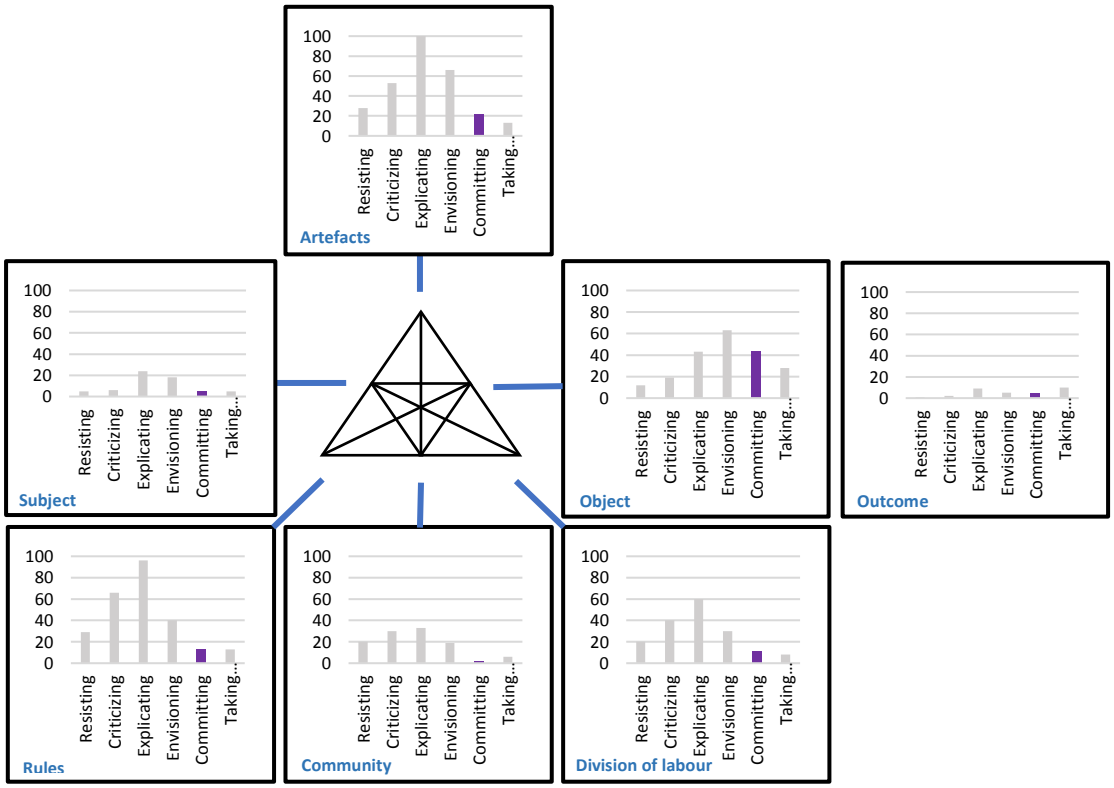


Figure 6.35. Episodes of commitment (in purple) related to activity's nodes



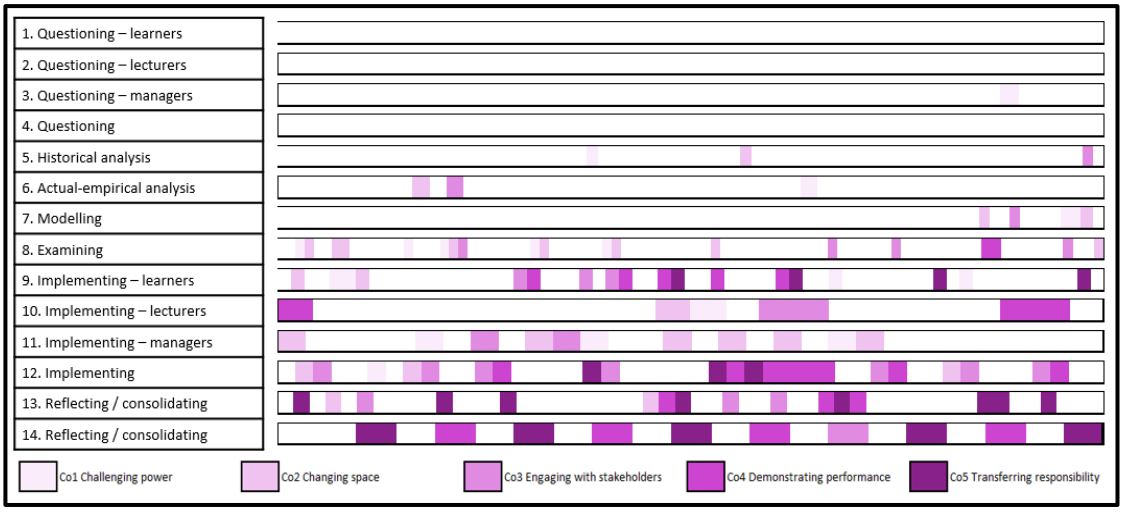
When identifying and analysing commissive sub-expressions, the notion of contradictions as drivers of change was deemed to be the most significant principle of Activity Theory. Five

types of commissive sub-expressions were evident in the inductive analyses: challenges to power; changing space; engaging with stakeholders; demonstrating performance; and transferring responsibility. Their frequencies are in Table 6.6, with their emergence across the intervention's sessions illustrated in Figure 6.36.

Table 6.6. Episodes with commissive sub-expressions

		Co Committing	Co1 Challenging power	Co2 Changing space	Co3 Engaging with stakeholders	Co4 Demonstrating performance	Co5 Transferring responsibility
Session	1. Questioning - learners	**0**	0	0	0	0	0
	2. Questioning - lecturers	**0**	0	0	0	0	0
	3. Questioning - managers	**1**	1	0	0	0	0
	4. Questioning	**0**	0	0	0	0	0
	5. Historical analysis	**3**	1	1	1	0	0
	6. Actual-empirical analysis	**4**	1	1	2	0	0
	7. Modelling	**5**	2	2	1	0	0
	8. Examining	**19**	5	8	4	2	0
	9. Implementing - learners	**18**	4	2	3	5	4
	10. Implementing - lecturers	**7**	1	1	2	3	0
	11. Implementing - managers	**11**	3	6	2	0	0
	12. Implementing	**22**	1	3	7	8	3
	13. Reflecting / consolidating	**17**	0	2	3	4	8
	14. Reflecting / consolidating	**10**	0	0	1	4	5
Sub Total:		**117**	19	26	26	26	20
% of Total Episodes:		**15.58%**	**2.53%**	**3.46%**	**3.46%**	**3.46%**	**2.66%**

Figure 6.36. Episodes with commissive sub-expressions emerging in each session

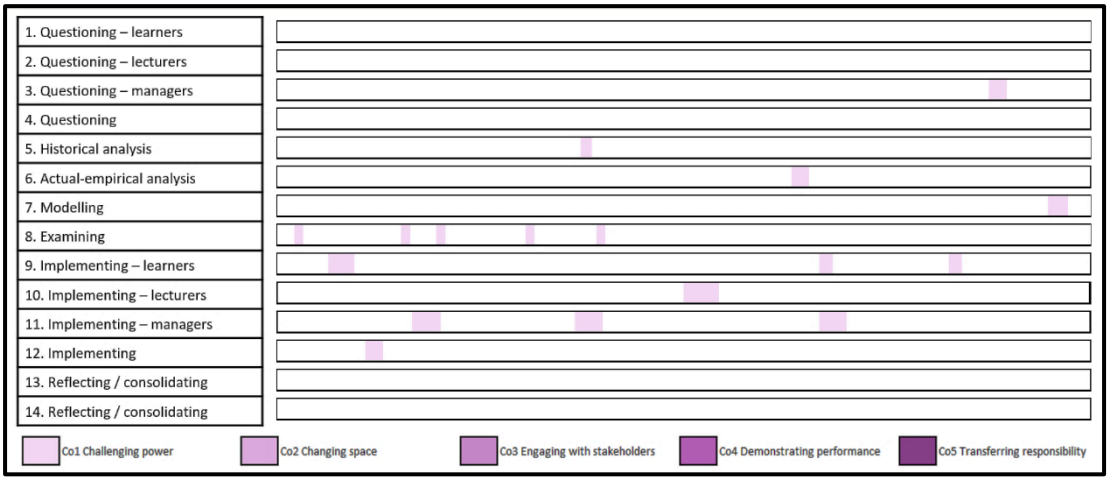


6.6.1 Commitment to challenging power – Co1

Committing to challenging power relationships was evident in 19 episodes. Sub-expressions involved participants making specific, time-bound and measurable self-obligations to disrupt the normative expectations of their interactions with people of different rank and status. Their emergence is illustrated in Figure 6.37. In the example below Lancelot, a learner, describes plans to approach other work units, to attract colleagues to take up their own trials. This was potentially disruptive to his relationships with managers of hierarchical work divisions, with inherent political risks to his career:

"… [motions to division of labour] this is military diplomacy, we haven't got experts in industry doing military projects … and vice-versa we haven't got military leaders doing technical or learning stuff … **everyone play to their strengths**. I'll put here [object for managers' rules-producing activity] '**stop us all going off-piste with military diplomacy**' … and in here for you lot [lecturers' division of labour-producing activity] **'keep us on the rails technically'** … in a week I'll get a penalty statement {committing} of how I got on asking [other work units] to come on board … **the sort of thing any of their managers would be worried about**." [*Lancelot, Session 10 – implementing*].

Figure 6.37. Episodes with sub-expressions of commitment to challenging power – Co1

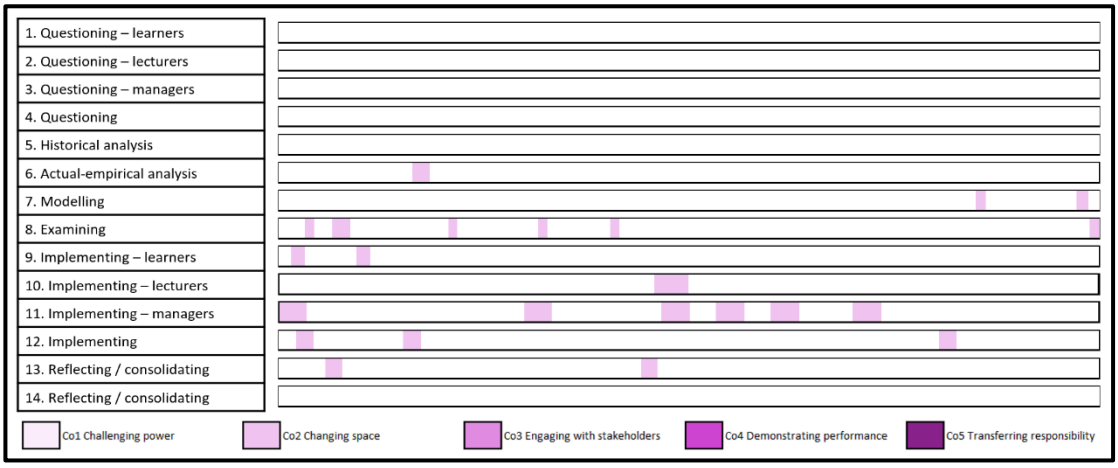


6.6.2 Commitment to changing space – Co2

Commitments to changing space were in 26 episodes. They were directed at TEL's location, infrastructure or environment including: the geographical locations for TEL's spaces; the physical layouts of spaces in TEL; and configurations of space such as adapting it to suit the varying social interactions of dispersed or centralised groups. Their emergence is illustrated in Figure 6.38. In this example Carlton, a manager, commits to using spaces for further remote deployments, as part of a wider negotiated episode in which the austerity and remoteness of space was declared to be a critical factor for realism in boundary-crossing TEL:

"… we'll come up with stuff to present to them [strategists] … like **a case study of us going against policy** [motions to rules] and going remote **to prove the point about value for learning** … we can just go to [military training area] and **use the dog to wag the tail in a more realistic place … the same challenges as real work, whatever we need to do in real life we'll need to do there**, the way we talk to each other and other people who can help, the tech we'll need … we can book it, I'll do it {committing}." [*Carlton, Session 12, reflecting and consolidating*].

Figure 6.38. Episodes with sub-expressions of commitment to changing space – Co2

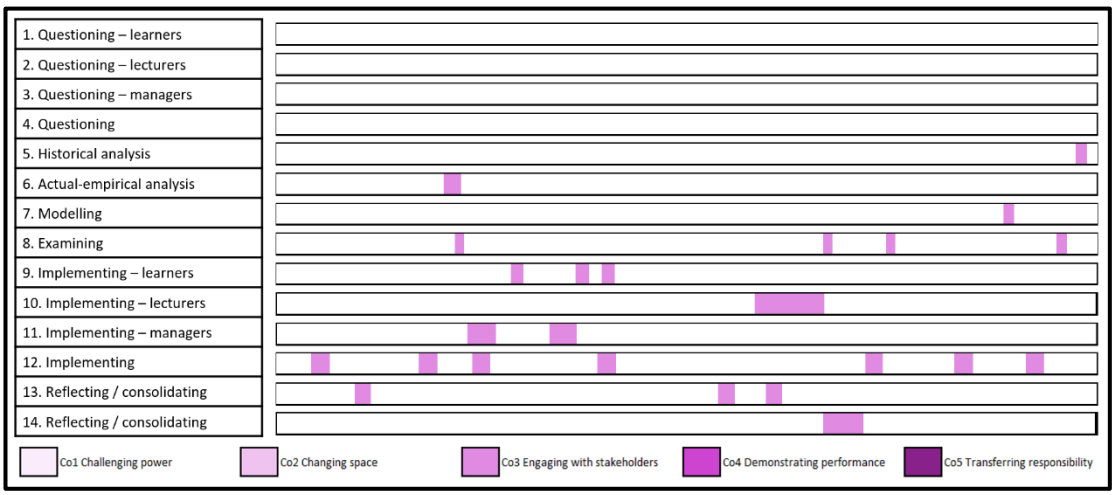


6.6.3 Commitment to engaging with stakeholders – Co3

Commitment to engagement with stakeholders was evident in 26 episodes, which included both engaging with different stakeholders, and engaging with existing stakeholders in different ways. Their emergence is illustrated in Figure 6.39. In this example Warwick, a learner, describes the limitations of artefact-mediation in collaborative tasks, turning to cultural mediation and committing to the curation of AV media as mirror data:

> "… getting onto outside experts … **the Cold War stuff** [secure ICT platforms] … **won't work for contingency ops** [operations] … it **doesn't just need a few tweaks we need to start all over again** … **we need tech that we can talk to the world with, not the rest of defence, and that isn't going to look like anything defence uses … let's come up with some vids** [AV mirror data] **for next time** [subsequent session] **… where we couldn't do it** [TEL] **without us going to a civvie** [civilian] **expert** {committing}...". [*Warwick, Session 11 – reflecting and consolidating*].

Figure 6.39. Episodes with sub-expressions of commitment to stakeholder engagement – Co3



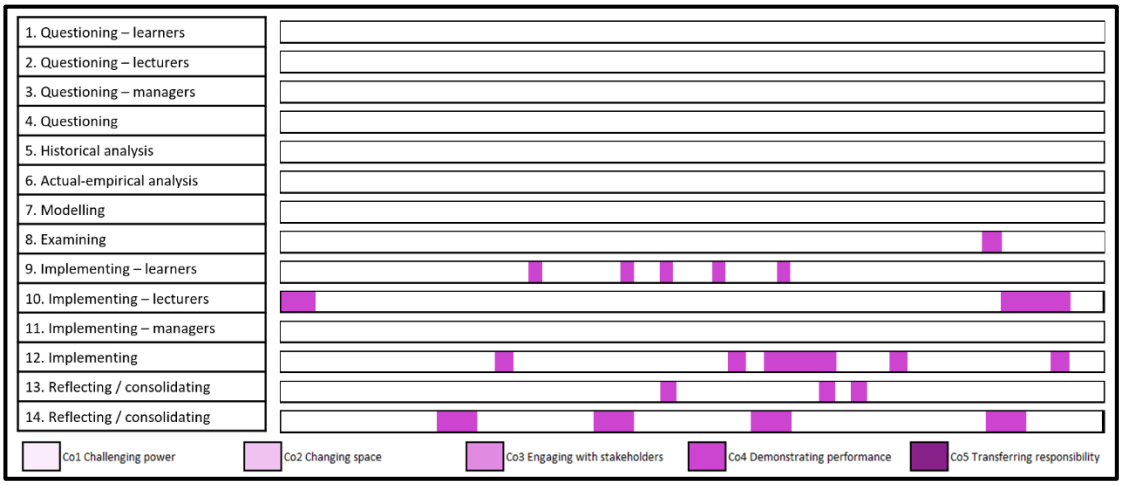
6.6.4 Commitment to demonstrating performance – Co4

In 26 episodes there were sub-expressions committing to demonstrating successes and failures. They included: producing and exhibiting AV media of performance for peer evaluation; exhibiting successes and failures for external expert evaluation; and demonstrating collaborative, rather than individual, performance in TEL. Their emergence is illustrated in Figure 6.40. Here Carlton and Emil, a manager and lecturer respectively, discuss dilemmas of visionary models versus concrete experiences, committing to demonstrate performance at infrastructure sites some distance from the RSME whose value was to be judged by external experts:

> "… **I've bought into the idea of letting them** [experts outside the RSME] **assess how they** [learners] **got on … but it's going to take so much time to get all of the PI** [professional indemnity] **and all of the political bollocks for them to go** [to the CNI site] … **we've all seen these things almost get there and then someone pulls the plug last minute** … once we get a decent relationship built up someone at puzzle palace [RSME Headquarters] will decide it's too sensitive … **I've got a lot to do to make it happen …**". [*Carlton, session 11 – implementing*].

> "… **that's exactly what you're here for and what you're paid for though** {primary contradiction} … **it doesn't matter how hard it is for us** … **it matters how much better it is for everyone** [motions to community] {secondary contradiction} … **if we don't do it now then when will we? And if it's not us then who?** We need to get this ready for next time we meet up {committing}, or we won't do it at all". [*Emil, session 11 – implementing*].

Figure 6.40. Episodes with sub-expressions committing to demonstrating performance – Co4



6.6.5 Commitment to transferring responsibility – Co5

Commitments to transferring responsibility were evident in 20 episodes. They involved the collective subject negotiating their pursuit of more or less responsibility for certain aspects of boundary-crossing TEL. Proposals for change were generally iterative, with clashes between redesigned elements and further innovation arising in contradictions. Participants faced double binds between competing commitments, for example: on one hand, upholding values and standards through military rules on communication and security; on the other hand, committing to meet TEL challenges to the best of their abilities. Their emergence is illustrated in Figure 6.41. In the following transitional episode Rhet, Carlton and Finlay, a learner, manager and lecturer respectively, discuss contradictions and negotiate commitments to resolving them by iteratively concretizing change then remodelling their interacting activity systems:

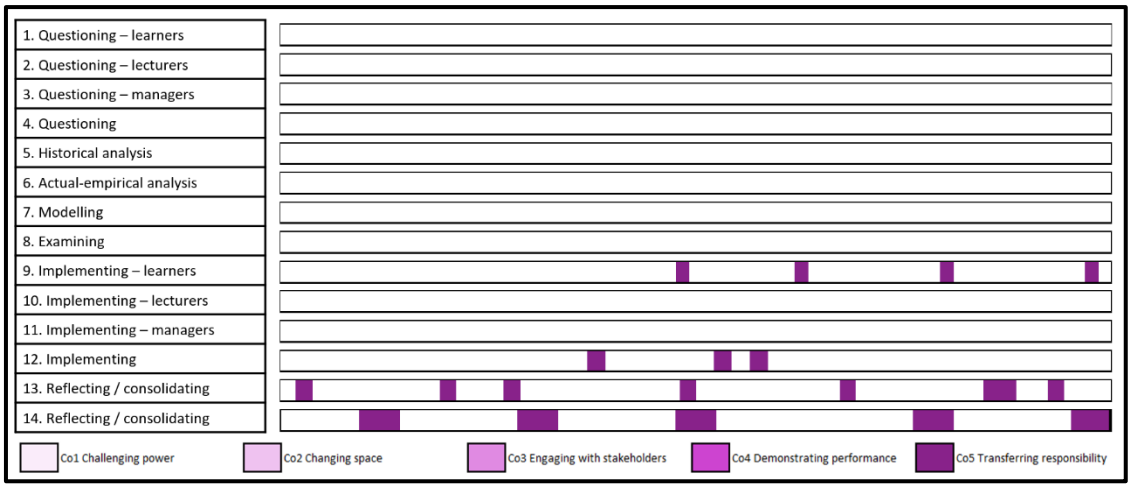
> "… one of you [managers] needs to … go public that this [motions to rules] is bullshit and has been for years … **one of you whose paid the big bucks will need to say publicly … TEL here gets us out the door but doesn't prepare us for real life** {primary contradiction in object} **that the subject is an unrealistic cohort** … passing as quick and cheap as possible but not in anything realistic {primary contradiction in subject} **…**". [*Rhet, session 11 – implementing*].

> "… **to be fair we're worried for its** [policy's] **ability to keep up as contingency ops [operations] get even less predictable** {secondary contradiction between rules and object} … what we've done here [motions to new rules] is show if anything we need to push further away from the centre but be open and own it [the risk] …". [*Carlton, session 11 – implementing*].

> "… why don't you use imagery in the Twitter feeds then, make it normal that way … **why not tweet about the things people are learning on the industrial attachments** [with civilian experts] **and take ownership of the risks that way … we'll** [lecturers] **make sure there's experts available** {committing} …". [*Finlay, session 11 – implementing*].

> "… and **we'd use a lot of that as future mirror data … we'll leave it as crumb trails for the next groups** …". [*Rhet, session 11 – implementing*].

Figure 6.41. Episodes with sub-expressions committing to transferring responsibility – Co5



6.6.6 Summary of committing

Figure 6.2, at the opening of this chapter, shows how commissive expressions, in purple, emerged along with other expressions. Figure 6.36 isolates commissive sub-expressions in different shades of purple, whose relative darkness illustrates increasing future-orientation and collaboration. Whilst some isolated sub-expressions of committing were exhibited in early sessions, they gained momentum from implementation onwards. Prior to this point, sub-expressions were individually formulated and of here-and-now consequence, such as individual challenges to power (Co1) and isolated changes to personal space (Co2) made during historical and actual-empirical analyses. Notable episodes with side-by-side sub-expressions of commitment emerged during the third quarter of the twelfth session. Here commissive acts coalesced in the plenary, alternating between committing to engaging with stakeholders (Co3), demonstrating performance (Co4) and transferring responsibility (Co5). The remainder tended to alternate with envisioning and taking action, illustrated by broad lead-and-lag relationships of all three expressions (see e.g. Figure 6.1 and Figure 6.2).

Transitional episodes with commissive sub-expressions arose notably during the negotiation of dilemmas between visionary models and concrete experiences (Virkkunen, 2006: 58). Models of activity systems, four-field analyses and timelines were consulted by participants to inform commissive acts, whose subsequent concretisation informed further modelling and committing. These oscillations about moments were initiated when modelling and examining proposals, whilst remotely deployed on tasks, using artefact-stimuli such as portable surfaces, AV recordings, digital photography and workbooks. Participants socially negotiated the risks and benefits of their individual and group commitments. Concrete experiences, described in the subsequent section, were then called upon by participants to

iteratively adapt their task stimuli, firstly by individual recall from recorded springboards in workbooks and secondly negotiated with other participants' springboards informing collaborative and dilemmatic negotiations on surfaces.

6.7 Taking consequential actions to change the activity

Figure 6.42 shows that episodes with expressions of taking action were negligible until the last third of the intervention, rising to a steady rate from the ninth to twelfth sessions, falling to moderate levels during reflection and consolidation. Figure 6.43 shows that taking action was the most frequent expression to be directed at the outcome of activity; in contrast it was either the least or second least frequent to be directed at all other nodes.

Figure 6.42. Episodes related to expressions of taking action (Y axis) in sessions (X axis)

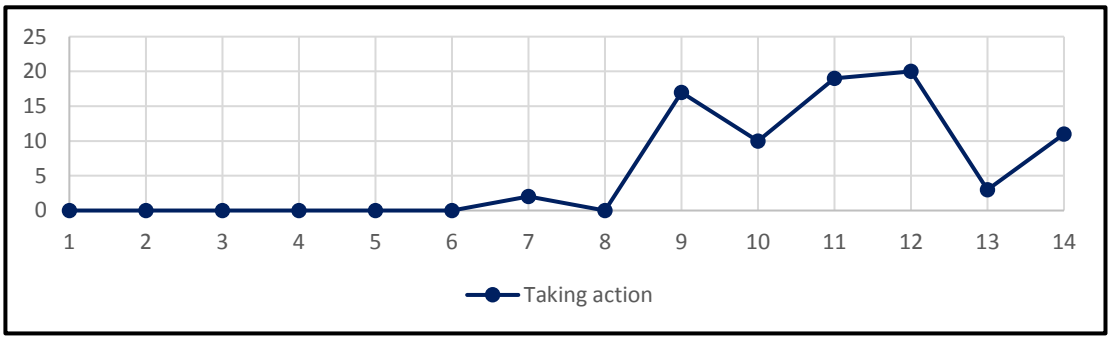
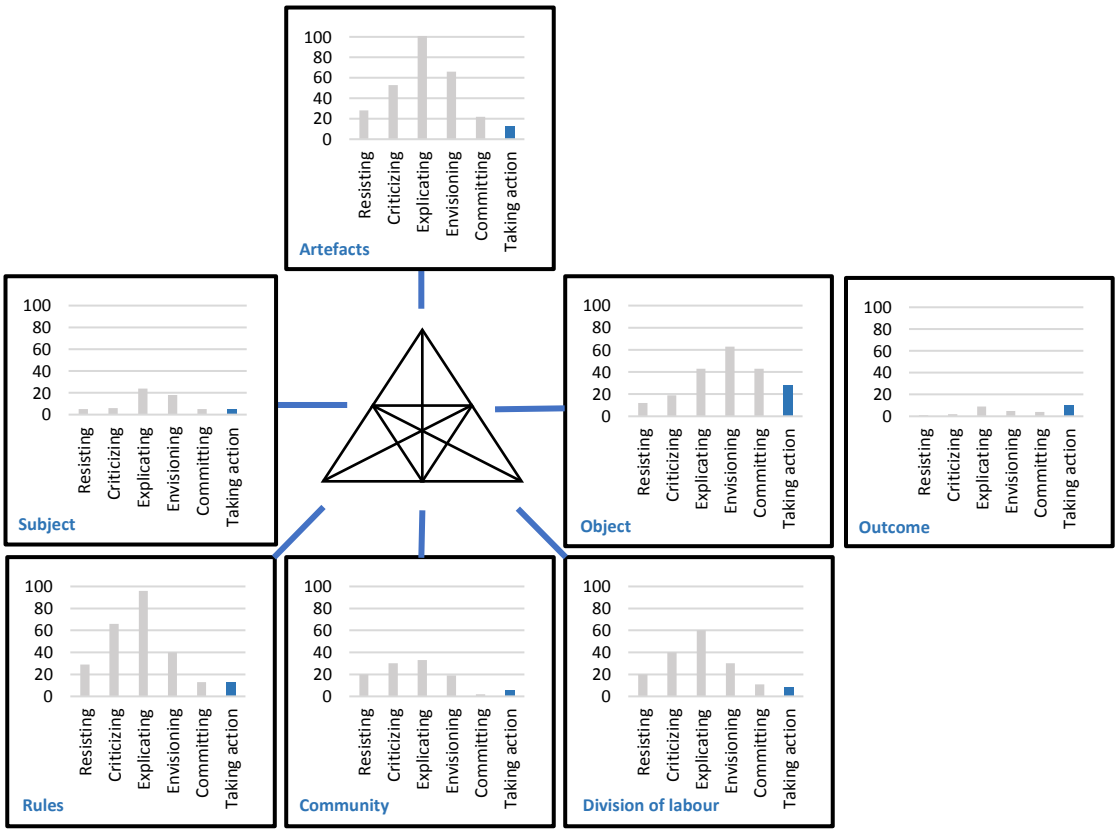


Figure 6.43. Episodes of taking action (in blue) related to activity's nodes

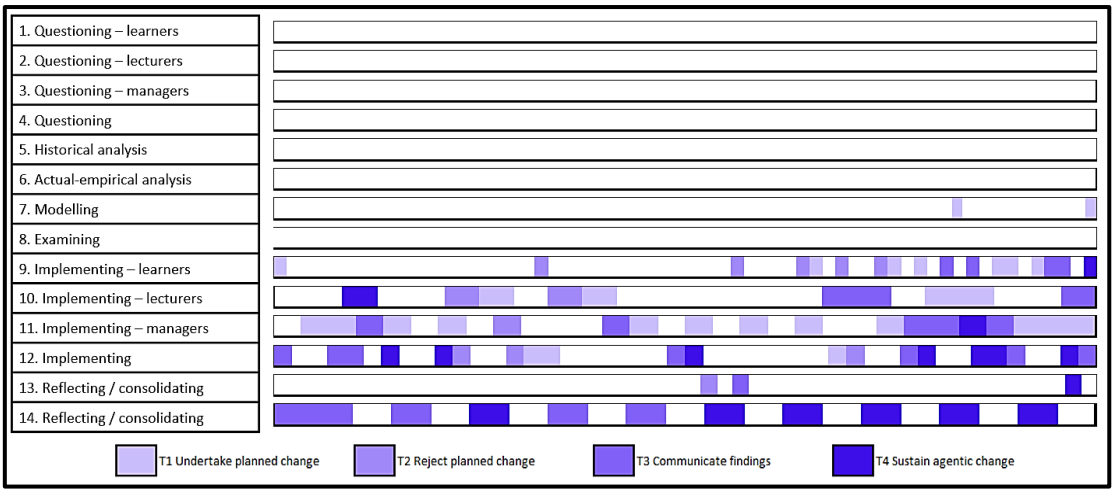


There were four sub-expressions of taking action to emerge during inductive analyses: undertaking planned change; rejecting planned change; communicating findings; and sustaining agentic change. There were 82 episodes with expressions of taking action whose frequencies are shown in Table 6.7, with their emergence in each session illustrated in Figure 6.44. Each sub-expression is then described in some detail in the sub-sections below.

Table 6.7. Episodes with sub-expressions of taking action

		Taking action	T1 Undertaking planned change	T2 Rejecting planned change	T3 Communicating findings	T4 Sustaining agentic change
Session	1. Questioning - learners	**0**	0	0	0	0
	2. Questioning - lecturers	**0**	0	0	0	0
	3. Questioning - managers	**0**	0	0	0	0
	4. Questioning	**0**	0	0	0	0
	5. Historical analysis	**0**	0	0	0	0
	6. Actual-empirical analysis	**0**	0	0	0	0
	7. Modelling	**2**	2	0	0	0
	8. Examining	**0**	0	0	0	0
	9. Implementing - learners	**17**	7	5	4	1
	10. Implementing - lecturers	**10**	4	2	3	1
	11. Implementing - managers	**19**	12	1	5	1
	12. Implementing	**20**	3	3	7	7
	13. Reflecting / consolidating	**3**	0	1	1	1
	14. Reflecting / consolidating	**11**	0	0	5	6
Sub Total:		**82**	28	12	25	17
% of Total Episodes:		**10.92%**	**3.73%**	**1.60%**	**3.33%**	**2.26%**

Figure 6.44. Episodes with sub-expressions of taking action emerging in each session



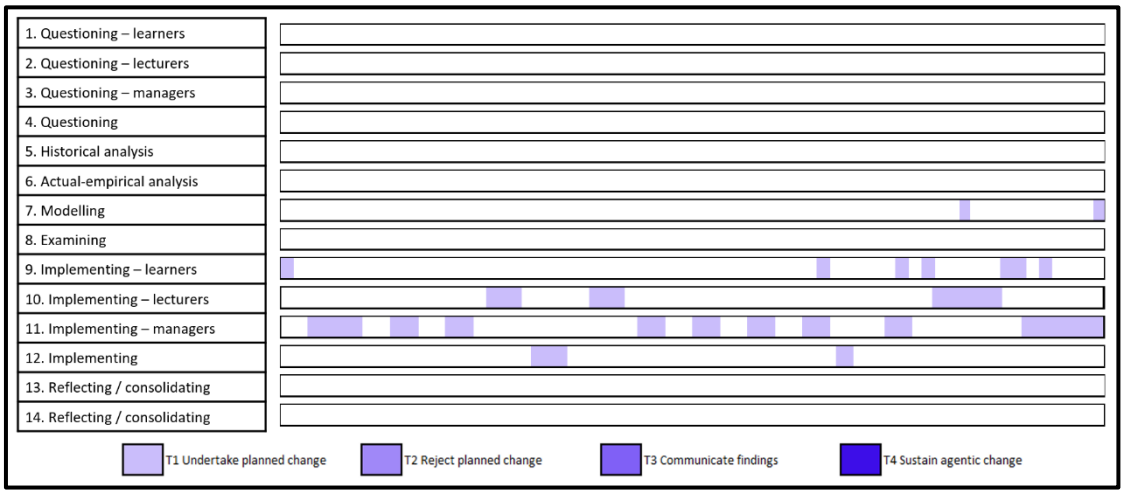
6.7.1 Taking action to undertake planned change – T1

28 episodes included sub-expressions of taking action for planned change. These related to participants' unquestioned concretisation of previously agreed proposals, often presenting examples of productive failure. Whilst they generally exposed further disturbances, the planned changes were concretised nonetheless and issues were revisited in later sessions, rather than dynamically adapted during concretisation. Their emergence is shown in Figure 6.45. The example below is from Percey, a manager, describing failed attempts to comply

with policies on TEL and communications security when remotely trialling an early version of activity:

> "… **training policy isn't being followed** … **security policy isn't being followed** … we'd agreed to send each other things properly, not on WhatsApp … how quick and easy it was to contact them [experts] on WhatsApp even if we had DII [Defence Information Infrastructure] {secondary contradiction between rules and artefacts} … **we couldn't talk to them** [experts] **or do our jobs properly on DII, but it's what we said we'd do, so we did it … epic fail, it proves we need to change the rules or change what we do** …". [*Percey, Session 7 - modelling*].

Figure 6.45. Episodes with sub-expressions taking action to undertake planned change – T1



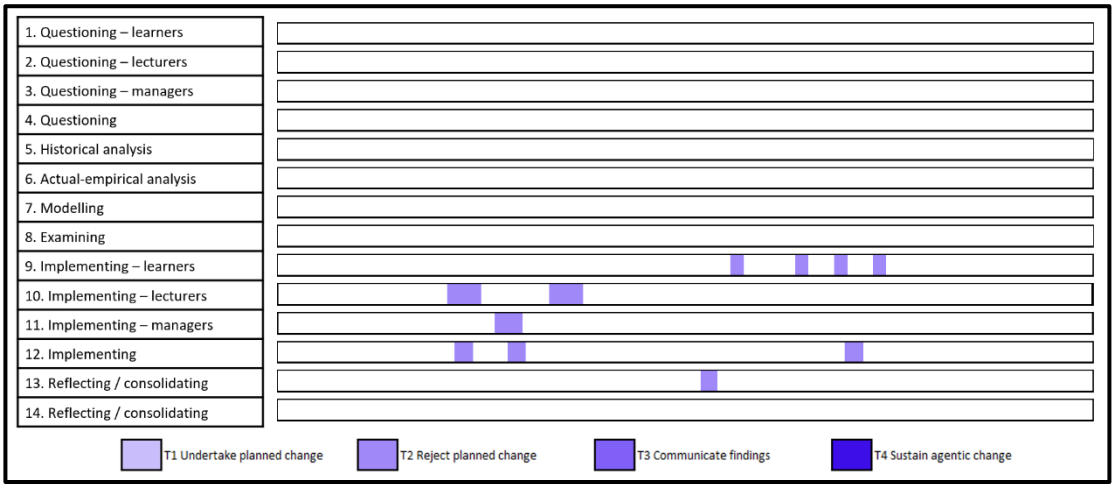
6.7.2 Taking action to reject planned change – T2

Taking action to reject planned change, instead taking different forms of action at the time and point of need, was evident in 12 episodes. They showed evidence of agentic initiative at the point of concretisation, demonstrating understanding of how action related to activity. Their emergence is shown in Figure 6.46. In this example Lancelot, a learner, retrospectively describes his rejection of agreed proposals to test activity locally:

> "… sitting here watching videos on shit going wrong [mirror data] and thinking 'oh fuck me, it's awkward to watch alright but **it's not getting us nowhere**' … **we thought well … let's all fuck off** to [remote training area] **and aggravate some fucking real contradictions down there** {taking action} … we're not using defence tech for proper recce [reconnaissance] jobs … they [artefacts] just don't work … so **we done our own version for them mirror materials** … somebody had a great metaphor … there's an elephant in the room but someone's put him in a box so people just think there's a

massive wooden box that shakes then makes a fucked up trumpet noise, so what we did wasn't really to do anything about the elephant, it was just to smash up the box and go 'surprise fuckers it's an elephant' … **we made it so there's no choices now we actually did something … it might not have been what we said in here but … what we'd decided wouldn't have worked but we knew the small-hand-big-map [wider activity] so knew the risks of improvising I suppose** ..." [*Lancelot, Session 12, reflecting and consolidating*].

Figure 6.46. Episodes with sub-expressions taking action to reject planned change – T2



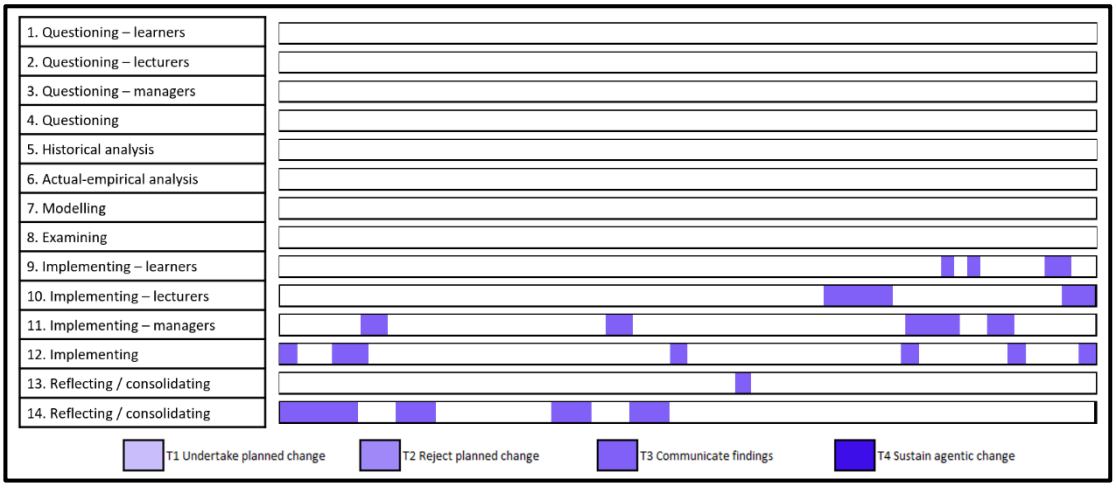
6.7.3 Taking action to communicate findings – T3

Taking action to communicate findings of change was evident in 25 episodes, generally exhibiting evidence of collaborative acts which were intended to promote the sustenance of change into the future. Their emergence is shown in Figure 6.47. The transitional episode below illustrates how Jared and Percey, a learner and manager respectively, retrospectively describe how they communicated findings across the wider military engineering community:

"… at the tech symposium [annual meeting of Royal Engineers technical trades] we thought … who'd honestly keep it going given **it's a career risk …** questioning **whether what we're paid by the public for actually fits what we're achieving here** {primary contradiction}. We agreed, or rather you [managers] did, to **challenge policy and doctrine** {taking action} **… maybe it'll be better to think of starting this** [expansive cycle] **all over again from the start** … **we wouldn't want them** [future participants] **missing these questioning bits for themselves** [motions to mirror data].". [*Jared, session 12 – reflecting and consolidating*].

"… **we could get this** [mirror data on remote trials] **and the lessons identified stuff … we've got stacks of evidence … but it's a bit like saying don't dare be fucking surprised by this** we've been publicizing it {consolidating} …". [*Percey, session 12 – reflecting and consolidating*].

Figure 6.47. Episodes with sub-expressions taking action to communicate findings – T3



6.7.4 Taking action to sustain change – T4

Taking action to sustain change into the future was evident in 17 episodes. Sub-expressions were specifically directed at those who would inherit the benefits and liabilities of this instantiation and sustain its developmental agenda. Their emergence is shown in Figure 6.48. In this episode Warwick, a learner, Percey, a manager, and Paderau, a lecturer, discuss their actions to further sustain expansive learning:

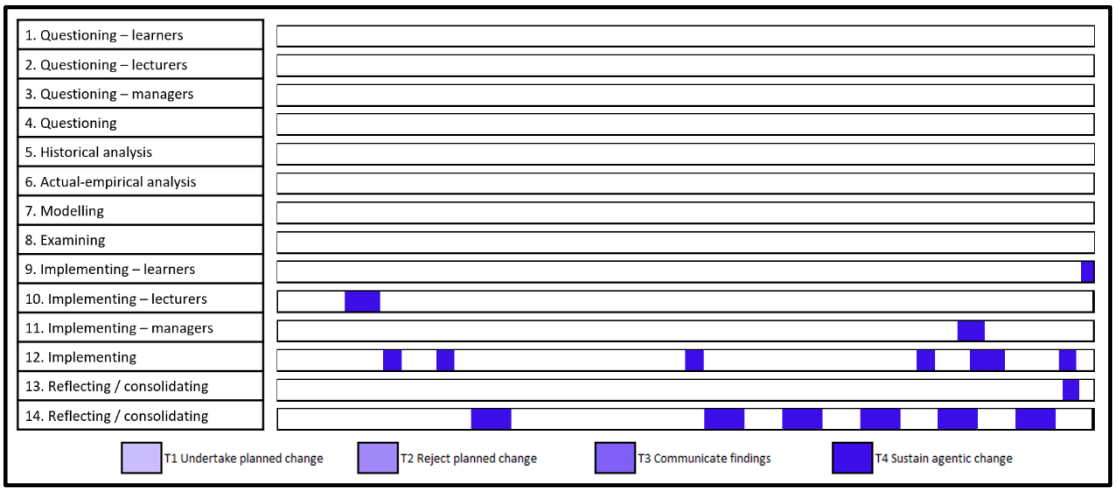
"… **we'd be proper pissed off if all of this turns out to be for fuck all**, so it'd be nice if people want to take it on but **it needs to be in a way that's consensual … they pull rather than us push** {consolidating} …". [*Warwick, session 12 – reflecting and consolidating*].

"… what if it came to a choice between … more of the same and their own diluted version … like we considered just to get it out of the door … we've got this getting more and more diluted then every time, weak as piss … **maybe we should give them a framework like, a working model, a case study to hold it all together …**". [*Percey, session 12 – reflecting and consolidating*].

"… but that [a working model] misses the point … that'd be like saying **don't do that top down shit, it's bollocks the world's changed, do this top-down shit instead …** no,

I think the point was … learning how to learn … so that the contingency stuff doesn't put the shits up people when they're miles away and need to get a solution ... we've changed this [motions to new activity system and expansive cycle] precisely because **senior civil servants can't do radical** … **they** [future participants] **will need to do all that resist and critique stuff that sets the scene so it's not the same old shit for them … a working model isn't expansive … it's** [Change Laboratory] **not a franchise** …". [*Paderau, session 12 – reflecting and consolidating*].

Figure 6.48. Episodes with sub-expressions taking action to sustain change – T4



6.7.5 Summary of taking action

Figure 6.2 at the opening of this chapter shows how expressions of taking action, in dark blue, emerged along with other expressions. Figure 6.44 isolates the sub-expressions in different shades, whose relative darkness illustrates their increasing future-orientation and collaboration. Sub-expressions of taking action gained momentum from the latter stages of the first implementation session, where they were expressed alternately with envisioning and committing. These early exhibited sub-expressions progressed from generally individual and here-and-now perspectives, such as individually undertaking or rejecting agreed change (T1 and T2), toward collaborative and future-oriented acts to communicate with others and to sustain momentum into the future (T3 and T4). A notable coalescence of sub-expressions of taking action was in the last third of the eleventh session for managers, where they called upon previous commissive acts to take action to negotiate, reject, enact and sustain change, and to communicate their findings. Sub-expressions of taking action were highest during implementation, when all of the sub-expressions were exhibited relatively evenly, yet during reflecting and consolidating more future-oriented and collaborative sub-expressions (T3 and

T4) were identified in episodes, alternating with commissive sub-expressions of a similar collaborative and future-oriented nature.

The learner sub-group notably took action to work and learn remotely, intending to gain irrefutable and realistic data on concretisation to further iterate their redesign. The designs of their task stimuli, and the notion of empowering them to identify and curate stimuli for themselves, were instrumental to this initiative. Participants went on to propose and concretise their own instrumental second stimuli, both for their own benefit in this intervention and for use by others in future interventions. These acts indicate societal awareness of the iterative and cyclical nature of expansivity and long-term implications of taking action. A dilemma between expansion and regression (Virkkunen, 2006: 59) was apparent in many episodes, and particularly in these more collaborative and future-oriented sub-expressions of taking action. On one hand was the participants' motives to develop and further concretise redesigned activity. On the other hand, consolidation by others may have proved to water down their own impact. Contributory effects were raised during dilemmatic discussions of expansion and regression, with concerns that: the RSME's strategists would be more likely to accept less radical and more incremental forms of taking action; consolidation would feature low on other units' priorities; and other units may miss the point of formative interventions, preferring to transplant a working model rather than expansively build up to taking action. This point marked the cessation of sessions though not completion of the intervention; expansive work was universally agreed to be unfinished.

6.8 Summary of data analyses

Observations of the emergence of the main expressions of transformative agency, referring to Figures 6.1 and 6.2, show that coarsely there appear to be temporally alternating relationships between dominant pairings of expressions: resisting and criticizing in the first third; explicating and envisioning in the middle third; and committing and taking action in the final third. The identification and analyses of sub-expressions, relating them with each other and with other data from the intervention, expose further potential relationships to supplement coarse observations. These analyses are summarised below:

- Taking any expression in isolation, its sub-expressions initially emerge in separated staccato episodes, which are relatively isolated from episodes of the same expression. They tend to alternate with other isolated episodes, comprising other sub-expressions. Compare, for example, Session 3 on questioning activity for managers in Figures 6.5;

6.12; and 6.20. This session begins with a recognisable pattern of alternating and isolated episodes of resistance, criticism and explication, all comprising sub-expressions of relatively individual and here-and-now consequences.

- As the intervention proceeds and engagement with task stimuli increases, episodes increase in their collaboration and future-orientation. They coalesce with episodes of the same sub-expression, or sub-expressions of similar future-orientation and collaboration. To illustrate, compare Figures 6.28; 6.36; and 6.44. Sub expressions of here-and-now and individual characteristics - En1, Co1 and T1 - tend to be isolated and their examples generally include evidence of internalisation in task stimuli. In contrast, sub-expressions of the highest future-orientation and collaboration - En5, Co5 and T4 - tend to cluster with other sub-expressions which are also relatively future-oriented and collaborative, accompanied by externalisation and negotiation through shared stimuli.

- There appear to be correlations of the re-imagination of the object of activity and engagement with task stimuli, as sub expressions become more future-oriented and collaborative. There is an observable increase in the participants' attention towards the object of their activity as the intervention unfolds. The illustrations of activity's nodes show the extremes of this observation: the earliest sub-expressions of the intervention, individually resisting and criticising, peak for artefacts and rules; the last sub-expressions, those of collaboratively taking action, peak for the object of activity. The shifting attention between these two outer limits can be traced through the successive illustrations of activity: Figures 6.4; 6.11; 6.19; 6.27; 6.35; and 6.43.

- Taking any of the six main expressions in isolation from other main expressions, as the intervention proceeds there appears to be a *lengthening* time until participants exhibit their most collaborative and future-oriented sub-expressions. Correspondingly, there is a broadly recognisable pattern of delayed darkening in illustrations as the intervention proceeds: this can be seen in Figures 6.5; 6.12; 6.20; 6.28; 6.36; and 6.44. This suggests, for any isolated expression, that as change endeavours become increasingly expansive participants take more time to exhibit their most collaborative and future-oriented sub-expressions.

- The complexity, connectedness and concretisation of task stimuli highlight the importance of task design to subjective change. As the time to reach the most

collaborative and future-oriented episodes increases, so does their task duration, intensity and clustering. Data show correlations between increasingly troublesome engagement with stimuli (the time to reach a point of collaboration and future-orientation), and the increasing connection of stimuli with other phenomena through concretisation (the increased duration and clustering of collaboration and future-orientation having reached that point).

Further analyses in future projects will continue the redesign of boundary-crossing TEL activity with different participant populations, different times and different settings. The main contributions of the analyses are the identified sub-expressions of transformative agency in Table 6.8, which close this chapter and lead into discussions of the intervention's contributions to the existing corpus of literature.

Table 6.8. The intervention's sub-expressions identified during inductive analyses

Expression from Haapasaari et al. (2016)	Corresponding sub-expressions of transformative agency, identified during inductive analyses of the data
R: Resistance	R1: Resisting through articulation of change fatigue R2: Resisting personal roles in proposed change efforts R3: Resisting competing obligations on time / effort R4: Resisting through inertia of embedded social practices
Cr: Criticizing	Cr1: Criticizing proscription of involvement and control Cr2: Criticizing misalignment of societal and organisational problems Cr3: Criticizing social disorientation to understanding problems Cr4: Criticizing unclear expectations of people and technologies Cr5: Criticizing unclear loci of social control and risk
Ex: Explication	Ex1: Explicating possibilities of further task coordination Ex2: Explicating potential for changes to participant membership Ex3: Explicating potential for social defiance or compliance Ex4: Explicating potential of adapting physical environment Ex5: Explicating possibilities for changes to social use of technologies
En: Envisioning	En1: Envisioning changes to personal commitments and relationships En2: Envisioning changes to political selection and control of tasks En3: Envisioning changes to representations of competence En4: Envisioning changes to practice for engagement with experts En5: Envisioning enhanced ability to select and use technology
Co: Committing	Co1: Committing to challenging power relationships Co2: Committing to changing location, infrastructure or environment Co3: Committing to engaging with further stakeholders Co4: Committing to demonstrating successes and failures Co5: Committing to taking or transferring responsibility
T: Taking action	T1: Taking action to undertake planned change to practices T2: Taking action to reject planned change, or implement ad-hoc change T3: Taking action to communicate findings of changed practice T4: Taking action to sustain further agentic and expansive change

CHAPTER SEVEN – DISCUSSION

7.0 DISCUSSION

Prior to concluding the project, and describing its implications for policy and practice, the discussions below speak back to preceding chapters, in particular the literature which was reviewed in Chapter 3. My purpose is to place my findings in their broader context of the current corpus of literature. I aim to describe the modest contributions of the intervention to the intersection of the three fields of reviewed literature, describing the relevance of my results to each of those fields: military TEL and activity; boundary-crossing and epistemological critique; and multiple stakeholders and organisational change. In some limited divergence from the configuration of the literature review, I also refer in this chapter to methodological literature where it adds value to the discussions. The chapter first introduces broad contributions, followed by a discussion of each field: my core findings; how they appear to complement literature in that field, and then how they contrast with the field. Those sections lead to a collated summary of contributions to close the chapter.

7.1 Broad contributions of the intervention

The intervention's results in Chapter 6 have highlighted contributions to the extant literature reviewed in Chapter 3, discussed in three sections below. Firstly, the importance of resistance and critique to the remaining expressions of agency in my results show how a Marxist epistemology can confront prevalent top-down and deterministic approaches to military TEL; existing research accentuates the implementation of technological change for military *training*, which may impede *learning* unless participants are empowered to change their own activity. Secondly, the results show increasingly collaborative engagements with task stimuli to work through problematic conditions, highlighting the importance of both top-down and bottom-up moments for change and challenging the presumptions of consensus in the majority of studies; few projects have exploited the contradictions of diverse epistemic critique. Thirdly, my results show the increasing aggravation of contradictions in rules, community and division of labour which illustrates the importance of cultural mediation in the concretisation of change; in contrast with the dominant research foci on artefacts, the results show that cultural mediation was considered to be of higher importance for the sustenance of change. Each of the sections below details and exemplifies contributions to these fields of the literature in turn.

7.2 Research on agency and an epistemology of change in military TEL

In Section 3.2 of Chapter 3 I described the field of research in military TEL, which has almost exclusively focused on studies of top-down implementation of change and which has neglected agentic social activity. The related scalable efficiencies of cost and time were pragmatically the focus of this field of literature, which has prioritised behaviourist military *training*. Yet this project demonstrated that the indiscriminate application of military training's behaviourist pedagogies may hinder military *learning*, unless participants are empowered to change to their own activity. The dearth of research in military learning, as discrete from training, may be associated with: political drivers to import predictions rather than researching authentic contexts; military HE being so niche as to not deserve situated empirical research; or defence's vague and under-theorised definitions of TEL. These drivers relate to my ability to make modest claims of originality for the intervention's situated, problematic, participant-led approach. Contributions to the field are summarised in two sub-sections below: agency in military TEL; and a Marxist epistemology for change.

7.2.1 Contributing to research on agency in military TEL

In foregrounding the potential for participant agency in military TEL, my findings offer the field a study which counters the traditions of enculturation and behaviourism which appear to dominate the literature. In contrast, this intervention's results have empowered participants of military TEL to undertake the agentic promotion, legitimisation and authorship of challenges to their own social conditions. Engendering and normalizing multi-voiced and troublesome negotiations importantly related to participants' conflicting agentic motives, whose connections with volitional action are described by Sannino (2015a: 10) and Haapasaari & Kerosuo (2015: 46) as necessary for successful interventions. The explicit normalisation of volitional action through task stimuli seemed to relate to the intervention's success in engendering agency for participants of military TEL. An example can be found in Sub-section 6.2.4, where social practices were legitimately resisted through task stimuli. This finding was believed to be a point of original contribution; agency would normally indicate misbehaviour and dissent in military work and learning, rather than association with development (see e.g. Kirke, 2010: 359; Huhtinen, 2013: 76).

My results share characteristics with a small number of studies in the field of military TEL. In the review I have acknowledged rare calls from other authors who also challenge the dominance of enculturation and behaviourism. It is with these projects that my own work

shares its most striking commonalities: rejecting the status quo of behaviourist training; seeking development through diverse epistemic critique; and viewing research-interventions in authentic settings as fundamental for development. I share with Cornell-d'Echert (2012: 17) the concern that contemporary military learners must break free of institutional processes which assume they are "neither expected nor required to think" (p. 18). Like Dietz and Schroeder (2012: 29) I recognise that research of military learning must seek epistemic critique from beyond their organisational boundaries. In common with Zacharakis and van der Werff (2012: 89), historicity and cultural mediation inform my project's results.

My results differ with the majority of studies in this field, which have retrospectively studied top-down implementations of artefacts, seeking to harness scalable cost and time efficiencies for military TEL. In rare studies where there has been bottom-up consultation (e.g. Bollard et al., 2015; Juhary, 2007) authors examined acceptance of predetermined change; in contrast, my results have benefitted from participants designing and enacting change. An example is their bottom-up commitment to create and curate mirror data in Sub-section 6.6.3, which could not have been achieved without the normalisation of bottom-up initiatives. A further lucrative outcome of my results, distancing them from most of the field, was the participants' bottom-up and problematic recognition that they had been undertaking boundary-crossing TEL *despite* rules, artefacts and division of labour. As a result the agentic interference of "life activity" described by Sannino (2015a: 2) and Thorne (2015: 63) included participants' prior investments of time and effort, initially generating defensive behaviours. Emotional attachment to activity upheld resistance to its sustained intellectual analyses, whilst direct experiences yielded agentic criticism, a positive conflicting state to begin the intervention. This vindicates framing resistance and critique as necessary and positive (Sannino, 2010: 839) which is also claimed to be an original contribution in this field.

7.2.2 Contributing to research on an epistemology of change in military TEL

My findings offer this field of literature, on change in military TEL, a situated empirical project which is directly related to the emancipation borne of a Marxist epistemology for change. Researching political power and its historicity in have proven lucrative to my results, empowering participants to take ownership of the process of changing social conditions. Notably, my project has counteracted the widespread conflation of military TEL with the solitary consumption of digital media. To explain, there appears to be a prevalent conception that military TEL is the individual rehearsal of pre-ordained, top-down and implemented digital content. In contrast my project has empowered military learners to

define and design, for themselves, ways of coping with increasingly contingent social conditions. In contesting the historically embedded vertical acquisition of knowledge in military TEL, these results justify a Marxist epistemology. This is the first such study in UK defence, perhaps due to military strategists associating Marx with despotic political regimes rather than development (a related analysis is in Lima, Ostermann, & Rezende, 2014: 594).

There are examples of empowerment and emancipation in defence-related learning, although they avoid claims of Marxist influences. The unpalatability of a Marxist epistemology may relate to the preclusion of participants in studies of military learning (see for example Fletcher, 2009: 72; Kerry, 2016: 29; Durlach, 2012: 331). In empowering participants, my closest cognate studies are those in the high-reliability organisations of commercial defence such as Blackler et al. (2003: 131) and Duffield and Whitty (2014: 311). Commonalities with Blackler et al. (2003) include our shared empowerment of participants: to question and redefine activity; to change conceptions of expertise; and to influence cultural mediation (p. 141). In common with Duffield and Whitty's (2014) study, both of our projects have empowered operational members of organisations to expose and aggravate problematic circumstances, rather than continue with failed practice since "owning up to failure may cause shame" (p. 313). In extolling the benefits of a Marxist epistemology, I apparently share common ground with only one other western military pedagogue; Falk (2008: 8). Falk describes how Marx and Engels have bestowed principles with which participants may critique the "ideal types" of military learners (p. 13), yet does not go further to operationalise productive research, and this intervention seems to be the first with both a Marxist epistemology and empirical contributions to the field.

In their most striking contrast with the majority of studies in this field, my results have foregrounded TEL's problematic social conditions. The results have directly benefitted from Marxist principles such as aggravating contradictions, socially questioning practice, and taking control of artefacts, all of which have empowered participants to realise their active roles in TEL's change. Conceiving of artefacts as active carriers of social knowledge, shaped through time by participants, could have added value to other studies in this field. Yet such principles would have required authors to reconsider their top-down models of implementation, notions which may have been rejected by military clients. Drivers for Hickox et al. (1998: 608), for example, included examining and overcoming dissatisfaction with the top-down implementation of web-based testing in a military school. Learner resistance was met with hardware upgrades, deemed to be "the most critical need" (p. 604),

apparently identified without agentic input from learners. A Marxist epistemology in military TEL may thus demand an insider-researcher, to navigate the cultural sensitivity of military schools, a luxury which I have had and which others may not. Benefits of a Marxist epistemology for countering normative political expectations included participants' overt resistance and criticism; these are usually forbidden in military social interactions (Kirke, 2013: 17) despite their recognised value to well-being (Blunden, 2012a: 297).

7.3 Research on critique across boundaries and political control in HEIs

In Section 3.3 of Chapter 3, I reviewed the field of empirical literature on boundary crossing in HEIs, with a majority of studies avoiding the consideration of contradictory and diverse epistemic critique, leaving unexplored potential for developing TEL across boundaries (a rare exception being Doyle, 2008: 448). A contribution of the intervention is its engagement with diverse political perspectives for organisational change, challenging the conventions of the majority of studies in the literature; very few boundary-crossing TEL studies exploited the varied epistemic critique of stakeholders, instead politically controlling participants. The two sub-sections below describe the intervention's principal contributions to the field: critique across boundaries; and the political control of interest groups.

7.3.1 Contributing to research on diverse critique across boundaries

My findings offer this field a situated research project with critique across boundaries, exposing contradictory and problematic social conditions of TEL from diverse perspectives. Through epistemic critique, participants have challenged their TEL's cultural reproduction, rehearsal and internal review. The value of diverse, multi-voiced and problematic enquiry was enhanced by inviting critique across boundaries and through springboards (Engeström, 2016: 69), using these as techniques to help benchmark epistemic processes from elsewhere. Such techniques for inviting epistemic critique are rarely described in the field, yet they have allowed this project to benefit from change endeavours elsewhere and different times. An example is in Sub-section 6.3.2, where the military's neglect of expertise beyond defence is criticised and related to the perpetuation of cultural reproduction in TEL. Overall the results show that diverse critique across boundaries generated troublesome negotiations and conflicting motives, which were lucrative for change (Sannino, 2015b: 11). As a result, exposure to *inter*disciplinary critique empowered participants to break free of their *intra*disciplinary double bind, organizing the object of their activity rather than taking an insular stance and feigning indifference to it.

The results of the project share characteristics and residual challenges with a modest number of existing studies in this field. Examples of these shared characteristics include: the importance of clarity when aggravating contradictions and criticising at boundaries (e.g. Garraway, 2011: 212); moving beyond consideration of technological artefacts when criticising activity's mediation (e.g. Bharosa, Lee, Janssen & Rao, 2012: 11); and acknowledging, indeed in my own case encouraging, qualitative changes to the collaborative subject as a result of boundary crossing (e.g. Oliver, 2015: 376). My results share these authors' challenges in designing stimuli to allow diverse criticism at boundaries, balancing sensitivity with the provocation of troublesome negotiations. The resulting actions by my intervention's participants to design and curate their own stimuli were instrumental in their epistemic reaction to criticism; other authors in the field include stimuli enabling collaborative work to break free of double binds (e.g. Thompson, 2015: 23; Kerosuo, 2011: 392; Morselli et al., 2014: 346).

In spite of these shared characteristics my results have contrasted with most studies in the field, in particular where they have tended to avoid or downplay what could otherwise have been lucrative conflictual circumstances for change. Undertaking specific boundary work to challenge and aggravate conflicting motives has been welcomed by some HEI stakeholders in this field, yet it has threatened others, implying that a form of internal critique is important. Forstorp and Nissen (2011: 20) recognise cases of epistemic critique in HEIs for boundary crossing, although their proponents seem to be in positions of management. Managerial ideologies in this field seem to restrain genuine change through their pursuit of homogeneity, diluting potential for radical proposals and suppressing epistemic critique across boundaries. This has been manifested as a "partnership approach" in Milbourne, Macrae and Maguire's (2003: 20) study of education policies, and as "adaptations … to rules and values of the activity system they are in" by Snoek's (2013: 315) study of teacher training in HEIs. In contrast, this project's politically diverse criticism and engendering conflict were fundamental to my results; an example is in Sub-section 6.4.3, exhibiting participants' negotiation of social defiance or compliance to provoke changes to social conditions. Such results have countered the trend for consensus, which appears to be associated with the commodification of HE (Humberstone et al., 2013: 292).

7.3.2 Contributing to research on the political control of interest groups

The contributions of my findings to this field seem to be in providing an empirical example of the emancipation of politically diverse interest groups, showing how they might change their

own activity whilst creating and curating their own artefacts in change endeavours. In my project, diverse political interests drove movement about moments of top-down and bottom-up perspectives, whilst shared stimuli became the participants' intersubjective "focus of reflection and self-regulation" (Engeström, 2015: 251). The associated exposure and aggravation of contradictions through these stimuli involved emotive changes to activity's political control and mediation (see also Daniels, Cole, & Wertsch, 2007: 17). Their social negotiations of the necessity, causality and repercussions of political controls were important for concretizing change. Artefacts for the internalisation and externalisation of political controls enabled proposals and consequent repercussions to be modelled, negotiated and enacted. A Marxist epistemology was particularly relevant to engendering these political contributions of my results (Postholm, 2015: 48; Bligh & Flood, 2015: 141).

In some commonality between my results and the reviewed literature, the consideration of diverse political interests was evident in some studies. That stated, other authors' motives usually differed from mine; in the literature, these political interests were usually examined in order to control institutional exposure to risk. Tonyan and Auld's (2013: 226) study of teacher training in multi-national HE settings shares some of my political interests, in examining boundaries between educational and professional communities, although they seek to better understand professional practice and reduce its political impact on HE's stakeholders. Hartley (2010: 349) examines asymmetrical power relationships in educational institutions, proposing collaborative and communal modes of leadership, yet does so to reduce institutional risk rather than provoke genuine change to social conditions of learning. Other researchers examine political control to improve the appeal of academic subjects to their associated professions, differing from my results in their lack of focus on participant empowerment: Allen, Karanasios and Slavova (2011: 780) examine multiple groups and their influence on decision making in information sciences; Wilson (2009: 130) presents different political realities of groups influencing information systems.

In stark contrast with my results, much of the literature recognised political dilemmas for participants' social interactions yet seldom aggravated them to drive or catalyse change. Authors including Ridwan et al. (2016: 227), McLoughlin and Lubna Alam (2014: 132) and Humberstone et al. (2013: 250) appear to presuppose consensual appetites for change amongst interest groups. When left unresolved, such dilemmas have resulted in poorly assessed political benefits and liabilities to interest groups, for example: the sustainability of collaborative change after the research (e.g. Max, 2010: 236); misreported disciplinary and

institutional influences (e.g. McClam & Flores-Scott, 2012: 239); and influences of life outside the intervention on value judgements (e.g. Liu & Fisher, 2010: 193). My own results have relied on the exposure and aggravation of such political contradictions by participants themselves, rather than pursuing consensus. Notably, such notions as consensus appear to have presented participants with symbols of emancipation from institutional and disciplinary political control, as they conceptually distanced themselves from consent and embraced the value of their legitimised political conflict.

7.4 Research on multiple stakeholders and cultural mediation of change

Section 3.4 in Chapter 3 described my review of the field of multiple stakeholders and change, highlighting the limited examination of cultural mediation in existing studies. Existing studies have tended to neglect varied stakeholders' criticisms and their relationships with the cultural mediation of activity, instead examining predetermined artefact-centred interventions designed by researchers in conjunction with strategists (noted by Bates & Sangrà, 2011: 10). This intervention has challenged the dominant research foci, which seem to be on top-down changes to digital artefacts with outcomes considered from partial perspectives. Instead multiple stakeholders' diverse perspectives of cultural mediation, and relationships with organisational change, have led to the exposure and aggravation of contradictions to emphasise the importance of rules and division of labour, rather than solely artefacts. Two sub-sections describe the related contributions to the field: multiple stakeholder conflict and criticism; and activity's cultural mediation.

7.4.1 Contributing to research on multiple stakeholder conflict and criticism

My findings make a modest contribution to the literature in this field, particularly in their relationships between negotiating conflict and the design of task stimuli. My findings have established that without participants' conflicting motives and volition to act there would not have been transformative agency; their efforts would merely have yielded different forms of mediation (c.f. Sannino & Engeström, 2017: 60). By legitimising participants' engagement in criticism with task stimuli, and normalising the negotiation of their resultant political conflict, task stimuli ultimately became wholly owned by them: first stimuli were compiled by them; second stimuli were identified and enriched under their own control; mirror data were identified and curated by them; and contradictions were collaboratively aggravated and negotiated in ways determined by them. This may, at least for this instantiation, counter concerns that research which uses CHAT can blur the concerns of subjects (cautioned by

Bligh & Flood, 2017: 143). Without these troublesome negotiations of conflict and criticism, it is difficult to discern how the *societal* benefits of change could have sufficiently motivated *individuals'* actions. This potentially illustrates the role of stimuli and task design to "the organic connection between talk and consequential action [which] is an integral feature of these interventions" (Haapasaari et al., 2016: 234).

In common with a small number of projects in this field of literature, my results show that negotiations of conflict could be described as dialectical; commitments to take action seemed to disproportionately burden certain individuals, until the societal gain was identified through dialectical turning points. Examples of such conflict in the literature seem to appear in longitudinal or follow-up studies of change efforts, rather than empirically using conflict to drive or catalyse change. Yet studies which have embraced conflict for technology-related change suggest that results may be propitious. Miettinen and Virkkunen (2005: 449) discuss changing learning routines in reaction to crises and critical problems, identifying conflicting implications that may otherwise have remained unidentified. In Forman et al.'s (2015: 162) study of scenario planning with technologies, the authors identify defensive and conflictual needs of multiple stakeholders which were important local considerations for sustaining change. As with my own results, it is difficult to see how these changes could have been sustained without embracing the conflict and criticism of multiple stakeholders, as shown in Sub-section 6.5.5 and its discussion of diverse expertise.

Having acknowledged commonality, my results have contrasted with many studies in this field of literature. Researchers seem to have generally concealed or overlooked the criticism and resistance of multiple stakeholders, or framed them as incidental to the research rather than lucrative for change. The TEL studies by Waring and Skoumpopoulou (2012: 513); Barak (2012: 135); Powell et al. (2015: 6) recognise diversity and lack of consensus, yet appear to have eclipsed issues of criticism and resistance. This approach may relate to the subsequent rejection of implemented technologies or their use to merely sustain pre-existing practices. Examples of studies which concealed the conflicting characteristics of stakeholders include: Blin and Munro (2008: 478), whose conflict between traditional practices and electronic assessment was acknowledged yet unexplored; and Magen-Nagar and Maskit's (2016: 215) whose bottom-up concerns during the top-down implementation of technologies were unresolved. Other empirical studies of technological change in HE have eclipsed what could have been intersubjective criticism and conflict by engaging only one stakeholder group (e.g. Zhu, 2015: 65; Wall, 2015: 393; O'Donnell, 2016: 101).

7.4.2 Contributing to research on cultural mediation for organisational change

A further contribution of my findings appears to be in its use of task stimuli and mirror data to *deliberately represent* cultural mediation, including the creation of stimuli for the benefit of future consolidation. Participants created and curated task stimuli for *future* interventions by others, to preserve their progress in negotiating changes to cultural mediation. This contribution conveys the importance of task stimuli to cultural mediation of activity, related to an object which had eroded to the point where "the existing conceptualisation of the object and the tools available no longer match with it" (Virkkunen, 2004: 43). My findings have exposed the futility of incremental and additive changes to technologies of production, without also reconsidering the object and changes to the cultural mediation of activity. My findings acknowledge the failed alleviation of historically embedded problems, which had been repeatedly attempted by strategists' top-down implementation of digital artefacts, yet activity had retained its unchanged division of labour and rules until the intervention. My findings thus foreground the importance of cultural mediation to change, rather than limiting endeavours to the implementation of new instruments (Engeström, 2015: 261).

In common with limited studies in this field, my results recognise the growing importance of recognising the importance of cultural mediation as a reaction to the increasing availability of digital artefacts. Many authors share my concerns of technologies and political domination in TEL, through the cultural reproduction of social conditions for learning. My own results have highlighted resilient secondary contradictions between rules and division of labour, which were so stubborn and historically embedded that resolution was impossible at the physical site, exemplified in Sub-section 6.4.4. In response, participants moved to a remote location to aggravate cultural mediation in a realistic and authentic setting. Agherdien's case study of academics' development in Hardman et al. (2015: 163) recognises the importance of cultural mediation to sustaining authenticity when changing technologies of production. Rinne and Koivula (2009: 183) describe the need for cultural mediation (though not in those exact terms) when change in HE is undertaken in reaction to market orientation; a driver which typically increases expectations of the availability of artefacts yet backgrounds rules, community and division of labour. Like the authors above, participants curated their own stimuli for cultural mediation in the name of authenticity and vocational realism.

In contrast with the majority of studies in this field, my results have legitimised participants' identification, creation and curation of their own stimuli to redesign the cultural mediation of their own activity. My results show that collaboratively aggravating contradictions, and shaping rules, community and division of labour, is important for authenticity and for sustaining change in boundary-crossing TEL; Sub-section 6.5.2, for example, illustrates participants attributing blame for the misalignment of TEL tasks with vocational tasks. Authenticity has been examined elsewhere, for example by Zitter et al. (2012: 128) who study HE and vocational fields of digital communication, and Perret-Clermont and Perret (2011: 97) introducing vocationally realistic manufacturing technologies into education. Whilst these and other authors use notions related to cultural mediation, such as meaning schemes and compliance, they are seldom analysed as mediators of tripartite relationships in the way of rules, community and division of labour to expose and aggravate contradictions. My project's participants recognised lucrative techniques to aggravate contradictions in cultural mediation, such as analysing authentic corporate documents, AV media of tasks and social network communiques; through these, participants designed and curated their own task stimuli to redesign activity's rules, community and division of labour.

7.5 Summary of discussion

The intervention contributes to each of the three reviewed fields illustrated in Figure 3.1, with original yet modest contributions to their overlapping intersection. The following collated summary closes the discussions and leads to the concluding chapter:

- Firstly, the findings have highlighted limitations of the prevalent deterministic approaches to military TEL; defence's indiscriminate pedagogies for behaviourist *training* were found to frequently impede critical *learning*. Through a Marxist epistemology, my project's participants undertook the agentic and expansive development of their own activity, which appears to be an original contribution in military TEL. This field's literature rarely has examined participants' agentic exposure and aggravation of historically embedded contradictions. The implications of practitioners authoring their own responses to complexity and change are described by Engeström and Scaratti (2016: 170) as "perhaps the most important learning challenge of our time".

- Secondly, oscillations between moments of top-down and bottom-up perspectives in researching boundary-crossing HE was lucrative for participants' transformative

agency yet it has challenged the conventions of the literature; few related studies had exploited the epistemic potential of diverse critique across boundaries in HE. The contributions of my results in this field are related to exposing activity to diverse epistemic critique, and then engendering political conflict to overturn its conflation with negativity and disrespect. The implications of such diverse epistemic critique for boundary-crossing TEL are generally under-researched (Guile, 2011: 59). Through CHAT and the Change Laboratory methodology the intervention has enabled research of the conflictual political control implications of boundary-crossing TEL, which appears to be an original contribution.

- Thirdly, examining TEL's historically embedded cultural mediation has countered the dominant research foci in HE, of technology-related organisational change as comprising the top-down implementation of digital artefacts. Challenging the pre-ordained implementation of digital technologies is common to many Change Laboratory interventions in HE (e.g. Guzmán, 2018: 78; Deslandes, 2018: 11; Postholm, 2015: 48). The original contribution of this intervention was related to negotiating multiple stakeholders' perspectives of the cultural mediation of activity; rules and division of labour were thus identified by participants to be of higher importance than artefacts when concretizing and sustaining change.

CHAPTER EIGHT – CONCLUSIONS

8.0 CONCLUSIONS

The opening chapter of my thesis described problematic boundary-crossing TEL at the RSME, followed by its operationalisation and theorisation. The literature review then summarised a corpus of literature whose fields were analysed to position this project, and the planned intervention was subsequently described in the research design and methodology. The empirical data and analyses then provided a synopsis of findings, with contributions to the reviewed literature in the discussions of the previous chapter. In this concluding chapter I first reintroduce the research questions, before answering them. The order in which I address the questions warrants brief explanation; I believe that it is first necessary to explain and elaborate my answers to the six sub-questions, since those will inform my response to the main question. Therefore, I first answer the sub-questions and consolidate them in my response to the main question. In the latter stages of the chapter I make my final claims and bound their generalisability, followed by describing the implications for policy and practice. To close the thesis, I acknowledge the limitations of my research before describing its exposure of additional problems and further research opportunities.

8.1 Reintroducing the research questions

In Chapter 1, I presented one over-arching research question, related to the transformative agency of participants and the structure of the research-intervention, with sub-questions which referred to the six expressions of transformative agency described by Haapasaari et al. (2016: 242): resisting; criticizing; explicating; envisioning; committing; and taking action.

> **RQ 1.0**: How can a Change Laboratory research intervention foster the empowerment and emancipation of a military HEI's learners, lecturers and managers to collaboratively reshape their TEL activity, enabling them to better engage with expertise outside their organisational boundaries?

The six sub-questions asked how participants of the intervention:

> **RQ 1.1**. Resist the proposed change?
>
> **RQ 1.2**. Criticise current activity and suggest tasks and objects for discussion?
>
> **RQ 1.3**. Explicate new potential for developing the activity?

RQ 1.4. Envision new patterns or models for their future activity?

RQ 1.5. Commit to concrete actions to support change to activity?

RQ 1.6. Take consequential actions to change activity?

8.2 Answering the research sub-questions

My responses to the research sub-questions are below. The theoretical influences of CHAT and the Change Laboratory methodology seem evident in the intervention's empirical progress, manifested in the results both directly and indirectly. Direct effects of empowerment and emancipation were materialised through the participants' expansive identification, creation and curation of task-stimuli, and their episodes of resulting negotiation, enactment and evaluation of concretised changes to their own boundary-crossing TEL: tangible and observable changes have been made to their activity's object, artefacts, rules, community and division of labour. Indirect effects of CHAT and the Change Laboratory methodology were conceived through the apparent changes to participants themselves; clearly their subjective development could not be directly observed, but was inferred from their collaborative and future-oriented behaviours and episodes. Evidence of empowerment and emancipation is thus described from task stimuli and episodes with sub-expressions of transformative agency.

8.2.1 Resisting

The resistive sub-expressions identified during inductive analyses were:

- R1: Resisting through articulation of change fatigue.
- R2: Resisting personal roles in proposed change efforts.
- R3: Resisting competing obligations on time / effort.
- R4: Resisting through inertia of embedded social practices.

The early legitimisation of resistance through given double stimulation tasks was important for participants, not necessarily for them to exhibit resistance per se but to normalise their further participation in multi-voiced and troublesome negotiations. Resistance was typically engendered and negotiated through engagement with historically-oriented task stimuli: data in the form of audio-visual (AV) material and anecdotes of the failures and successes of previous change endeavours (R1: change fatigue); mirror data of personal involvement in activity (R2: personal roles); individual task stimuli in workbooks, informing subsequent social task stimuli on surfaces, and live disturbance diaries of roles and responsibilities (R3:

competing obligations); and AV data of historically embedded problems, whose ownership was negotiated and whose societal consequences were mutually recognised (R4: social practices).

8.2.2 Criticizing

The criticizing sub-expressions identified during inductive analyses were:

- Cr1: Criticizing proscription of involvement and control.
- Cr2: Criticizing misalignment of societal and organisational problems.
- Cr3: Criticizing social disorientation to understanding problems.
- Cr4: Criticizing unclear expectations of people and technologies.
- Cr5: Criticizing unclear loci of social control and risk.

Transitional criticizing episodes allowed participants to contribute to the social identification of specific, intersubjective and historically embedded problems in activity which deserved examination in further detail. Criticizing was typically engendered through increasing engagement with task stimuli representing historical and current conditions. Participants individually and collaboratively analysed: historical power relationships related to cultural mediation of activity beyond production (Cr1: proscribed control); historically embedded disturbances, through task stimuli and mirror data of persistent isolationist problems in military TEL (Cr2: societal misalignment); timelines and four-field analyses on individualist and deterministic approaches to TEL (Cr3: social disorientation); the role of people and technologies in the evolving germ cell of boundary-crossing TEL, and in alternatives which did not evolve (Cr4: sociotechnical expectations); and the social identification, aggravation and negotiation of contradictions of power and control (Cr5: loci of social control).

8.2.3 Explicating

The explicating sub-expressions identified during inductive analyses were:

- Ex1: Explicating possibilities of further task coordination.
- Ex2: Explicating potential for changes to participant membership.
- Ex3: Explicating potential for social defiance or compliance.
- Ex4: Explicating potential of adapting physical environment.
- Ex5: Explicating possibilities for changes to social use of technologies.

The explication of future possibility and potential involved participants calling upon and modifying their past, present and future forms of artefact-stimuli with increasing initiative and self-influence. Participants collaboratively modified and curated their artefact-stimuli to suit the negotiations at hand: identifying relationships between levels and elements of action, activity, and different activities (Ex1: task co-ordination); negotiating changes to division of labour and the effects on activity's subject and community (Ex2: participant membership); identifying ways to collaboratively and actively highlight root causes and effects of problems (Ex3: social defiance or compliance); aggravating contradictions and undertaking historical analyses to establish the effects of space on activity (Ex4: physical environment); and referring to past experiences to inform their possible influence on the physical artefacts of TEL (Ex5: select and use technologies).

8.2.4 Envisioning

The envisioning sub-expressions identified during inductive analyses were:

- En1: Envisioning changes to personal commitments and relationships.
- En2: Envisioning changes to political selection and control of tasks.
- En3: Envisioning changes to representations of competence.
- En4: Envisioning changes to practice for engagement with experts.
- En5: Envisioning enhanced ability to select and use technology.

The collaborative construction and examination of future-oriented models typically involved participants calling upon individual tasks in workbooks, to contribute to their social tasks on surfaces. Envisioning was typically engendered by participants increasingly rejecting given stimuli, in favour of identifying and curating their own stimuli and mirror data: modelling their own actions and proposing contributions to societal activity (En1: personal commitments); their further aggravation of contradictions to identify and enrich double binds in TEL resourcing and scenarios, negotiating motives for its future development (En2: task selection and control); proposing the reconceptualisation of proficiency to include the social and societal understanding of work and learning problems (En3: representing competence); modelling changes to division of labour, with the identification of individual and societal concerns for consolidation (En4: engaging with expertise); and raising the potential of TEL activity with jointly constructed collaborative artefacts, with potential new contradictions (En5: select and use technology).

8.2.5 Committing

The commissive sub-expressions identified during inductive analyses were:

- Co1: Committing to challenging power relationships.
- Co2: Committing to changing location, infrastructure or environment.
- Co3: Committing to engaging with further stakeholders.
- Co4: Committing to demonstrating successes and failures.
- Co5: Committing to taking or transferring task responsibility.

Self-obligating acts with measurable specificity were undertaken through the collaborative negotiation and co-configuration of previous proposals. Transitional episodes related to various artefact-stimuli, with the commissive negotiations led by participants themselves: adapting activity systems and four-field analyses, to understand and influence normative relationships with higher ranking personnel (Co1: challenging power); re-examining expansive cycles and remodelling activity systems, to sustain change through varying locations, physical infrastructures and environments (Co2: changing space); committing to further aggravation of contradictions in future activity, and negotiation of the individual and social impact of commissive acts (Co3: engaging with stakeholders); overtly publishing media of success and productive failure in work and learning (Co4: demonstrating performance); and taking ownership of the generation and curation of future mirror data for irrefutable evidence of having made commissive acts (Co5: transferring responsibility).

8.2.6 Taking action

Regarding taking action, the sub-expressions identified during inductive analyses were:

- T1: Taking action to undertake planned change to practices.
- T2: Taking action to reject planned change, or to implement ad-hoc change.
- T3: Taking action to communicate findings of changed practice.
- T4: Taking action to sustain further agentic and expansive change.

Transitional episodes of taking action described consequent concretisation of change, usually in retrospective ways. Episodes were generally expressed whilst iteratively amending and curating artefact-stimuli on surfaces and workbooks: tracing progress with expansive cycles; studying mirror data; generating further ideas; and revisiting models of concretised and aspirational activity systems. Taking action was assisted by stimuli which at this point were

wholly owned by participants, and accounts were generally retrospective accounts captured during reflective sessions to iterate and consolidate findings across the group: the implementation and concretisation of plans, regardless of their risk and impact (T1: undertake planned change); the ad-hoc or reactive change to planned implementation and concretisation, when faced with unexpected conditions (T2: reject planned change); recording elements of new activity, empirical observations of predicted contradictions and surprising effects (T3: communicate findings); and the further generation and curation of mirror data for use in future interventions by other participants (T4: sustain agentic change).

8.3 Answering the main research question

This section, where I respond to the main research question, refers to my previous answers to sub-questions; they necessarily precede and inform this answer to the main question. A Marxist epistemology, CHAT's historical and dialectical materialism, and the Vygotskian influences of the Change Laboratory methodology, seem fundamental to my ability to answer the main question. I describe below how the intervention relates to the empowerment and emancipation of participants, with salient points on how it unfolded, and prominent observations concerning how my intended design diverged from actuality.

- The six main expressions of transformative agency temporally alternated in dominance as the intervention unfolded. Three dominant pairings evolved in the order implied by Haapasaari et al. (2016: 242): resisting and criticizing in the first third; explicating and envisioning in the middle third; and committing and taking action in the final third. This relatively coarse observation of emergence is unsurprising; the evolution of expressions broadly reflected the expansive intent of sessions and their associated double stimulation tasks, which were anticipated to engender and sustain transformative agency. Working in reverse order, there is a traceable and self-evident dependence to many sub-expressions. Those of taking action required previous commitment (see for example T3's antecedent reliance on Co4 in Chapter 6), which in turn required envisioning of solutions and prior explication of the underlying problems (see for example En4's antecedent reliance on Ex2 in Chapter 6). The most important sub-expressions were deemed by participants to be those of resistance and criticism, whose normalisation in task stimuli was critical to their multi-voiced and troublesome negotiations. A notable example is Sub-section 6.2.4 in Chapter 6, illustrating how stimuli may engender subjective development of resistance in the face of bureaucratic inertia. Yet resistance and criticism were amongst the least frequent, indicating that

frequential statistics may be indicative of evolving agency but are not conclusive, with consequences for the design and analyses of task stimuli.

- When any main expression is isolated from the remainder, its sub-expressions tended to begin emerging in separated staccato episodes, which began coalescing and becoming future-oriented and collaborative as the intervention unfolded. Sub-expressions of the highest future-orientation and collaboration tended to cluster with sub-expressions which were similarly future-oriented and collaborative. These future-oriented and collaborative episodes correlate with the involvement of multiple participants in externalisation of their meaning-making, through their problematic negotiation of increasingly concretised and shared task stimuli. Sub-section 6.3.5 in Chapter 6 provides an example of sharing meanings of criticism through shared task stimuli, undertaken by multiple participants who had diverse power relationships outside the intervention. This builds on and reaffirms Haapasaari et al.'s (2016: 258) observation that "though the first expression of transformative agency is initiated by an individual, it requires collaboration and collective agency in order to survive and expand".

- When all of the main expressions and all of the sub-expressions are collated and considered as a compilation, there appear to be correlations, in episodes and their related task stimuli, between re-imagining the object of their activity and their increasing concretisation of their proposals for change. The attention given to the object of activity, as the intervention advanced in time, can be compared in the episodes and the related task stimuli: the intervention's earliest episodes and task stimuli, where sub-expressions related to here-and-now and individual consequences of resistance and criticism, peak for activity's artefacts and rules; whilst the intervention's later episodes and task stimuli, where sub-expressions related to future oriented and collaborative commitment and taking action, peak for the object of activity. A notable example is Sub-section 6.4.3 in Chapter 6; the object of activity is iteratively considered whilst relating it to the collaborative negotiation and concretisation of changes to rules and division of labour. This shifting attention towards the activity's object, in their concretised task stimuli and in episodes, illustrates how participants collaboratively expanded the object of their boundary-crossing TEL activity; by definition this appears to signify their success in expansive learning (Bligh & Flood, 2015: 153).

- Taking the evolution of each of the main expressions in turn, there are increasingly prolonged times for each to reach their most collaborative and future-oriented sub-expressions (for example, the time between sub-expressions Cr1 to Cr5 is less than that between sub-expressions Co1 to Co5 in Chapter 6). This suggests that as change becomes progressively expansive, participants increasingly call upon prior task stimuli and previous negotiations in order to continue building their transformative agency and concretising proposals. This observation relates to how building transformative agency resulted in a number of divergences between the designed intent and the actual intervention (Virkkunen & Newnham, 2013b: 79). The most significant inflection of divergence was when learner participants deployed remotely, which surprised all of the intervention's participants and which was preceded by a lengthy period of discussing their related double bind, consulting mirror data and engaging with stimuli. These protracted negotiations culminated in the commitments to move physical location in Sub-section 6.6.2 in Chapter 6, which were accompanied by collaborative work on task stimuli which increasingly connected activity with other phenomena. There were compounding levels of participants' engagement with mirror data and previous stimuli to share meaning. Implications for development were thus lucrative (Bligh & Flood, 2017: 143), yet the increasing connectivity of activity took compounding time, resources and effort to concretise.

- As sub-expressions became more future-oriented and collaborative, and task stimuli become more concretised, participants increasingly associated change with the cultural mediation of activity (see for example the varying implications for rules and division of labour for Ex4, En4 and Co5 in Chapter 6). This correlates with increasing attention toward the object of activity in stimuli, indicating developing understanding of object-oriented activity and the resulting implications for cultural mediation. This can be seen in the progression from early sessions when rules, community and division of labour were considered by participants to be beyond their influence; they tended to discuss artefacts in early proposals to overcome their double bind such as in Sub-section 6.3.4 where they directly criticise their media and platforms. In later sessions, such as those described in Sub-section 6.5.5, participants had benefitted from having enriched and concretised their modelled activity, and had negotiated a number of secondary contradictions associated with rules, community and division of labour. Participants had thus recognised how mediators were at odds with the object of activity and with other mediators, and were proposing remediation for sustaining

change. These examples illustrate the value of object-oriented activity and its contradictions to understanding implications for change.

- Comparing sub-expressions with related stimuli, participants articulated for themselves the direct benefits to redesigning activity, and the manifestations in stimuli, of their developing transformative agency. For example, Sub-section 6.7.4 in Chapter 6 illustrates participants' own perceptions of their agentic development, with relatively conflictual negotiations of their proposals for consolidation. When such future-oriented and collaborative sub-expressions emerged in transitional episodes (as defined by Kerosuo, 2011: 392) participants' stimuli were recognisably more negotiated and conflictual than previously (see for example the stimuli related to sub-expressions R1, R2, R3 and R4 in Chapter 6) . This negotiation of conflict included their ability to collectively diverge from the designed intent of the intervention (though to continue in its expansivity; see e.g. Bligh & Flood, 2015: 154). The early legitimisation of resistance and critique through task stimuli, described above, was important to such feelings of empowerment. Subsequent sub-expressions were plainly influenced by resistive and critical empowerment, which is apparent in episodes and related stimuli (see for example the principled language code of Ex3, En2, Co1 and T1 in Chapter 6). Power relations were central to establishing early familiarity with conflict (also acknowledged in Foot, 2014: 340), which again vindicates a Marxist epistemology and the Change Laboratory methodology; learning to manage discomfort and conflicting political motives was vital for equitable participation.

8.4 Core claims

Having answered the research question I will now make clear my core claims to originality, which are tempered by: the incompleteness of expansive learning; my intervention's narrow context; and the bounded activity and temporality of the research. I make two modest claims: I claim originality in empowering military participants of TEL to make concrete changes to their social reality through a Marxist epistemology; and I claim originality in identifying sub-expressions of transformative agency.

- Firstly, I claim that this is the first study to use a Marxist epistemology to develop the agency of participants of military TEL. In empowering participants to exhibit and develop agency, a Marxist epistemology has assisted their exposure and resistance of ideologies and power inequities in ways not previously examined. These were critical

to the intervention's participants changing their own TEL activity. Without a Marxist epistemology and Vygotskian perspectives of CHAT, my project risked continuing to propagate dominant practices of implementing artefacts to gain scalable exchange value observed elsewhere, and it would have under-prioritised the cultural mediation of TEL in its authentic context.

- Secondly, inductive analyses of sub-expressions of transformative agency are also claimed to be original. These sub-expressions deserve further empirical work to ratify or reject their generalisability in other social conditions. Yet even in this limited study, their increasingly collaborative and future-oriented nature presents a strong argument for bottom-up and top-down representation in research of HE, rather than pursuing the pretence of consensus. To explain, the opposing poles of representation (in the intervention's case between operational and managerial participants) were deemed to be crucial to generate problematic yet lucrative perspectives for change. In turn those perspectives drove increasingly collaborative and future-oriented transitional episodes. Sub-expressions were thus intrinsically related to oscillations between moments of top-down and bottom-up initiatives for change, with social negotiation of systemic contradictions. These characteristics are in contrast to claims of consensus and finality.

8.5 Implications for policy and practice

Rather than seeking the pretence of consensus for policy and practice, this intervention has built on a Marxist epistemology and Vygotskian principles to continue exposing and aggravating contradictions for further developmental change. The project has resolved many contradictions and has generated many more. Its top-down and bottom-up poles of representation were deemed to be crucial, generating oscillations about moments which resulted in increasingly collaborative and future-oriented sub-expressions. These oscillations are recognised only in limited studies (acknowledged by Bligh & Flood, 2015: 142), with research on HE often striving for elusive sector-wide range rather than local problems. Notions of agency have seldom been operationalised as dilemmatic or transformative, with many authors calling for agency yet not taking the necessary steps to aggravate contradictions and change social circumstances. There are challenges for porting the results into broader policies and practices of boundary-crossing TEL (see also Bartholomew & Hayes, 2015: 25) which are considered separately below.

8.5.1 Implications for policy

The implications of these findings for policy are assessed to be nascent and problematic, with further consolidation planned to aggravate contradictions in rules-producing activity. The results of this intervention have been acknowledged by managers of the RSME and, as described in earlier chapters, evidence of boundary-crossing TEL is being published in the RSME's corporate media, yet its results continue to directly violate defence policy on a number of counts (Defence Authority for People, 2015), notably:

- Military personnel ought to learn from formally authorised defence trainers, in defence facilities, and with defence ICTs (p. 43).
- Changes to programmes ought to be authorised by a nominated defence authority and accompanied by cost-benefit analyses (p. 83).
- Authorised specifications ought to control what is taught and how it is taught, both sanctioned by defence authorities (p. 90).

In light of these and other requirements, I assess that it is over-simplistic to take local (and therefore changeable) political acceptance of the results as sufficient for their sustenance. HEIs comprise only a marginal sector of defence's educational establishments, yet all military schools are subject to the same policy (ibid.), which pragmatically focuses on the predictable requirements of the overwhelming mass of defence schools. Policy is written to regulate skills-based mastery, by the rehearsal of specified and pre-ordained tasks, in stipulated conditions, and policy is thus incommensurate with sustaining the project's results. The risks of not influencing policy, in the face of contingency and organisational uncertainty, is recognised by Donaldson (2015: 609); "Organisations facing low uncertainty are fitted by specialised and centralised hierarchical structures, whereas organisations facing high uncertainty are fitted by lower specialisation and decentralisation". In contrast, military HE faces high uncertainty due to wider societal trends and developments, whilst it is fitted by specialised and centralised hierarchical structures.

On a related political note, there were conceptions amongst the intervention's participants that there was a certain catalysation of their agency to be gained by bending and breaking defence policies, and an associated sense of groups bonding in their joint and surreptitious disobedience of policy. The qualitative implications of dissenting yet agentic behaviours have been researched from an anthropological perspective (Kirke, 2010: 359), but apparently not from epistemological or pedagogical perspectives. Irrespective of the perceived local

benefits, covert dissent (as discrete from legitimised resistance and criticism) is likely to stifle genuine change, and may even restore the political status quo and social conditions that drove this intervention; redesigned boundary-crossing TEL could revert to being non-compliant, un-resourced and thus unsustainable. This raises concerns of attributing value to local change endeavours by participants themselves, which will be difficult beyond the immediate setting without the involvement of strategic policy makers (see e.g. Saunders, Trowler, & Bamber, 2011: 204-205). On a related note, political control was related by participants to a number of the RSME's "grand issues" (Tight, 2012a: 118) such as TEL's internationalisation, commercialisation, and income generation beyond defence.

Retaining political sanction to the local level also relates to negative backwash effects on wider organisational learning, which may stultify the further consolidation of the results. Local rule-bending elsewhere in defence has been attributed to "adaptation traps that have acted as barriers to higher-level learning", analysed for local rule-bending by Catignani (2013: 30). Similar challenges for policy in HE have been analysed as tensions between "changes and continuities" by Evetts (2014: 46), such as the rising tensions between changing the loci of control for HE's governance, and the requirement for HE's continuity of authority. At the time of writing, proposals for taking on the challenges of these double binds are being compiled; in my opinion they demand the development of a Marxist epistemology for genuine change to policy, rather than the toleration of local rule-bending. These future endeavours aspire to empower participants to engage in "innovative ways to influence policy" (Gunn, 2015: 34). In summary, defence learning policy needs to change if it is to regulate and sustain the epistemic benefits of the project, in the increasingly negotiated and contingent environment of military work and learning (Sookermany, 2016: 287).

8.5.2 Implications for practice

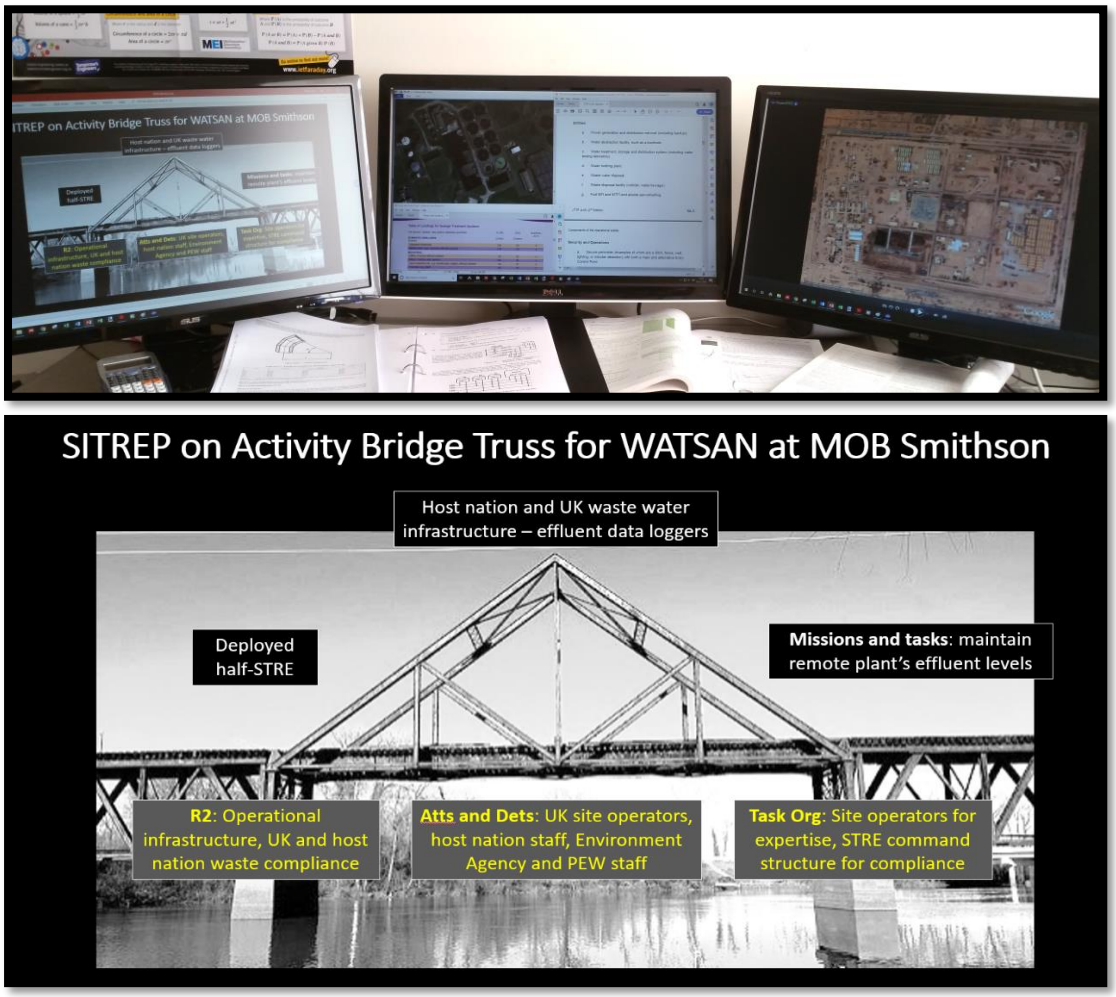
Implications for practice can be considered in two distinct yet related ways: the immediate, direct and local implications; and the more general implications beyond the intervention. For both, the project's Marxist and Vygotskian approaches appear to have been lucrative for provoking the transformative agency of learners to *continue* redesigning their own practice; that was the project's most important outcome (see also Engeström, 2013: 85). Locally, participants continue to redesign their boundary-crossing TEL, and continue to do so in reaction to contingent conditions for work and learning; this has implications for practice which may appeal to strategists. Yet they have learned to do so by exposing and aggravating contradictions of division of labour and rules; this has implications for practice which may

not appeal to strategists. It seems relevant to practice that no further implementations of technological artefacts were ever likely to resolve participants' double binds, and local practice since the intervention has included a focus on rules, community and division of labour which was not previously evident.

Notwithstanding the ongoing policy implications above, these local accomplishments have alleviated many of the social conditions described in Section 1.4, and have satisfied my personal aims for the intervention, despite their exposition of further problematic conditions. It is notable in ongoing consolidation that, having domesticated task stimuli, evidence of consolidation at the time of writing bears many of the theoretical and methodological principles of the intervention, yet they bear little visual resemblance to the stimuli used in sessions. Stimuli and terminology now use the lingua franca and conceptual models of military engineering, with the exception of activity systems (although they are now referred to as "activity bridge trusses"). Division of labour is referred to as "task org [organisation]"; community is referred to as "atts and dets [attachments and detachments]"; and rules are referred to as "R2 [reports and returns]", whilst the object of activity is referred to as "missions and tasks". Further negotiations take place in "sitreps [situation reports]" which, along with these previous terms, are part of routine military management.

Participants thus appear to have routinised the outcomes of the intervention, with little residual terminology or visual imagery of CHAT or the Change Laboratory yet many of the associated principles. An example of practice showing the influence of the Change Laboratory's surfaces is shown in Figure 8.1. At the time of writing I noticed that these surfaces were being instinctively used by participants who had moved on from my programmes, and were being employed on a subsequent task for failing wastewater engineering on military operations. It illustrates their curation of stimuli and concurrently illustrates the routinisation and domestication of the project's results. On the right is an example of *mirror material*, showing AV of failing wastewater engineering on military tasks. The centre screen shows examples of *ideas / tools* with springboards of informative problems with UK wastewater infrastructure. Also shown are relevant extracts from policy documents and legislative guidance, influencing the identification of contradictions and negotiations. On the left screen is an example of models / visions, here showing an activity system labelled an "activity bridge truss", using real imagery of a bridge; that forms the enlarged image below. The model of activity is then used to re-examine mirror data and ideas / tools, to critique the problem and the proposed solutions.

Figure 8.1. An example of domesticated Change Laboratory surfaces in use at the RSME



This may appear to be relatively trivial, yet the empowerment of military learners to critique and influence their activity in this conflictual way, and to curate stimuli to empower their successors, are significant qualitative developments for practice. Participants' value judgements of qualitative implications for practice may contradict those of strategists, who are likely to be concerned with performativity at the institutional level (an example of defence's growth in competitive positioning, described for HE by Saunders, 2012: 234). A dilemma for strategists is that commercialising the project's implications for practice will either necessitate their overt acceptance of non-compliance, or will catalyse changes to policy. Such dilemmas illustrate the interconnectedness of policy and practice and the potential for further conflictual development in expansive cycles. Rather than conducting gap analyses between policy and practice in further consolidation, my ongoing evaluation will consider and compare the varied experiences of these stakeholders (see also Saunders, Trowler & Bamber, 2011: 205). The practice-based outcomes of a Marxist epistemology, and of dialectical materialism, present important implications for further consolidation: material activity has primacy; knowing is social and inseparable from doing; and understanding

activity's meaning requires consideration of its social and historical context (Nicolini et al., 2003: 8). These are also important to guide my project's limitations, described below.

8.6 Limitations of the project

This intervention's Change Laboratory methodology has directly challenged established practice and has empowered participants in a number of formative ways: aggravating contradictions for their own development and that of their TEL (Engeström and Sannino, 2011: 371); overcoming negative connotations of contradictions in work and learning to instead grasp the developmental potential of conflict (Nicolini, 2012: 120); relating the development of cultural mediation with the interaction enabled by technologies (Luckin, 2010b: 165); and legitimizing the primacy of material work and learning through an understanding of object-oriented activity (Arnseth, 2008: 294). In their current state my results are limited to the relatively narrow bounds described in this thesis. The project may be of broader interest to Activity Theorists, Marxist interventionists, and TEL researchers. Generalisability beyond these constraints is limited, and will be difficult for me to substantiate without further expansive cycles, a shortcoming which may be a dialectical outcome of its meaningful local impact.

Constraints for generalisability are driven by the boundedness of activity and by its collective subject, whose composition alleviated some methodological concerns by provoking issues of agency and power (Bligh & Flood, 2017: 143) yet exacerbated others such as the inability to capture individual agency (Englund & Price, 2018: 201). Whilst multiple perspectives have provided lucrative conflicting motives, the collective subject proscribed my ability to represent individuals. As a result, my analyses have aggregated heterogenous perspectives of "systemic relationships" (Langemeyer & Roth, 2006: 36), and my findings are reductively attributed to the whole collective subject (Langemeyer, 2017: 40). Aspects of individual agency cannot be isolated, and I believe that I have answered my research questions yet only at the collective level (Kontinen, 2013: 113). Such limitations seem common to interventions in Marxist and Vygotskian traditions, whose diverse political membership is necessary to expose activity's complexity (Langemeyer, 2017: 41). Individualistic perspectives would raise false hopes of personal political emancipation; this is a social and not an individual phenomenon (Ratner, 2017: 59). Nonetheless, my results remain limited to this collective subject and this activity.

8.7 Further research opportunities

The formative intervention summarised in this thesis has empowered participants to question and influence their own activity, engendering their ability to change their own social conditions for boundary-crossing TEL. It has thus achieved what it set out to in the introductory sections, and it has alleviated my personal concerns which I set out in Section 1.4. Whilst modestly successful in that relatively local and time-bound impact the project has exposed further research opportunities and new concerns for me to contend with, particularly in sustaining agentic change to other units, influencing policy and considering ongoing evaluation of boundary-crossing TEL. These further opportunities may help to confront and challenge widespread observations of TEL's deterministic claims, such as those described by Goodchild and Speed (2018: 11) as a "disjuncture between the fantasmatic grip of TEL and practical experience". Further research will consolidate the expansive findings to other units, in different physical spaces, with different social conditions, and with a wider population. These opportunities will serve longer-term expansive cycles with other work units, noting that co-configured designs are "never truly finished" (Nummijoki & Engeström, 2010: 54).

Situating the intervention's results in the intersecting fields of the literature has also identified its partiality. There were few empirical studies which recognised incompleteness, although methodological guidance consistently describes the potential and requirement for ongoing intensified collaborations (e.g. Virkkunen & Newnham, 2013f: 237). As the researcher-interventionist, I was personally prepared for the uncertainty of encountering "a piece of the history of the future" (Engeström, 2015: 262) yet I had insufficiently equipped participants for the paradox of enabling the consolidation of their agentic yet incomplete work by others, who may undermine their efforts. This dilemma, between expansion and regression, seems similar to the "two-edged sword" of expansivity for the Change Laboratory methodology itself (Virkkunen & Newnham, 2013f: 235). Mitigation is therefore considered similar to that proposed for the methodology itself (ibid.); further empirical applications and their theoretical examinations are necessary. My subsequent intervention will likely re-introduce many of these participants, when they have vocational perspectives and more varied perceptions of further contradictions. We have to accept that expansivity can surprise, and that future participants may expansively break free of our own findings and expectations whilst developing their own transformative agency; a fitting illustration of further contradictions and incompleteness with which to close the thesis.

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APPENDIX 1 – SAMPLE OF LITERATURE REVIEW

Authors	Title	Year	Source title	Volume	Issue	Page start	Page end	Abstract	Methodology, framework, paradigm	Methods	Dept, Field, Focus	Broad categorizations / dimensions	Notable comments with examples / selections of text	Observations and dimensions of change through an expansive learning intervention [as opposed to implementation of change]:	Engage internal stakeholders in TEL acceptance	Practice and exhibit TEL for adaptability
Waring T., Skoumpopoulou D.	An enterprise resource planning system innovation and its influence on organisational culture: A case study in higher	2012	Prometheus (United Kingdom)	30	4	427	447	Many organisations are adopting new enterprise resource planning (ERP) systems to address their organisational and business problems. These technologies may promise utopian visions of information management, yet often they have the potential to re-	Case study.	Document analysis, interviews and participant observation	Business management. TEL to attract engagement of internal stakeholders in	Useful for engaging faculty again with TEL change, yet again no learner involvement. [Also of note, it seems to me that	A rare analysis of the **sociocultural relationships of ERP systems in HE**, and ultimately where it leads to vis-à-vis explanations of change, eg P428: "One such consequence, although not overtly considered in previous ERP research in higher education, may be **the advancement of a culture of instrumental command and**	Reflection on the process (although not with participants) Looks like some missed lucrative opportunities for dialectical materialism which could have been aggravated with expansive cycles " concerns with the manner in which determinism is frequently conflated with materialism, and voluntarism with idealism, resulting		Individuation, which is not necessarily a barrier to change but can empower individuals to become agents
Jeggels J.D., Traut A., Kwast M.	Revitalization of clinical skills training at the University of the Western Cape.	2010	Curationis	33	2	51	59	Most educational institutions that offer health related qualifications make use of clinical skills laboratories. These spaces are generally used for the demonstration and assessment of clinical skills. The purpose of this paper is to share our experiences related to the revitalization	Experiential learning (Kolb).	Observations of case-based teaching. Skills lab method: -Orientation, -Visualization -Guided practice	Medical clinical skills labs. [Clinicians; digital tech and AV adaptation and adoption in simulated	Balancing authenticity with safety. External influences [economical – the need to compete financially, take	Students were the intended beneficiaries, yet were not involved in the redesign and change, eg P52: "Traditionally students were given a lecture-demonstration which was followed by practice sessions and then a clinical assessment. Students would **often rote learn the steps of the procedure and**	Wholly a top-down implementation by the researchers, followed by some retrospective participant reflection on their assessment	Wholly a top-down implementation by the researchers, followed by some retrospective	
Lin C., Singer R., Ha L.	Why university members use and resist technology? A structure enactment perspective	2010	Journal of Computing in Higher Education	22	1	38	59	This case study investigated university members' use of and resistance to a communication information technology system in a higher education organization. This case study utilized the technology enactment framework to examine structure enactment in	Structuration theory [Giddens]. Case study.	Closed questions. Open-ended survey questions. One-on-one in depth interviews.	ICT adoption and resistance. Media studies. Communication studies. Org change to	Technological determinism from strategists. No learner involvement. [Missed opportunity for dialectic work]	Some similarity with exhibition of transformative agency, and also some resemblance to the expansive cycle. The authors identified the addition of "resistance" to the existing typology [Orlikowski, 2000 and 2002: 257] of enactment, see also P56. There also appears to be polarisation of the appetitite for change, eg P 44 "there was a **clear divide**	Questioning. Analysis (not double bind) Modelling Perhaps subsequent stages were constrained by the focus on Giddens's structuration? Missed opportunity to aggravate contradictory multi-voiced concerns "clear divide between university	Questioning. Analysis (not double bind) Modelling Perhaps subsequent stages were	
Hossain J.	Professional development of higher education teachers: Can ODL contribute?	2010	Turkish Online Journal of Distance Education	11	1	123	133	In the present era of information technology the system of education has undergone a lot of changes. Open and Distance Learning (ODL) around the world is perhaps the most important evidence to it. Despite the fact, ODL has not been popular in Bangladesh for a	Houle and the six classic needs of a practising professional. Boshier's EPS.	Questionnaire (six open ended questions)	Teachers: English Business Administration Engineering History Philosophy	Economic. Response to ODL [ODL for the speed and time advantage of professional development of staff].	Cultural factors concerning ODL as a response to the cost and time of the alternatives for staff CPD (procuring CPD and allowing staff the time and subsistence to attend), eg P129 "But the opinion of Levis (2002) on e-learning maintained a **link between economy and knowledge and directly pushed the tertiary level teachers**	None evident; implementation of ODL as a top-down model for teachers' CPD. Government led policy	None evident; implementation of ODL as a top-down model for teachers' CPD. Government led policy	
Ensminger D.C., Surry D.W.	Relative ranking of conditions that facilitate innovation implementation in the USA	2008	Australasian Journal of Educational Technology	24	5	611	626	This study compared how people working in three different types of organisations in the United States (K-12 schools, higher education, and business) rank the importance of eight conditions that have been shown to facilitate the implementation of	QUANT	Implementation Profile Inventory (IPI) (Surry & Ensminger, 2004). Post-hoc comparisons.	Different lecturer groups: K-12. Business-industry. HEIs.	Conditions that facilitate TEL change. Nature of innovation [and how it relates to the conditions that facilitate it].	Valued conditions for change did vary across the cohort groups. See P418 for the comprehensive analysis which may have revealed much more with some follow-up QUAL: "Overall, the **condition of resources was the most valued condition among those in the K-12 group and the higher education group** ... Business settings are	None; another top-down implementation with retrospective QUANT data on valued conditions for change	None; another top-down implementation with retrospective QUANT data on valued conditions for	
Matthews N.	Conflicting perceptions and complex change: Promoting web-supported learning in an arts and	2008	Learning, Media and Technology	33	1	35	44	This article discusses the processes and outcomes of an attempt to encourage academic staff to use a web-supported learning package in a UK post-1992 university. The researcher adopts an 'insider' approach to research, drawing	Participant observation.	Informal discussions. Semi-structured interviews. Artefact analysis (policy	Media Studies. Critical and Cultural Studies Org change to attract	Useful critique of the notion of a unitary "culture" which can be changed in association with technology.	[NB this is also a useful account of insider research]. Incredibly valuable statement in the abstract, P35: "While **no dramatic increase in the numbers of staff using the new technology** was observed in the first year of implementation, the research suggests this is **viewed not as a failure**	Analysing current activity and some acknowledgement of the existing of a double bind but not its aggravation, which may have been valuable for different stakeholders whether staff/students or disciplines/faculty/department.	Analysing current activity and some acknowledgement of the existing of a double bind but not its	
Dearnley C., Dunn G., Watson S.	An exploration of on-line access by non-traditional students in higher education: A case study	2006	Nurse Education Today	26	5	409	415	The nature of Higher Education (HE) has seen many changes throughout the last decade. The agenda for widening participation in HE has led to an increase in the number of students with a broader range of educational backgrounds. At	Mixed method. Case study.	Postal survey (multiple response, closed questions). Semi-structured telephone	School of Health Studies TEL for WP Org change to attract	Apparently student-driven although economic [imperative for attraction of registrants].	Some evidence here of a drift towards technological determinism, eg P410: "Involvement in the Blackboard pilot phase, and its introduction to a range of programmes within the Division, created a demand for staff to develop media communications skills and, for some, **to re-think their approach to**	Analysing current activity yet not as an intervention; more as a commentary on the empirical data which was gathered through postal survey		Analysing current activity yet not as an intervention; more as a commentary on the empirical
Bell M., Bell W.	It's installed... now get on with it! Looking beyond the software to the cultural change	2005	British Journal of Educational Technology	36	4	643	656	This case study looks at the lessons learned from the ultimately successful implementation of the Blackboard Managed Learning Environment at Northumbria University and explores how these are now being applied to the	Case study	Focus groups [staff and learners]. Postal surveys. Telephone interviews.	FE and HE for Northumbria University and associated colleges.	Staff and learner involvement in configuration of VLE. Attempts to resolve top-down and	There are obvious attempts to discuss strategist and operational staff conflicting priorities, and these are recognised but not exposed or aggravated and so remain unresolved, and there are elements of activity which seem to emerge from the account eg see the RULES and COMMUNITY and DIVISION OF LABOUR	Some evidence of these, although they appear to be done retrospectively on a system which is coming anyway? Analysis (not double bind) Examining and testing (which made proposals but didn't progress to adjustment or enrichment)		Some evidence of these, although they appear to be done retrospectively
Angelica Risquez, Sarah Moore	Exploring feelings about technology integration in higher education: Individuation and congruence	2012						Purpose – This study aims to utilize two key psychoanalytical concepts – individuation and congruence – in order to analyze individual responses to organizational change and to propose a	QCA? Mixed? States some parts are naturalistic yet uses open-ended	Online questionnaire, open-ended responses, content analysis	Teachers in Irish HE; faculty only. Examines individuation and congruence with TEL and	Importance of contradiction. Most common response was labeled undecided. The engaged response	P331 for agency and for questioning, resistance etc with individuation: " ... individual and group aims do not necessarily need to be at odds, but the process of individuation can have unexpected outcomes for the role of the individual in the organization or group. If increased self-awareness and individuation is	Individuation, which is not necessarily a barrier to change but can empower individuals to become agents and leaders of change. Also a framework to diagnose change readiness ... No learner engagement. Wary of disproportionate representation ... " **claims may be mistakenly understood as an expression**	Individuation, which is not necessarily a barrier to change but can empower individuals to	

APPENDIX 2 – SAMPLE OF ATLAS.TI COMPUTER AIDED QUALITATIVE DATA ANALYSIS