Arguing with technology: Teaching and learning argumentative writing in the digital age English classroom

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Arguing with Technology

Teaching and Learning Argumentative Writing in the Digital Age English Classroom

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I certify that the work presented in this thesis is, to the best of my knowledge and belief, original, except as acknowledged in the text, and that the material has not been submitted, either in whole or in part, for a degree at this or any other university.

I acknowledge that I have read and understood the University's rules, requirements, procedures and policy relating to my higher degree research award and to my thesis. I certify that I have complied with the rules, requirements, procedures and policy of the University (as they may be from time to time).

Signed …………………………………………………… Date 22/12/17
Abstract

Argumentation is an under-developed practice in secondary English classrooms where the focus of essay-writing instruction has become the testing of content and the practising of text and paragraph templates. Under these constraints students are failing to see the process or product of writing as authentic or meaningful. In one response, educational technology promises much, with its multimodal hook, the lure of real-world communication and the proposed independence of its users. To date, however, the potential of educational technology to promote critical thinking that can be transferred to critical writing is underexplored. An opportunity exists to evaluate how argumentation can provide a communicative impetus in a digital learning environment focused on dialogue and collaboration. Theory and practice – based on student voices – can be foregrounded to evaluate the use of scaffolding-type programs, such as digital argument mapping, in the writing classroom.

Adopting a design-based research methodological approach, data collected from treatment and control groups of Year 9 and 10 students (aged 14-16 years) explored argumentation and digital argument mapping skills and interactions as part of a normal term’s unit of work in two school settings. This research aimed to discover the nature of student disengagement with contemporary practices for the writing of opinion, then explore the results and interpretations of working in an alternative approach. Digital argument mapping was trialed in order to evaluate both its impact on the effectiveness of student writing, and its impact on student engagement with practices dependent on dialogue and collaboration during the writing process.

Skills in argumentation improved from pre- to post-test writing and both students and teachers reported the usefulness and energy of an approach that focused on the purpose of writing. Most significantly, the use of a digital scaffolding type program challenges several contemporary assumptions about the effectiveness of educational technology in the writing classroom, and for learning more generally. In particular, the creation of a dialogic learning environment around intervention technology used to supplement, not replace, the teacher, was found to lead to more engagement in the writing process and more effective writing. Research findings suggest that a carefully structured teaching program centred on argument can reinvigorate writing by focusing on dialogue and collaboration as part of the planning stage of writing.
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Abbreviations

ACARA – The Australian Curriculum and Reporting Authority

AITSL – Australian Institute for Teaching and School Leadership

CSAV – Computer Supported Argument Visualisation

DAM – Digital Argument Mapping

DBR – Design-based Research

HSC – NSW Higher School Certificate

ICSEA – Index of Community Socio-Educational Advantage

NAPLAN – National Assessment Plan, Literacy and Numeracy

NSW – New South Wales, Australia

OECD – Organisation for Economic Co-operation and Development

PISA – Program for International Student Assessment

ZPD – Zone of Proximal Development (Vygotsky)
Chapter 1 – Introduction

This dissertation reports on the findings of a design-based research investigation into digital argument mapping as a scaffold for argumentative writing. Across a ten week school term students, teachers and the researcher were the co-designers of a learning environment in which argumentation skills were explicitly taught, then practised in an online environment, and finally tested in the writing of students. A mixed methods research design aimed to source both quantitative data about improvements in argumentation evident in writing, and qualitative data about the interpretations of students and teachers of the process. True to the principles of design-based research this process involved the attempt to put theory about writing instruction, argument and technology “into harm’s way” (Cobb, Confrey, DiSessa, Lehrer, & Schauble, 2003, p. 10) amidst the unpredictability of functioning classrooms in order to produce outcomes that might enrich both theory and instructional design.

This investigation is concerned with the potential of the socio-cognitive activity of argumentation (Schwarz & Asterhan, 2010) to lead to a reinvigoration of argumentative writing in general, and in the form of the essay in particular. In a broad context of standardisation and high-stakes testing on the one hand, and the revolution promised by digital educational technology on the other, research on capacities like argumentation is important because it focuses the attention of teachers and educators on processes of learning and communication that need to be explored within today’s digitally-opened and yet tightly policy-framed classroom walls. In a teaching and learning context that is the focus of such competing – and sometimes contradictory – theoretical and policy pressures, this dissertation asserts that a focus on capacities such as argumentation is a powerful way to examine and unpack two key dualities that mark subject English at the present juncture: print vs digital literacies, and critical-creative thinking vs standardisation.

Argumentative writing as manifest in ‘the essay’ is an ideologically contested schooling practice in the context of multiliteracies and digital culture generally, but it is also the contemporary standardised assessment reality for high school students across the globe (Andrews, Torgerson, Low & McGuinn, 2009). There are many potential approaches to the teaching of argumentative writing, and indeed the essay form. However this investigation specifically explores the extent to which the
communicative character of argumentation can foster the sustained and effective writing of opinion, by refocusing teaching and learning on process over product and communication over structure in the development of writing.

1.1 Background

There is a whirlwind of competing – sometimes contradictory, sometimes fertile – pressures on the desire to learn and teach the effective writing of opinion in the English classroom. While a multiliteracies pedagogy posits a situated practice of meaningful tasks, a community of learners and the valuing of an individual’s experience (Exley, 2015), an increasingly high-stakes NAPLAN\(^1\) testing regime pushes teachers towards intensive exam preparation and decontextualized skills acquisition in echoes of a “language skills model” of English (Thomson, 2009, p. 13). The Australian Curriculum\(^2\), resonating powerfully with Dartmouth in its 50th anniversary year, meanwhile suggests that subject English “helps to create confident communicators, imaginative thinkers and informed citizens” (ACARA, 2014, Rationale para. 1). Yet important questions remain unanswered. For example, how in a climate of teacher professionalization and validation where proficiency in educational technology is demanded (AITSL\(^3\), 2012), can the “digital multimodal landscape of the classroom” (Jewitt, 2010, p. 362) be harnessed to promote particular capacities such as argumentative writing? Additionally, and perhaps most importantly, in an era of curriculum narrowing (Macken-Horarik, 2014) where is the space and time for collaboration and authenticity in the process of writing? In short, some of the post-Dartmouth binaries (see for example Trimbur, 2008) characterizing subject English are still unresolved: are we student-centred or test-centred? Interested in activity and process or knowledge and subject-matter?

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1 Introduced in 2008, the National Assessment Program – Literacy and Numeracy (NAPLAN) is a series of standardised tests of basic skills in reading, writing, language conventions and numeracy. These are administered nationally to students in school Years 3 (students aged 9), 5, 7 and 9.

2 The Australian Curriculum, administered by the Australian Curriculum Assessment and Reporting Authority (ACARA), is the national curriculum which has been in the process of implementation and review since 2010. The new English Years 7-10 curriculum was first taught to students in Years 7 and 9 in 2014, the year in which data for this investigation was collected.

3 The Australian Institute for Teaching and School Leadership (AITSL) “provides national leadership for the Australian, State and Territory Governments in promoting excellence in the profession of teaching and school leadership” (AITSL, n.d.).
The contemporary character of subject English is in many ways defined by the attempt to facilitate self-expression in the modes of speaking, writing and representing framed within the continuities and discontinuities in the types of “English discourses and practices” (Reid, 2003, p. 100) described in the paragraph above. The movements, approaches and paradigms that derive from policy and curriculum documents, as well as research and practice, ostensibly attempt to enhance student ability to express ideas, either creatively or analytically, so that a composer can successfully engage with an audience.

The process writing movement sought to begin with the student’s own world, then guide that process of self-expression through drafting and conferencing – like real writers – towards the goal of a published work with a real or imagined audience in mind (Campbell & Green, 2006a). Next the genre movement sought to help students to “gain the cultural knowledge and understanding to be active participants” in social discourses by laying bare the structures and purposes of the key text types available to and required of them (Sutherland & Wilkinson, 2010, p.175). Around these approaches, behaviouralist, skills-based, functional-linguistic, constructivist, and cognitive theorists and practitioners have attempted to weave together the competing strands that continue to challenge the English teacher – the need to teach the craft of writing, combined with the need to encourage the creativity that will engage the student in the practice.

The school-based writing with which this dissertation is concerned is an extension of oral and academic practices stretching back to Ancient Greece. Across the curriculum, but particularly in the Humanities, high school students are asked to write analytically in a variety of forms and contexts. They answer comprehension questions in class as a way of advancing content and conceptual understanding. They consider information and express opinions about it in various general and specific forms such as expositions, letters-to-the-editor and reports. Above all, they are asked to write persuasively in the default assessment tool of contemporary schooling culture – the essay.

The problem for subject English is that most of the writing which students do in and for school is not communicative. Applebee and Langer (2011) report that high school students spend more than 80% of their writing time on non-compositional writing. That is, they are filling in blanks, doing short answer exercises and copying
down notes. When it comes to writing essays, this once tentative and expressive practice (Sanborn, 1994) has become a chore characterised by adherence to classroom codes such as the instruction to ‘Discuss’, which is more pretence than an invitation to authentic communication (Pirie, 1997). Criticism of the ways in which the essay is currently conceived and taught is equal parts frustration at a dying art and concern that a set of practices and dispositions vital for healthy social interaction is not being engaged with by students. Across the field, detrimental effects on critical thinking (Morgan & Beaumont, 2003) and democracy (Andrews, 1994) have been observed and theorised. Proponents of revitalisation have made calls to action based on the potential benefits of functional linguistics (Llosa, Beck, & Zhao, 2011), rhetoric (Moon, 2012) and digital culture (Kuhn & Crowell, 2011).

The genesis of this investigation lies in the observation that a set of schooling dispositions and practices valued by wider society may be on the decline, and that schools are challenged in their ability to address the problem. In addition, the contemporary policy, curriculum and research landscape is presenting teachers with often contradictory signposts about the place of writing in our culture, and the place of technology in facilitating that writing. As much as writing is an act of culture, with schools charged with its development, it is at base an act of communication (Winch, Johnston, March, Ljungdahl, & Holliday, 2015). School-based literacy is generally understood to involve the ability to communicate one’s ideas successfully in a variety of sanctioned forms. Communication here, in its socio-linguistic sense, is seen to involve more than the transmission of information; it is a purposeful activity that depends on the understanding of audience and context, as well as the styles and forms needed to interact constructively with an other. If, as Pirie (1997) has suggested, the fit between communication and a key practice such as essay-writing seems like a strange one, then this is a strong warning that our conception of what school-based writing has become is dangerously narrow.

From this problematizing of the relationship between writing and communication, this investigation developed a set of research directions. The first two being:

**1. The assessment of the nature and extent of student disengagement with the writing of opinion and the teaching approaches currently in use to develop it.**

**2. The evaluation of an alternative approach based on the mode of discourse of argumentation, one that utilises an eclectic set of practices ranging from**
cognitive to dialogic in order to facilitate more effective writing and more engaged writing practices.

Meanwhile, an additional research direction developed around the claims of digital educational technology that the decline of communicativeness in the classroom has been due to the restrictiveness of print culture literacy and its associated schooling practices (see for example Kalantzis & Cope, 2008). From the perspective of digital literacies, writing – especially with pen and paper – is a symbol of a traditional culture that values individual authorship and the reader-as-receiver. According to many, digital technologies have ushered in a revolutionary era of openness, agency and divergent knowledge (Lenhart, Arafeh, Smith, & Macgill, 2008). Even in the early 90s it was observed that the electronic word on the screen, in its non-linearity and provisional nature, reveals its constructedness and so permits a fluid and interactive relationship between composer and audience (Bolter, 1991). More recently the multimodal reality of the participatory digital world beyond the classroom (Healy, 2008; Kress, 2010; Ljungdahl, 2010) has been seen to disrupt the traditional hegemony of the written word on the physical page. The authority of printing, characterized by the distance from writer to reader and the power of the institutionally ordained private thought made public, does not sit easily with the lifeworlds of contemporary students. It is also a uniquely challenging aspect of the contemporary English classroom where digital educational technology and its related practices sit in tension with, for example, assessment requirements to produce handwritten essays of literary criticism.

After an assessment of student attitudes to current practices associated with writing (research direction 1), and an evaluation of their response to argumentation (research direction 2), the third research direction was developed in order to bring the potential of digital technology to engage students in thinking and writing analytically, under critical attention:

3. The evaluation of attitudes to and experiences of digital argument mapping, in order to establish both useful theory and practice for the writing classroom, and an assessment of students’ and teachers’ attitudes to educational technology for learning more generally.

Educational technology, particularly in its web 2.0 incarnation, seeks to bring the benefits of out-of-school communicative practices into the classroom (Fullan &
Langworthy, 2014). The argument is typically that through access to unlimited content, especially user-generated, as well as web-based communication technology and digital programs that allow for multimodal text production, learning is being revolutionised so that digital communication facilitates critical thinking, creativity and collaboration (Kress, 2003).

However, research findings on the extent to which this is actually taking place in classrooms are equivocal at best. The tension here for educators is that the technical ability to ‘communicate’ in order to find or present information, or exchange messages with another, translates in very complex ways to learning. As many studies as there are suggesting gains in learning from communicating with digital technologies (for example, Somekh et al., 2007), there are as many others bemoaning the lower-cognitive and non-communicative nature of much in-class technology use (Beavis, 2010), as well as the less than beneficial effects of its use on learning generally (Livingstone, 2012; OECD, 2012). This is often blamed on a recalcitrant teaching profession, but there is at least as much opportunity to criticize policy-makers, theorists, technology companies and educators who have failed to explain how an affordance of digital technology can be taken up in real classrooms, with the demands of community, curriculum and a range of learners, to enable skills valued by the subject.

In the end we as educators need more evidence in order to pick a clear and useful path through polarised debates between those panicking at the proposed death of print literacy, and “the promoters of the latest whizz-bang technology” (Snyder, 2008, p. 13). The latter often need to characterise subject English as the leaden-footed cause of this unfulfilled potential, but this is in many ways a straw man tactic that ignores a century’s worth of work within the subject, particularly from the Critical Literacy field⁴, on ways to make writing more meaningful, purposeful, authentic and hence communicative.

⁴ See for example the Four Literacy Resources (Freebody & Luke, 1990).
1.2 Argument and Communication in a Digital Age Learning Environment

The conceptual framework for this dissertation begins therefore with the existing approaches that subject English has for addressing the communicativeness of student writing. As we have seen both process writing and genre approaches tackle this issue and their limitations are well rehearsed in the literature (Sutherland & Wilkinson, 2010). Research into cognition, thinking schools (Golding, 2005) and philosophy (Lipman, 1991, for example), has explored both the effects of these approaches on communication and the way communication can facilitate processes such as higher-order thinking. The way these processes manifest as writing in either print or digital contexts is, however, under-explored in the literature. Literature in the field of new literacies also makes claims about the inherent communicativeness of the multimodal and internetworked technologies (Twiner, Coffin, Littleton, & Whitelock, 2010), but likewise is challenged by the application to print literacy. Often the suggestion seems to be a simplistic rejection of one for the theoretical benefits of the other: “What literacy teachers need to know is how to transform the print-based practices that have dominated western schooling into digital practices that more closely reflect the authentic uses of literacy beyond the classroom” (Mills & Levido, 2011, p. 81).

Critical literacy on the other hand has always taken up the notion that fluency in writing is achieved “by focusing on meaning rather than form” (Janks, 2010, p. 158). In this view writing is always an act of communication in which an “ethic of social justice” (p. 18) is the social purpose achieved by learning about and then disrupting social discourses. The critical pedagogy movement, especially in the United States, has aimed to empower students by helping them find their voices and thus be able to enter into dialogue with institutions. Morgan (1997), however, has claimed that in the Australian context, the critical literacy field has to some extent been hamstrung by its limited focus on a critical analysis of language.

More recently, Misson (2012) has made the argument that in the digital era, the project of subject English may well be “to give students the textual control that they need to engage in all the material, social and personal aspects of their lives” (pp. 27-28). More than testing, back-to-basics or the ability to construct a website, this means the ability to “engag[e] with the world” (p. 29). Misson’s suggestion, and
one taken up in the conception and design of this project, is that subject English should therefore focus on capacities that are valued by the subject because they facilitate this engagement.

One such capacity is argumentation. As a “mode of discourse” (Andrews, 1995, p. 4), rather than a genre or form, argument is a way of communicating that implies an intended audience, a context and a purpose. We argue in formal debate and in tentative dialogic exploration, but we always argue by staking out a position in response to another position. In this way argument is not only a capacity which enables the individual to “engage with the collective” (Mitchell, 1995, p. 133) but it is a capacity that necessitates an “interpretive community” (Kress & van Leeuwen, 2001, p. 9). Along with Kress and van Leeuwen, this dissertation considers communication to be dependent on both the articulation of ideas and their interpretation. Perhaps the limitations of writing instruction approaches and of digital communication revolve around the under-theorisation in literature and under-utilisation in classrooms of an interpretive community to give contexts to acts of communication? Writing opinions without a purpose, audience and context makes for arid and generic essays. Likewise pretty Powerpoint presentations with no purpose beyond the demands of classwork and no connection to the authentic, real-world concerns of students are equally likely to be ineffective and equally unlikely to enable students to engage with people and ideas that matter to them. In other words, neither an essay or a multimodal presentation, in and of itself, will satisfy the element of ‘Significance’ in the NSW Quality Teaching Framework (DET, 2003) without accessing the students’ background knowledge or enabling them to apply new understandings to real-life contexts.

This investigation has been guided by three particular conceptual frames. The first is a critical theory focus on “technology-in-use” (Edgerton, 2007, p. xi) as a way of grounding digital rhetoric around participation and empowerment. Simply, a critical theory of technology sees technology as an environment rather than an assemblage of tools (Feenberg, 2009). Learning is contextualised and so analysis addresses not what a technological tool can do but what becomes of learners and teachers in their relationships around technology. In particular this dissertation keeps in mind Selwyn’s (2014) conception of the ideologies of consumerism and corporatism inherent in every relationship with educational technology, in order to ground the
claims of technology proponents, teachers and students about what is possible in the digital realm.

The second conceptual frame is a sociocultural understanding of literacy and learning (Carlisle & Jordan, 2012), which extends logically from this perspective on technology. This frame explains the focus on the purposes and contexts of writing, and it also orient this investigation towards the socio-materiality of classroom practices (Johri, 2011). The emphasis throughout is on the interactions between learners, teachers, artefacts and cultural elements such as values and policy in a “learning environment” (Istance & Kools, 2013, p. 43). Related literature refers to a Social Infrastructure Framework (Bielaczyc, 2006) or the Ecology of Resources (Luckin, 2008) available to a student in any learning context. All are interested in relationships, collaboration and dialogue in ways that are currently undervalued by research on both writing and educational technology, and especially the combination of the two.

Finally, argument is considered in this investigation as a socio-cognitive activity. Argumentation can be seen as a set of cognitive practices, with much literature exploring the impacts of teaching an explicit set of argument terms and concepts such as ‘thesis’ and ‘counter-argument’. These are variously referred to as argument schema (Felton & Herko, 2004) or schemata (Nussbaum & Schraw, 2007), but this dissertation will utilise the more common label ‘argument grammar’ (Llosa et al., 2011; Noroozi et al., 2012). Argument mapping can be seen, for the purposes of this investigation, as a scaffolding type activity (Sawyer, 2006) which involves a cognitive focus on models, self-regulation, strategy development and the gradual fading of those supports. An argument map visually represents, usually in a distinctive inverted tree structure, the series of statements and supporting evidence that constitute an argument. In a hierarchical structure beginning with an overarching thesis, descending text boxes organise reasons – often referred to as ‘claims’ – and the supporting evidence these claims rely on. Arrows and lines then illustrate the inferential connections between them. While an argument map can be used to analyse an existing argument, say in a work of philosophy (see for example, Harrell, 2005), and this may be useful for the study of complex texts in the secondary classroom, an argument map can also prepare student thinking for the process of writing a sustained argumentative text.

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5 See section 4.2.4 for examples of student-constructed argument maps.
This investigation seeks to build on literature, however, which sees this largely cognitive process as embedded in the social relations of the classroom. This investigation utilises the work of Andrews (1994, 1995, 1997) and Andrews et al. (2009) on the many purposes and forms of argument, and the work of Schwarz and Asterhan (2010, p. 137) on “the social activity” of argumentation blending dialogic (empathy with another) and dialectic (critical analysis of alternative viewpoints) moves. In this way, this investigation has situated itself around questions relating to communication and interaction in the classroom which it seeks to answer within a critical socio-cognitive frame.

Before clarifying the research problem and impetus for research that characterises this investigation, a further note on terminology within the argumentation field. While there is general agreement (see for example Andrews et al., 2009; van Eemeren et al., 2014; Zarefsky, 2014), that argumentation refers to a communicative and interactional activity (as opposed to the product implied by the term ‘argument’) there is less consensus over terminology related to genre, form and purpose of writing. Following Andrews et al. (2009) I will consider non-fiction to be a meta-genre, under which sit a number of genres or text-types such as the essay. The kind of writing that may be deployed to construct an essay, or letter-to-the-editor, is sometimes termed analytical or expository writing, and perhaps ‘the writing of opinion’. For the purposes of this investigation, working within the argumentation field, I will prefer the more specific argumentative writing in order to convey a sense of the purpose, context and cognitive components of the activity of writing an argument. I will avoid synonyms in the field for the sake of clarity; Andrews et al. (2009), for example, have deployed ‘argumentational writing’ in order to counter the negative connotations of ‘argumentative’, while Kuhn, Hemberger and Khait (2016) refer to ‘argumentive writing’.

1.3 The Research Problem

In the light of the contemporary gap between essay-writing practices and the social, cultural and political space that educators ideally imagine for writing, there is a temptation to rid ourselves of the essay as an anachronism. Indeed, over time it may metamorphose into a form more at home in a multimodal context. However, in the
meantime, while the essay remains the default assessment form of the Humanities, there is an interesting juxtaposition where both the essay, implicitly, and the multimodal, explicitly, claim to be vehicles for productive self-expression and commentary on society, while both invite serious doubts as to the legitimacy of their claims. If neither currently fulfils this key role in the education sector – and in society generally – then the disappearance of the essay would leave a gap in students’ abilities to explore and interpret the world that is not convincingly filled by either the multimodal, or other modes and forms. Andrews (1994), for example, suggests that the richness of narrative is insufficient to challenge the stories told by those in power; it is the communicative aspect of argument that is essential to social harmony. A specific capacity such as argument may also provide the impetus for digitally produced knowledge to move beyond the limits of self-expression and consumer activity on social media (Selwyn, 2014) and make good its emancipatory promises by producing critical knowledge.

Research over the course of the last decade has considered ways to promote various aspects of argumentation in the writing of students. Nussbaum and Schraw (2007) explored the expansion of writers’ argument schema to incorporate counter-argument, but this was in an undergraduate and non-technology context and based solely on quantitative data. The uses of argument to improve critical thinking has been explored by Harrell (2005), but the focus was again at undergraduate level and involved the analysis of existing arguments. Cullen has extended this focus on argument in philosophy to the uses of digital argument mapping (Noden, 2015), and Nussbaum, Winsor, Acqi and Poliquin (2007) have explored online Vee diagrams6 as a source of improvements in student critical thinking. Elsewhere, argument has been considered as part of online discussion groups (Morgan & Beaumont, 2003) and a-synchronous online writing (Coffin, North, & Martin, 2009), but significantly in relation to the aims of this dissertation, there has been a dearth of research on how this transfers to the composition of sustained writing in either print or digital literacy contexts, let alone in a secondary English classroom.

In one exception, the recent work of Kuhn et al. (2016) has focused on school-aged writing by exploring the influence of dialogue on the development of critical thinking which is then displayed by students in their essay-writing. My

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6 A ‘Vee’ diagram is named for its V shape, which is intended to provide a structure for organising information, ideas and sub-topics about a subject being studied.
investigation therefore chimes with current approaches that are exploring structured environments where student-student talk can be developed towards critical thinking and writing. While argument and argument mapping have both been the subject of extensive research, there is therefore an opportunity and need for research into argumentation in high-school contexts where the evidence is drawn from texts or issues under study in class, and where the production of sustained writing that matters educationally, socially and personally to the student is the objective.

Furthermore, by situating that research in a digital context, this investigation will consider the interactions of technology and dialogue, technology and collaboration and technology and argument in a way that is largely absent in the research literature, particularly as applied to student writing. A digital argument map functions as a multimodal text, using a mixture of diagrams, symbols, image and text to represent the structure of an argument. Research on translating graphical representations into writing suggests that this process involves not only resemiotization (Iedema, 2003) but the facilitation of student inference-making through the visual display of information and relationships (Ainsworth, 2006; Sawyer & Greeno, 2009; Waldrip, Prain & Carolan, 2010). As research into the school use of technology as part of writing instruction continues to suggest (Graham, Capizzi, Harris, Hebert & Morphy 2014), word-processing and information search remain the norm. It is therefore imperative that opportunities are created to investigate specific digital platforms that are designed to enable critical thinking, and extend that investigation to evaluate the impact on student writing in ways that can be usefully communicated to practicing teachers in the field.

It is hoped that the refocusing of writing pedagogy onto capacities like argumentation may therefore have an effect on the ways in which we perceive, use and research educational technology. If the challenges of communicating effectively are mirrored in both print and digital domains, then an understanding of the ways in which a capacity valued by subject English is then addressed by the affordances of the digital may illuminate key issues in both fields. Hattie (2009, p. 221), has made the important distinction that research into educational technology has been limited by the fact that “the majority of studies are about teachers using computers in instruction and there are fewer studies about students using them in learning.” Argumentation and digital argument mapping (DAM) in a high school context, focused on students producing written texts, are thus key points of
intervention in the existing research field. Writing ten years ago Davies suggested that “using computers in the classroom to enhance opportunities for serious, sustained written composition” is an “aspect of technology” that “English teachers urgently need to start experimenting with” (2007, p. 64). It is not clear that educators and researchers have given his exhortation the attention it needs in the intervening years.

Investigating student use of DAM will also allow us to assess several key assumptions about learning with technology. DAM is a scaffolding technology that facilitates thinking and planning towards argumentative writing (Clark & Martinez-Garza, 2015). Research is needed on whether this kind of technology use in class is engaged with by students who, we are informed, prefer independent, self-paced online learning which mirrors their lifeworlds. It is also crucial for educators to explore whether students are willing and able to transfer skills from a dialogic and collaborative, technology-facilitated learning environment to a print literacy one where they are required to write argumentatively in order to satisfy assessment needs. As a scaffolding technology, digital argument mapping also challenges assumptions in the multiliteracies field that educational uses of technology that merely facilitate traditional practices – such as sole-authored sustained writing – are redundant and perhaps counter-productive in an age of learning by design and new literacies (Healy, 2008; Knobel & Lankshear, 2014). A starting point on a capacity such as argumentation is needed as an antidote to research tendencies which dismiss scaffolding and similar approaches in favour of exploring the affordances of new technologies in and of themselves. A starting point outside of the claims of the technology also pushes the focus away from testing for effectiveness to evaluating the experiences of students and teachers in a learning environment.

Such an impetus for research, above all, brings the processes of learning back into prominence. In an age of constructivism, where the emphasis has for so long now been on the learner’s active construction of meaning through discovery, inquiry, guidance and problem-solving, it is concerning that both writing instruction and digital technology seem to have become overly concerned with the products of learning. The focus has narrowed to text types on the one hand, and multimodal products on the other. This investigation is concerned with the processes involved in developing more effective writing, and the processes students participate in

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during the use of technology that may engage them in expressing their opinions effectively.

1.4 Research Design and Organisation of Dissertation

Under a design-based research umbrella that emphasizes both educational theory and practice, this investigation brings the nexus of writing and technology into focus at a critical juncture. Decision-making for both schools and individual teachers about their approaches to the teaching of argumentative writing is complex and fraught in a context of concern about literacy standards and test results, and the pressures of competing educational policy and society-wide cultural forces.

The literature review of Chapter 2 first sets out the conception of this investigation within the frames of literacy, writing instruction, educational technology and argumentation. The methodologies chapter, Chapter 3, describes the conception, instruments and processes of a mixed methods methodology in order to explain and justify a quasi-experimental intervention that sits at the heart of this investigation. Existing class groups of approximately 25 students were randomly assigned to treatment classes utilising digital argument mapping, and control classes who prepared for a final essay assessment using established writing instruction methods only. The enacted research design is then described in Chapter 4, with a specific focus on documenting both the intended and the actual designed intervention in order to demonstrate both reliability and usefulness to classroom teachers.

The findings of the mixed methods methodology are presented in three chapters. The first presents and analyses the results of writing pre- and post-tests for the treatment and control classes, while also factoring in variables such as streaming level and attitudes to writing to hone our understanding of improvements in argumentative writing effectiveness suggested by the writing data.

The second and third Findings chapters rely on qualitative data drawn from student and teacher interviews, triangulated with writing and questionnaire data, to analyse the interpretations of students and teachers of their experience of writing practices and educational technology. Participants were asked to consider both existing
classroom practices and their perceptions of working with the digital argument mapping program.

Two Discussion chapters then evaluate these findings in order to report on the significance of the intervention for both theory and practice in writing instruction and the use of educational technology to facilitate effective and engaged writing of opinion. Throughout, the digital argument mapping program is treated as a type of practice and a type of technology embedded in a learning environment. As such, it is possible to draw conclusions from this intervention about both the importance of general classroom writing practices that involve communication and process, and general classroom uses of educational technology that involve dialogue, collaboration and the scaffolding of critical thinking and writing.

1.5 Research Aim, Question and Objectives

1.5.1 Aim:
To investigate the potential for digital technologies designed to scaffold students’ skills in argumentation, to foster engaged learning practices and the effective writing of opinion.

1.5.2 Research question:
For digital age students, can argumentation provide the communicative purpose that will lead to effective and engaged sustained writing?

1.5.3 Research objectives:
In a controlled setting,

1. To identify and evaluate changes in students’ argumentation skills evident in essay-writing after participating in a unit of work involving the digital scaffolding of argumentation.

2. To evaluate attitudes to working with argument in order to distinguish this approach from other contemporary approaches and therefore explain changes in students’ writing and attitudes to writing.
3. To evaluate the extent to which digital technologies used in the classroom facilitate learning interactions that are valued by students, and may therefore explain their engagement with digital argument mapping.
Chapter 1 – Introduction

Figure 1  Overview of key elements of the investigation

Explore literature approaches to writing in a digital age classroom  
(Chapter 2)

Identify and evaluate changes in argumentation skills evident in essay writing  
(Chapter 5)

Evaluate the impact of streaming, school, year and attitudes on treatment group results  
(Chapter 5)

Analyse attitudes to learning with educational technology  
(Chapter 7)

Evaluate implications for writing pedagogy and educational technology  
(Chapters 8-10)

Analyse attitudes to writing, existing writing pedagogy and DAM  
(Chapter 6)

Argument as communicative impetus for sustained writing
Chapter 2 – Literature Review

For almost a century subject English has had an impetus towards facilitating writing connected to both the life worlds of students and authentic real world problems that provide a purpose and meaningful context.

This impetus is challenged in contemporary classrooms by policy agendas such as a back-to-basics call in the face of a perceived drop in standards, as well as the assessment regimes required in a high-stakes testing context. It is challenged from within the classroom by the fact that the two most ubiquitous writing approaches of the last half century – process writing and genre-based – are often enacted in watered down forms that lead to boredom and the production of mechanical student writing. Finally, the impetus towards writing that matters is challenged by the practices, agendas and policies of the digital age. Teachers are often characterized in the media and research literature as either luddites or digital immigrants, forms such as the essay are dismissed as vestiges of heritage print culture and the multimodal is held up as the pinnacle of revolutionary new literacies developed through new learning with new technologies.

This literature review sets out the case for a measured appreciation of the current literacy landscape, one that avoids either panic or baseless celebration. Theorists and practitioners from within the critical literacy field have long championed approaches that value non-fiction student writing that matters personally and politically. The 21st century response to this call should not involve the dumping of process writing, genres or the essay, and should not involve a blind rush to the digital. Instead, one path forward is to consider the importance of capacities such as argumentation as a means of refocusing on communication, process over product, and critical reasoning. In an age when the digital arguably provides the heightened means to manipulate, interact and design, and cognitive approaches are broadening the constructivist paradigm, capacities such as argumentation provide an opportunity to refocus that core impetus of subject English at a juncture when such a political project is keenly relevant.
Chapter 2 – Literature Review

Figure 2.1 The literature review element of this investigation

Explore literature approaches to writing in a digital age classroom

Argument as communicative impetus for sustained writing

- Evaluate implications for writing pedagogy and educational technology
- Identify and evaluate changes in argumentation skills evident in essay writing
- Analyse attitudes to learning with educational technology
- Evaluate the impact of streaming, school, year and attitudes on treatment group results
- Analyse attitudes to writing, existing writing pedagogy and DAM
- Explore literature approaches to writing in a digital age classroom
2.1 Introduction: The Problem of Writing.

According to a Pew Research Centre study on the attitudes of teen students to writing, students are “motivated to write by relevant, interesting and self–selected topics, with attention and feedback from engaged adults who challenge them” (Lenhart at al., 2008, p. vii). For these students, “writing is instrumental… [i]hey write to make something happen” (p. 52) whether that means a better grade, a scholarship or a social or political vision. Interestingly, these tech-savvy students, while recognising the practical benefits of being able to revise on computer, do not believe that digital technologies make a big difference to the quality of their writing. In fact they believe that improvements in their writing skills are due to the “writing instruction” (p. 43) they have received rather than from the affordances of educational technology.

This is good news for a field that conceives of writing as both an act of communication and an act of culture (Winch et al., 2015). In the realm of literacy education for high school aged students, texts are viewed as meaningful acts of communication and the teacher’s job is to help students to communicate well, for aesthetic or functional purposes. Writing is much more than a tool or a series of skills; it opens up a reflective process that is critical to learning, a view supported by current curriculum mandated policy: “English provides students with opportunities to think in ways that are critical and creative using information and ideas and arguments to respond to and compose texts” (New South Wales Board of Studies, 2012b). In this broadly socio-linguistic framework writing is seen holistically as a contextual interaction between text, composer and audience (Shetler, Thomas, & Di Lauro, 2013).

The Australian Curriculum and its supporting documents describe a broad role for writing, a mode usually contained within the generic term ‘composing’. According to outcome EN5-1A, a participating student in this investigation would be expected to “respond to and compose increasingly sophisticated and sustained texts for understanding, interpretation, critical analysis, imaginative expression and pleasure” (Board of Studies New South Wales, 2012a, p. 4). In these policy statements, writing is envisaged as complex, relevant personally and socially, and connected to real-world purposes and contexts: students “compose sustained
imaginative, creative and critical texts that represent aspects of their expanding personal and public worlds, for a wide range of purposes, including for enjoyment and pleasure” (Board of Studies New South Wales, 2012a, p. 16).

The problem is that these student interpretations, abstractions from the literature, and policy statements do not always match learning and teaching practices as observed in classrooms portrayed elsewhere in the literature. In their snapshot of writing instruction, Applebee and Langer (2011) found that high school students spent over 80% of writing time on non-compositional tasks: short answer exercises, fill-in-the-blanks and information copied from their teachers. In a recent U.S. national survey (Graham, Capizzi, Harris, Hebert, & Morphy, 2014) weekly tasks were found to involve worksheets, notes and short answer responses. Sustained writing of texts that most depend on context and purpose – stories, essays, biographies, blogs and letters for example – were assigned once or twice a year.

The undermining of the ideal of communicative, cultural, purposeful writing has been recognised for quite some time within the field. The model that Martin (1985) identified as the long-standing high school norm – the “ten years of expressive/narrative writing and two years of literary criticism” (p. 53) – may not have changed as much as one would hope in the intervening years, and may still limit a student writer’s potential engagement with the world in either print or digital contexts. Furthermore, Kemp’s influential conception of “the container model of writing” (1995, p. 180), an individualistic, mechanical approach to writing instruction which focuses on structure and the mental processing of the writer, may still be constricting a student writer’s choices. If writing is largely non-compositional, and when composition is required it is used most often to test content knowledge in ways that are negatively affecting writing programs (Graham et al., 2014), the possibilities for writing to be an act of communication engaged in effectively by students are limited.

One result of instructional practices and approaches that are focused on content, testing and decontextualized skill-building, is that for over two decades now there has been increasing concern within subject English about the effectiveness of, and student engagement with, argumentative writing. Andrews (1995), for example, describes the then widespread sense in education circles through the 1980s and 1990s that students were failing to develop adequate argumentation skills. He
suggests that argumentative writing “often proceeds by set formulae which are not enjoyed by students and which cramp their expressiveness” (p. 5). More recently, a U.S. National Commission on Writing survey (2006a) found extensive concern at tertiary level that students were failing to produce clear, accurate and logical writing. This finding is mirrored in Australia where the University of Sydney’s writing ‘Hub’ found “students unprepared for university writing after high school and unprepared for workplace writing after university” (Shetler et al., 2013, ‘Collaboration’ para. 2). A recent AIG workplace literacy survey (Australian Industry Group, 2010) reports on employers’ dissatisfaction with both general literacy levels and the ability to use appropriate written communication for “team based approaches to problem solving” (p. 5).

The literature in the fields of literacy, subject English and educational technology has taken a keen interest in the differing conceptions and practices relating to the learning and teaching of writing in secondary classrooms. While the ‘problems’ explored cover a wide range of concerns, from the sense of a general malaise (the U.S. National Commission on Writing (2006b) bemoans the forgotten ‘R’) to specific fears such as the influence of textese on writing, this literature review will focus on attempts to explain the gap between our conceptions of what writing can be, and what is experienced and produced by students. In particular, both explicit and implicit assessments of the decline of argumentative writing – in all its forms – to engage teenage thinkers and writers will be considered in order to develop a theoretical context for this dissertation’s evaluation of digital argument mapping.

2.2 Luddites and Reactionaries in the English Staffroom.

The main contemporary criticism of subject English is that it is stuck in a print culture orbit that conceives of text as fixed and sacred, and the reader as passive (see for example, Kalantzis & Cope, 2011). In this view – largely from within the multiliteracies field – the resistance to the potential of digital text, in particular its multimodal facilitation of agency, is partly responsible for keeping school-based writing as a feature of “Heritage Modern Schooling” (p.78) with its assembly line approach to knowledge.
Can we solve the problem of writing by reinventing subject English, by making it more multimodal, more 21st century? This question actually implies a simplistic representation of the history of the subject, one that lies at the heart of a ‘straw man’ tactic on the part of those invoking revolution. Calls for reinvention rest on a series of claims about subject English that are more about staking out a position in the contemporary landscape (for more technology funding for example) than a reasonable analysis of the place of writing in this subject.

For example Eagleton (2008) has shown that by the end of the 1930s the subject already had a nurturing and civilising character, that then morphed in the 1950s and 60s towards student-centred learning and the appreciation of the diversity of language, its “rich range of social and cultural contexts” (Dickinson, 2010, p. 21). Subject English has always had to balance its social and cultural mission with its focus on craft and technique. Sampson, writing as early as 1921 could state that the purpose of English was “not to prepare children for their occupations, but to prepare children against their occupations” (cited in Protherough & Atkinson, 1994, p. 8). Of course this militant English is not (yet?) reflected in curriculum documents, but even there, we can identify many decades worth of alignment and realignment between the poles of literature and linguistic competence, between personal expression and socially anointed skills, and between critical and vocational literacies. In Australia this terrain has been explored by Hunter (1997) amongst others. It is a common thread of resulting discussion that it is time to move beyond simplistic formulations of English teachers as “literary types who prefer pen to word processor, page to screen, in-person to online communication, linearity to hypertext” (Snyder, 2001, p. 111).

Furthermore, work within the critical literacy arm of subject English has demonstrated, firstly, that the subject is already interested in authentic, purposeful and political writing, and secondly, that simplistic claims to self-expression through writing are dangerous whether they are made on paper or screen. The four strongest influences on writing instruction practices each, as we shall see, with important contributions to the ways in which argumentative writing can be conceived and taught, nonetheless have significant limitations that critical literacy has revealed. The child-centred growth model, firstly, and the Gravesian process-writing movement (Graves, 1983), secondly, can each be criticised for their valorising of the individual, expressive writer over the socially constituted self. According to
Morgan, the implicit teaching styles of both “may serve to reproduce the hegemony of the dominant, cultured, middle class” (1997, p. 59). The genre movement may have begun as a project of political intent in the revelation of the underlying structures utilised by the powerful, but may now have metamorphosed into a lifeless attempt to reproduce “generic conventions” (p. 59). A back-to-basics model, finally, envisages writing well as the following of rules learned from texts and practised through repetition to the point of mastery.

The Australian Curriculum as it stands draws from each of these traditions, as well as the more recent cognitive field. It is also clear that it reaches beyond them to the kind of socially transformative work that a commentator like Janks (2010) might recognise. She describes the important move from critical reading to critical writing within this tradition. “A critical approach to writing helps us to think about how texts may be re-written and how multimodal texts can be redesigned. It enables us to transform texts, to remake the word” (p. 18) with an intention clearly connected to an ethics of social justice.

Far from the stereotype of wallowing in a supposed print era tradition of canonical passivity, subject English has actually been remarkably self-critical through its history and is hence well placed to negotiate claims from the advocates of multiliteracies and digital technologies about the ways that writing should be approached. Indeed, far from being revolutionary – and therefore sounding a death knell for the subject – the clarion calls for engagement, authenticity and agency from the standard bearers of the digital are actually logical extensions of the decades-long concerns and practices of subject English. The luddites and reactionaries of the English staffroom are an imagined villain; the problem of writing actually needs the soberness of subject English, which as always, remains focused on giving students “the textual control that they need to engage in all the material, social and personal aspects of their lives” (Misson, 2012, pp. 27-28). In this re-imagining of the mission of subject English, the critical literacy field values students producing non-fiction texts, such as argumentative writing, as a key way of engaging meaningfully with their worlds.
2.3 The Digital Age

The fact that writing has not been a major focus of the research literature in the fields of multiliteracies, digital education technology and digital age culture, is both an observation and an impetus for the work of this investigation. In this section of the literature review I will explore what key assumptions in these fields tell us about the problem of writing and its putative solutions.

2.3.1 Multiliteracies and digital educational technology.

For the purposes of this dissertation, the term ‘multiliteracies agenda’ will be used to refer to both classroom practice and academic research that has responded to recent changes in the nature of literacy by positing a new communication landscape wherein the users of digital technologies compose and consume in multiple modes of text, audio and image, and conceive of themselves as having the technological and cultural competencies of the participatory culture (Jenkins, Clinton, Purushotma, Robison, & Weigel, 2006).

In an age where new digital technologies have facilitated a communications revolution (Kress, 2003), the importance of multimodality has been stressed to ensure that schools remain relevant institutions. Students’ “inherently multimodal and digital socialisation experiences” (Twiner et al., 2010, p. 212, emphasis added) have brought them into conflict with a print–culture literary environment characterised by the sound-word-sentence-text dynamic of “traditional pedagogy” (Kalantzis & Cope, 2008, p. v). According to Lankshear and Knobel (2006), this old mindset, Mindset 1, is predicated on “long-standing assumptions about bodies, materials, property and forms of ownership, industrial techniques and principles, physical texts, face-to-face dealings” (p. 34), while the new mindset, Mindset 2, conceives of digital natives, or insiders, interacting seamlessly in the realms of “new digital electronic internetworked technologies” (p. 34).

The prevailing discourses are those of interactivity and agency (instead of reception and passivity), collaboration and distributed expertise. In affinity spaces (Gee, 2004) the like-minded participate in a “progressive politics of information” (Lankshear & Knobel, 2006, p. 100), an almost millenarian desire that places them in conflict with a leaden–footed profession in which teachers are still trying to apply new tools to the familiar routines that characterise “conventional literacy”
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(Knobel & Lankshear, 2014, p. 97). Indeed the multiliteracies agenda clearly invokes a New Learning Pedagogy (for example Healy, 2008) where the teacher, as one of many in a “community of knowledge workers” (Healy, 2008, p. 9) encourages a learning-by-design approach that emphasizes the re-application of knowledge in new contexts as the measure of learning. Hence we now have producers and creators of knowledge, and not knowledge-retelling as the defining practice of education. In the traditional classroom both teacher and learner were supposedly deprived of agency; through the revolutionary affordances of digital technologies and the new learning opportunities of digital culture, teachers and learners will become knowledge designers (Kalantzis & Cope, 2008).

And yet, through all this valorising of knowledge production, the multiliteracies field has very little to say about the nature of the written products of this process, other than that they are digital, and hence ipso facto, superior to print age literacy. Nor is there a full analysis of how particular capacities valued by subject English, such as critical thinking, may be facilitated through the production of knowledge. Is the digital critical because it is digital? At its starkest, this kind of thinking appears in announcements such as: “What literacy teachers need to know is how to transform the print-based practices that have dominated western schooling into digital practices that more closely reflect the authentic uses of literacy beyond the classroom” (Mills & Levido, 2011, p. 81). The assumption that literacy outside the classroom is more authentic is evident; the implication that print-based practices, such as sustained argumentative writing, need to be transformed into digital ones in order to be authentic is striking.

Typical case studies within this frame – especially illustrating a Mindset 2 approach – follow a pattern similar to that in Healy’s (2008) discussion of a Year 2 class’ powerpoint presentation on koalas as an example of the New Learning Pedagogy. The pedagogical imperative of knowledge processing, learning communities, inquiry-based learning, student agency and text design is focused on the reapplication of knowledge in order to distinguish the experience from traditional literacy. However, the weight of theoretical work is on the multimodal process and its corollaries of malleable text and the life-worlds of learners, particularly the way this kind of multiliteracies work permits “individuals to shape themselves” (p. 6). The actual powerpoint presentation, and particularly its written verbal text, is
under-theorised in terms of the thinking and writing processes that have gone into it.

The problem of writing cannot simply be solved by extending the valid description of a newly multimodal literacy landscape to an ideal where text production is somehow automatically engaged, critical or authentic. The present investigation sits uneasily, therefore, within a valued multiliteracies “ethos” that focuses on “tangible public artefacts” created by “tools in use” (Knobel & Lankshear, 2014, p. 97). While the digital argument map explored in this intervention is multimodal and screen based, it cannot be described as an authentic multiliteracy product such as a zine, photo essay or blog. In fact, it is a teacher-oriented scaffold for the production of a traditional literacy product and thus can be characterised as a Mindset 1 approach. As such this investigation is both inside and outside the multiliteracies ambit, and may thus provide valuable insights about the ways in which this agenda is playing out in actual classrooms impacted on by policy and curriculum realities.

Much of the multiliteracies literature limits its analysis of the relationship between technology and pedagogy to the problem of how new technologies, such as Interactive Whiteboards, “can resource multimodal processes of teaching and learning” (Twiner et al., 2010, p. 212), but it does not do enough to explain how a – still contested – culture of participation and self-expression will reinvigorate the expression of meaningful ideas in any mode. This is especially true if the theorised identities of those writers and their teachers are limited to ones of self-actualisation and agency.

### 2.3.2 The digital age and its inhabitants.

Many current narratives of educational technology are based on simplistic notions of who teachers and learners are in contemporary educational settings. The weaknesses of the ‘digital natives’ categorisation have been well rehearsed in the literature recently; the OECD labels it a “stereotype” (2012, p. 52), while Bennet and Maton (2010) expose the ‘technological determinism’ of claims around innate or generational technological skill. And yet, the literature in this area seems to revel in this simplistic categorisation, with the apotheosis of criticisms centring on the failure of schooling to ‘meet’ the Net Generation by providing the sort of learning ‘they’ need (Gee, 2013). Perhaps the more timely question is whether the Prensky-ite conception is doing more damage to learners and learning by simplifying the
complex practices of identity involved in writing with digital technology both in and out of the classroom.

One important response to this simplification is that of critical social science, which explores the ways students perform themselves in the practice of using technology (Morgan, 1997). Critical theory is interested in the way narratives – based on humanist notions of self-actualisation and agency – of students as designers, creators or producers of their own knowledge may well be marginalising those learners without the prerequisite skills for such work. A parallel can be drawn to the way that the process writing approach has sidelined those without basic skills for the last two decades (Moon, 2012). Sociocultural learning theories, in contrast, have stressed that literacy is not a generic skill, either possessed or not, by the individual (Carlisle & Jordan, 2012). Furthermore, viewing students as inherently multimodal simplifies the nuances of the social context of learning embedded in notions such as communities of practice (Lave & Wenger, 1991). Here learning and knowledge creation are authentic, embedded in specific practices and pursued by goal-driven groups with shared cultural understandings and practices. Individual learners are social actors balancing individual identity with the demands of socially determined environments.

Arguments for student agency come from many directions. For Healy (2008, p. 6) learners can “shape themselves” through knowledge processing and text design. In the multiplicity of reading paths available in an electronic page, Kress (2003, p. 169) envisions agency, whereas the print culture allowed only “competence in use”. Even within the critical literacy fold, there is a narrative that producing texts, in and of itself, is a form of agency that “enables us to choose what meanings to make” (Janks, 2010, p. 156). Curiously then, the critical literacy field also enlists Foucault to critique such humanist paradigms. In this view freedom and agency are anthropocentric myths that result in ‘docile bodies’ (Leask, 2012). Here the ‘polish’ affordances of digital technologies allow a particular presentation of text and self to the world; there are identities and discourses in play and others that are silenced. Rhedding-Jones (1995), citing the work of Davies, 1991, reminds us that in the post-structuralist paradigm a subject can only conceive of him/herself "within terms of the available discourse" (p. 481). There is agency available, but not quite to be anything you want in an ideological landscape that includes both neo-liberal conceptions of individuality and State-sanctioned uses of the new technologies for
control and surveillance (Goodwyn, 2001; Selwyn, 2014). Perhaps teachers are not luddites for resisting, or at least negotiating, the relationships between students, learning and technology; without a careful shepherding, teachers may be merely enforcing the submission of their students to an authoritarian ideology by inducting them into its forms of representation (Morgan, 1997).

The two mostly commonly available categories for teachers – luddite or “digital immigrant” (Prensky, 2001, p.2) – either work to intensify the straw man tactic of creating a print literacy dinosaur to reject, or to simplify the work which many teachers have done to create meaningful roles and identities for digital age settings. One particularly insidious notion is that of ‘progressive vocationalism’ whereby teachers are to use new technologies simply to keep up with wider social and economic changes (Hammond, 2012). Much literature has explored teachers’ resistance to new technologies (see for example Bigum, 2012b), but more research is needed that explores why simply “aping” contemporary adolescent media behaviour in the classroom is good for learning (Perera, 2010, p. 211). Research from the last ten years that carves out more nuanced roles for teachers is outlined in the following table:

Table 2.1 Teacher roles in digital contexts

<table>
<thead>
<tr>
<th>Role</th>
<th>Researcher/s (for example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>New pedagogical roles</td>
<td>Adams, Sida-Nicholls, &amp; Brindley, 2007</td>
</tr>
<tr>
<td>Faded guidance or self-regulation, in the Self-regulated Strategy Development (SRSD) literature</td>
<td>Harris, Santangelo, &amp; Graham, 2008</td>
</tr>
<tr>
<td>Teaching metaphors such as ‘orchestration’</td>
<td>Harlow, Cowie, &amp; Heazlewood, 2010</td>
</tr>
<tr>
<td>Dialogic teaching in digital classrooms</td>
<td>Mercer, Hennessy, &amp; Warwick, 2010</td>
</tr>
<tr>
<td>Scaffolding and explicit teacher skill development</td>
<td>Zammit, 2010</td>
</tr>
<tr>
<td>Technological pedagogical content knowledge (TPaCK)</td>
<td>Koehler &amp; Mishra, 2009; Goodwyn, 2011</td>
</tr>
<tr>
<td>Activity Theory</td>
<td>Rambe, 2012</td>
</tr>
</tbody>
</table>
Each of these roles will be considered as part of the evaluation of the argument mapping intervention reported in this dissertation. For the moment, it is pertinent that from an Activity Theory perspective (see for example Engeström, 1987) – in which relations between subjects and between subjects and tools are always historically and socially situated – the teacher is as much a complex player in the social network of the classroom, and needs to be studied as such. The dialogue, interactions and collaborations around the treatment program allow for an evaluation of teacher and student responses to the kinds of pedagogical roles outlined in the table above.

Furthermore, Critical Theory’s interest in naïve notions of subjecthood for both teachers and students means that notions of the teacher as “fluid subject” (Sørensen, 2009, p. 165) during technology lessons, needs as much unpacking as do the emancipatory narratives of knowledge producing students that obscure the way subjects “constitute and are constituted by social practices and institutions” (Morgan, 1997, p. 2). This investigation was designed to explore more nuanced student and teacher roles and relationships in order to evaluate the kinds of writing selves that were in play during a technology-facilitated intervention in the process of writing argument.

2.4 Technology and Learning

The answer to the problem inherent in contemporary writing practice and instruction is not simply a recalibration of tired old English so that it is more digital. A more careful analysis, with perhaps more “humble” aspirations (Rowan, 2012, p. 9), suggests that in order to harness technology and digital culture productively in the writing classroom we need to take into account the following factors. First, the ideology inherent in any technology. Second, the complex nature of contemporary digital age learning and schooling from a sociocultural perspective. And finally, the connections between literacy, writing and knowledge–production in the digital era.
2.4.1 **Technology and ideology.**

According to Goodson and Mangan (1996, p. 65), educational technology is always “ideologically freighted innovation.” The multiliteracies agenda, which is inclusive of devices such as laptops, platforms such as wikis, programs such as Powerpoint, and practices such as social media, is firmly positioned within the prevailing cultural logics of 21st century capitalism. Contemporary ideologies of libertarianism, neo-liberalism and the New Economy, with their tapestry of values including self-improvement and empowerment, unimpeded individualism, flexibility and networked innovation (Selwyn, 2014) make it impossible to think of technologies and their framing practices as in any way neutral or value-free (Morgan, 1997). Technology is shaped by the predominant contemporary ideologies and helps to perpetuate them.

An instrumentalist rationale, whereby technology is viewed as the neutral servant of human desires, focuses on effectiveness and efficiency but ignores power. It leads to problematic inferences, such as the notion that “interactivity is a property of the tool” (Twiner et al., 2010, p. 215) rather than a factor of its use in complex settings, that have characterised research on two of the most common platforms through which a pedagogy of multiliteracies has been conceptualised and delivered: Interactive Whiteboards (IWBs) and programs like Powerpoint. Proponents typically focus on the power of the visual hook to engage, or the pedagogical benefit of the IWB solidifying, on the spot, communally constructed knowledge in the constructivist space of the classroom (see for example Twiner et al., 2010). Reedy (2008), on the other hand, in an ethnographic case study in one UK school, found that the visual affordances of both IWBs and Powerpoint solidified the sense of ICTs being presentation – as opposed to learning – tools. Goodwyn’s (2011) case study suggests that the Smartboard has teachers working “in a more didactic way” (p. 58). Typical of this more critical attention to the enactment of a multiliteracies agenda in classrooms, Wikan, Mølster, Faugli and Hope (2010, p. 229), note the differing perceptions of teachers (who thought Powerpoint made their teaching more “engaging”) and of students (who criticised this technique for being “repetitive and uninteresting”).

Perhaps most significantly, a valorising of technology in a Grand Narrative of digital progress exposes one of the most powerful tensions that marks the multiliteracies agenda. If there has indeed been a revolution, then the eagerness to
celebrate the potential of the new may have blinded us to some of the most powerful political implications of technological change. Firstly, despite the generally agreed resolution of issues of access in the Developed World at least (OECD, 2012), a new ‘digital divide’ related to educational benefits in accordance with economic, social and cultural capital, may be opening up (Beavis, 2010). Secondly, if multiliteracies have indeed exploded the preserve of “middle class literacy” (Green, 2006, p. x), then why has this explosion of the alternative not actually achieved educational and social equities? Thirdly, there has been intense debate over whether or not the electronic medium will facilitate communication by previously marginalised groups and hence reverse traditional power relations. If the history of the social uses of technology is correct, according to Snyder (2001), then the likelihood is that the technology will be adapted to needs and is thus more likely "to reinforce existing patterns" rather than create radical "new patterns of social practice” (p. 115) A critical theory of technology (Feenberg, 2009), sitting in a broadly Marxist and Foucauldian paradigm, suggests that while human rights claims have advanced, they have been framed by the "centralization of ever more powerful public institutions and private organisations" which are imposing "an authoritarian social order" (p. 147).

A critical framing of the technologies of the multiliteracies agenda makes simplistic claims for empowerment difficult in a context of surveillance, control and consumerist hegemony which are also affordances of the technology (Selwyn, 2014). If, however, technology is seen as an environment rather than an assemblage of tools, then the focus of study becomes how users live and work with and within technologies that are involved in the process of inscribing social values and meanings. For Sørensen (2009), learners as multiple and emergent selves exist in arrangements of human and non-human bodies where those arrangements, the spatiality, shapes the learners and their knowledge. This conception has roots in Dewey’s sense, a century ago, that technology is best viewed as an understanding rather than an artefact (Bruce, 2005). It is powerfully explored in Edgerton’s focus on “technology-in-use” (2007, p. xi) as a rethinking of universalist, bombastic and partial accounts of technology that focus on a heroics of invention and innovation in a naïve narrative of the future ameliorated by technology. Such a narrative is often part of an agenda for discussions of the past, present and future of technology tellingly “set by the promoters of new technologies” (Edgerton, 2007, p. ix) that
wilfully obscure how affordances like speed, access and quantity are not automatically linked to better outcomes (like equity or analytical thinking).

The antidote to a technologist triumphalism is not a technologist catastrophism. The dichotomy between the boosterist rhetoric of faith, inevitability and progress, and the doomster mantra of nostalgia and damage has benefitted neither students nor teachers (Selwyn, 2014). According to Bigum (2012b), the two key errors of current practice and research have been the search for evidence of improvement due to educational technology, and the ongoing focus on domesticating technology – the perennial search for educationally useful things for the latest innovation to do. If technology is seen as a practice rather than as an artefact separated from its social context, then researchers may be able to examine the enactment of multiliteracies in a more clear-eyed manner. In this exploration of a productive middle ground between triumph and catastrophe, effectiveness and the “domestication” of educational technology (Bigum, 2012b, p. 22), a critical theory of technology orients us towards related paradigms like Activity Theory (Engeström, 1987). This approach sees educational settings as complex arrangements within which simplistic, ostensibly ideology-free judgments about effectiveness or emancipation are difficult to make. A focus on activity systems brings the critical gaze back onto the mooted digital classroom without walls to acknowledge that the walls are not only still there, they are even more dangerous in their transparency (Morgan, 1997). Seeing educational technology as a “composite entity that consists of learner(s) and artefact(s) as instantiated in the learning activity” (Overdijk, Diggelen, Kirschner, & Baker, 2012, p. 194) also brings into sharp focus Morgan’s (1997, p. 192) question about the sorts of identities that are elided in a narrative of instrumentalism: “What does this technology ask you to become to use it fully?”

This dissertation has therefore taken up the phrase ‘learning environment’ (Istance & Kools, 2013, for example) to frame its discussion of digital technology and writing in the contemporary English high school classroom. The aim here is a more holistic evaluation of the complex interplay of classroom elements, of which technology is only one, in order to avoid a technological determinism where the focus is on obtaining the most from the artefact rather than considering good learning and teaching.
This investigation was conceived and enacted in a context where student meaning-making has been transformed in ways described by the multiliteracies paradigm. However the picture of a multimodal, internetworked learning and writing landscape has left many issues unresolved for the contemporary classroom.

### 2.4.2 Contemporary digital age learning.

It is easy to see why educational technology would make a constructivist enthusiastic. Learners as active agents in knowledge construction, the centrality of social interaction to learning, the engagement and stimulation to learning offered by relevant knowledge that can be interpreted and evaluated; these tenets of a constructivist approach to learning (Carlisle & Jordan, 2012) resonate strongly with the affordances claimed by educational technology. In particular, technology in the classroom is often characterised as an antidote to the one-size-fits-all pre-digital model (Bartolome, 1999) by encouraging self-direction, collaboration, inquiry and creativity.

Fullan and Langworthy (2014, p. 20) characterise a contemporary model of ‘new pedagogy’ – one that is arguably more humble and realistic than some predecessors – as dependent on learning partnerships between students and teachers, “deep learning tasks”, and digital tools that “enable and accelerate the process.” The technology here supports the creation and use of new knowledge (deep learning) and the focus on learning process rather than content (learning partnerships). Significantly, in these relations the teacher is neither traditionally didactic nor “standing too far to the side” (p. 22). In an echo of Hattie’s (2009) preference for the teacher as activator over facilitator, Fullan and Langworthy report on classroom successes that involved the teacher’s strategic use of technology to facilitate real world problem solving, feedback and metacognition.

One current and evolving example of this type of focus is the Computer Supported Collaborative Learning (CSCL) field with its emphasis on the design and evaluation of technology to support collaborative activity (Overdijk et al., 2012). Collaboration, however, is too easily equated with simply using educational technology. Wikan et al. (2010) review several studies that suggest the poor quality of collaboration using computers, emphasizing the lack of focus in group work, the poor division of labour and the shortcomings of the final products. The missing element is recognised as the work of teachers in “supporting and scaffolding the
learners during the process” (p. 225). This resonates with meta-studies (for example, Hattie, 2009), that regularly find computer use more effective when coupled with a diversity of teaching strategies. In a review of fifteen years of research in Argumentation–Based Computer Supported Collaborative Learning (ABCSCL), Noroozi, Weinberger, Biemans, Mulder and Chizari (2012) found that the computer technologies successfully scaffolded and structured argumentative learning, though not without the careful pedagogical development of ‘rich’ ABCSCL environments that are dialogic. Mercer et al. (2010, p. 197) define dialogic teaching as the process of actively involving students “in the process of knowledge construction through the use of talk and other means of communication”, and make a useful distinction between technical and dialogic interactivity: what a piece of technology can do, and what it can be used to achieve educationally. If students are competent communicators across the digital media they are conversant with, mobile devices and chat rooms for example, then it is imperative that pedagogical theory and practice consider how to bring those skills and practices productively into the arena of learning. “Dialogue is about taking your place in the world: learning to make yourself heard, listening to others” (Davies, 2007, p. 53); these are skills developing for students in both their digital worlds and their school-based learning environments.

Practice-based studies of learning (for example Johri, 2011) focus on the constant flow of activities that constitute learning, particularly the situated interactions in which goals are accomplished by communicating and negotiating. In this tradition, which shares a conceptual space with Lipman’s (1991) communities of inquiry and Lave and Wenger’s (1991) communities of practice, “the presence of material is less important than how the material is configured in practice and enacted in the moment” (Johri, 2011, p. 211). It is one thing to theorise such communities and their potential, but another to explore what kinds of knowledge are actually produced through them. A design-based research methodology, focusing on literacy practices as enacted in actual classrooms, can help to reveal the mechanics and the potential of such communities.

This is important because convincing evidence of the benefits of learning with technology is still elusive. In particular, the debate between those who see technology as a support for the delivery of a traditional pedagogy as opposed to the facilitation of a radically different one is ongoing. Partly, this ambiguity is due to
differing conceptions of learning. Is it a measurable quantity observed through test scores or is it the ability to transfer skills and ideas from one context to another? One recent overview (Livingstone, 2012) reports the following: many studies in the field describe teachers’ and parents’ beliefs rather than students’ abilities to develop and transfer understanding. Furthermore, according to her analysis of PISA surveys, those students who use computers sometimes perform better than both those who never use them and those who use them often. There is no support for the notion that simply because students like ICT they will be more motivated and hence learn. In fact we have long known (see for example Wolsey & Grisham, 2007) that the classroom motivation once provided by technology in and of itself has waned since home access has become the norm. Wolsey and Grisham (2007, p. 33) also suggest that the motivation factor exists now only if the technology infusion provides a meaningful instructional need and is focused on “student attitudes toward writing” rather than content or text production. Livingstone’s rejoinder about the development and transfer of understanding is thus doubly important: it is not only a question of where the research should focus, but at which point of the learning process should technology be utilised by students and teachers.

In the context of subject English, Flanagan and Schoffner (2013) report on research which emphasizes the effectiveness of technology as a supplement to instruction and a specific intervention in the process of learning. Livingstone’s (2012) most relevant conclusion in the context of this investigation is on the effects of such ‘blended learning’. According to her systematic meta-analysis the effects for blended learning outweigh those for either face-to-face or online. In particular, a digital “manipulation that trigger[s] learning activity or learner reflection and self-monitoring of understanding” (Livingstone, 2012, p. 12) was found to be effective, especially if it was part of a learning approach that included enough time, a variety of learning materials and opportunities for collaboration. Digital argument mapping is just such a scaffolding technology that seeks to supplement instruction by triggering learning activity.

2.4.3 Literacy, writing, knowledge-production and educational technology.

Text in its electronic form changes the nature of literacy both in and out of the classroom. Philosophy and research in this area have focused on the ways that the prevalence of the image over the word (Kress, 2003), and the way digital texts reveal their own constructedness (Bolter, 1991), have changed the nature of
communication. In particular, digital text is seen to permit greater choice and control, to increase motivation and engagement (Davis & Marsh, 2012), to enhance interactivity (Li, 2010) and to encourage the fluid and anti-authoritarian (Kemp, 1995). According to Edwards-Groves (2012, p. 100), writing “now encompasses a multidimensionality which harnesses design and multimodality”, shifting, but not replacing, fundamental skills in response to the multimodal features of contemporary text and the affordances of collaboration and manipulation of digital text that are now available.

The rhetoric in this field can tend to the heroic. Analysis ranges from the emancipatory potential of multiliteracies exploding the preserve of “middle class print literacy” (Campbell & Green, 2006a, p. x) through the way the multimodal in and of itself is seen to emphasize higher order thinking (Ljungdahl, 2010). The notion that technology is good for writing because it engages learners (Clark, 2010) and pulls them away from the “traditional essayistic literacy” (p. 27) that is seen to dampen composition, is a strong feature of the field. However, for every large scale study or meta-analysis that finds a connection between the use of ICT and attainment in writing (for example, Somekh et al., 2007), there is another that disputes any simplistic connection and draws attention to the ongoing pre-paradigmatic nature of the field (for example Andrews et al., 2007).

Ongoing large-scale research, particularly in the United States, paints a complex picture where the gap between the potential effects of technology on writing often sit at odds with reported classroom uses. Purcell, Buchanan and Friedrich (2013, p. 52) for example, describe the positive sentiments of teachers towards the potential of digital technologies to enable them to “see their students thinking.” Teachers pinpoint the technology’s facilitation of wider audiences for student work, greater collaboration and personal expression. In a more quantitative survey of teaching practices, however, Graham et al. (2014 p. 1029) found that outside of word processing and content search, “the use of computer technology was absent from most middle school teachers’ classes”. Around three quarters of teachers never used the collaborative, sharing or scaffolding affordances of the digital technologies to support their teaching of writing.

It is in this context that some research has attempted to delineate a place for the writing of opinion, specifically, in digital settings. Merchant (2007), for example,
while accepting the centrality of the image in the age of the screen, reminds us of the ongoing importance of the word, and suggests that simplistic notions of print vs screen literacy may be responsible for the atrophied state of policy and the limited uptake of the new literacies agenda. According to the British Educational Communications and Technology Agency (Becta) research reported by Adams et al. (2007), effective use of ICT in the classroom depended on teachers focusing on specific skills, rather than content or the entertainment factor of the technology. Similarly, Misson (2012) advocates a focus on ‘capacities’ like imagination or empathy as the foundational work of subject English. In more general overviews of what works in the writing classroom, Hattie (2009) found that processes that could be facilitated using computers, such as collaboration and peer-review, were more useful when teamed with the explicit teaching of writing strategies and the steps of the writing process. Similarly, Graham and Perin (2007) found that the teaching of strategies such as summarising and sentence-combining and a focus on sharpening inquiry skills, were more meaningful than word-processing for example. Simply typing up student work has a moderate effect size and “may be especially effective in enhancing the quality of text produced by low–achieving writers” (p. 17). According to this influential report, the goal of teaching writing should now be to enhance the ability for students to make meaning in a variety of contexts. Writing would thereby become a “personal tool for transforming one’s own experiences and knowledge” (p. 23), in a move that takes the learner from “knowledge-telling, characterised by writing akin to speaking, to knowledge–transformation” (p. 23) characterised by reasoning, the extension of ideas and a meaningful deployment of writing to influence the student’s real world.

Interestingly, while the word-processing affordances of technology facilitate a process-writing approach, it is more difficult to align the needs of a genre approach to the uses of educational technology. While the presentation affordances allow educators to model text types and the editing capabilities allow for the rearranging of sentences within a paragraph for example, the role of educational technology in teaching structure appears to be limited to a rudimentary manipulation of templates, for example. Whether this is one of conception or capacity is not clear, but it may also help to explain current impasses if the text types approach to argumentative writing is the classroom norm.
If the convergences of educational technology and current approaches to writing instruction are at best unclear and at worst, problematic, then this might help to explain the growing interest in explicit-teaching and cognitive approaches in this area. In contrast to the decontextualized practices of a back-to-basics approach, explicit teaching values the role of the teacher as overt instructor working as one element of a learning environment. Although easy to dismiss as chalk-and-talk, there has been a resurgence in focus here from within diverse sub-fields such as critical thinking (Wilks, 2005), technology and composition in the tertiary sphere (Moody & Bobic, 2011) and the teaching of rhetoric (Moon, 2012). In alignment with Graham and Perrin’s overview (2007), which found the explicit teaching of writing strategies to be the most effective, there is a re-emphasis on the teacher’s role in explicitly teaching metacognition, thinking and writing skills, particularly as an antidote to the independent digital learning environment that valorises practices such as self-paced learning for which there are, at best, ambiguous literature support (see Tullis & Benjamin, 2011, for example).

2.5 Argumentation

Argumentation is not a writing strategy that can be explicitly taught. It is more so a thinking strategy that can then be applied to different modes of communication such as argumentative writing, and different texts, such as the essay. It is the key contention of this investigation that the capacity of argumentation may be an important catalyst for writing that moves beyond re-packaging content, to being written communication in the service of critical literacy, democracy (Andrews, 1994) and reflectiveness, the OECD (2012) key competency for learning.

2.5.1 Defining argument

Argument is best understood as a mode of discourse in the same manner as narrative or description (Andrews, 1994). In a broadly socio–cognitive framework, argumentation can be seen as a “verbal and social activity of reason aimed at increasing (or decreasing) the acceptability of a controversial standpoint for the listener or reader” (van Eemeren et al., 1996, p. 7). This is achieved by marshalling propositions and their supporting evidence in a process of justification aimed at influencing – rather than physically coercing for example – a rational audience.
The capacity for argumentation is recognised as crucial to schooling and learning from at least three standpoints. Firstly, the Australian Curriculum, while underplaying the term ‘argument’, repeatedly emphasizes critical and analytical composition, with a concurrent awareness of audience, purpose and context, in order to construct “logical argument” (New South Wales Board of Studies, 2012a Stage 4 Outcomes, para. 2). Secondly, recent publications attest to the growing international interest in argumentative reading and writing (Newell et al., 2011), argumentation and reasoning from a socio–cognitive perspective (Schwarz & Asterhan, 2010), and argumentation and education (Mirza & Perret-Clermont, 2009). The studies share an interest in argumentation not only as a specific set of skills to be learnt, but its potential for fostering learning across the curriculum. Schwarz and Asterhan (2010), for example, conclude that argumentative practices support the development of genuine reasoning and lead to improvements in conceptual understanding. And finally, argumentation, viewed as mode of discourse or communicative activity related to rhetoric, is at the centre of renewed interest in argumentative writing (Llosa et al., 2011) focused on communication. A reorientation towards rhetoric, a field grounded in a practical tradition of social utility focused on the intentions and means for the individual to intervene meaningfully in his or her world (Moon, 2012), is distinct from current school-based writing paradigms that are based on testing content or fitting into pre-ordained forms; in other words a product-centred conception. Kuhn, Hemberger and Khait’s research (2016), for example, demonstrated that dialogue rich learning environments, where discourses during the process of learning are carefully managed by the teacher, facilitate student transfer of argumentation skills to their essay writing.

In many ways the essay symbolises all that is wrong with print-literacy generally and current approaches to writing instruction specifically from a digital age standpoint. Far removed from its original rhetorical and Montaigne-era exploratory roles, the essay has rigidified over the 20th century to be more concerned with form over the investigation of ideas (Sanborn, 1994). In its current role as the generic content–tester of the Humanities in upper secondary and tertiary contexts, the essay may be an exercise in factual writing, but it does not encourage true discussion or speculation (Andrews, 1995). In its current incarnation, essayist literacy is manifested in the kind of extended sole-authored linear structure that seems archaic in light of multimodal possibilities. The essay as a mode of communication is
removed from the personal lives of students, not to mention the kinds of texts they would usually compose or respond to. It is highly ritualised instead of authentic argumentation, and it is modelled on a restrictive adversarial conception that has no meaningful audience.

As I have argued elsewhere\textsuperscript{7}, perhaps an awareness of the communicative purpose of argument may work as an antidote to the aridness of the essay, which for many students has become an inauthentic role play at genuine argumentation? We argue to fulfil many different purposes: to “clarify…persuade…win…entertain…unload… resolve… find identity” (Andrews, 1994, pp. 62-63). Not only are these important for the health of democracy, they suggest that there is hope yet for the essay, \textit{if} it is viewed as one possible socially constrained manifestation of argument. In an ideal world students would be able to persuade someone to consider them for a job interview, as well as articulate their nuanced thoughts about the nature of humanity in \textit{Hamlet}. The external inducement approach to essay-writing (you need it to do well in exams, uni, life etc) is akin to a medicinal approach to life: this is painful but you’ll thank us later. Some students are willing and able to take this on, but who can blame the many who are not? A focus on argumentation, and the competencies needed for doing it successfully, leads to an understanding that the essay, the letter to the editor, the job application and the restrained missive to the Real Estate agent demanding action on the long-promised water heater, are equally valuable forms that depend on a core set of skills, prime in which is the ability to suit argumentation to the context, purpose and audience (including the imagined academic marker).

\subsection{2.5.2 Argumentation and learning}

The research literature in the field of argumentation – a noun that focuses attention on the processes of arguing, rather than products, either verbal or written which may be referred to as ‘argument’ – expects two consequences of an eclectically broad approach that involves cognitive, socio-linguistic and systemic-functional elements. Firstly, in the sub-field usually referred to as learning-to-argue (Schwarz, 2009), students are expected to improve in their ability to deploy an evidence-based argument suited to a particular audience and purpose. Secondly, in the sub-field of arguing-to-learn, students deploy their argumentation skills to develop higher order

or more conceptual content knowledge and understanding. Learning to argue involves the acquisition of skills such as justifying, challenging, using counter-arguments and conceding. This is distinguished – too strongly sometimes according to Schwarz who sees the two as interconnected – from arguing in order to achieve a specific goal, either learning generally or the construction of knowledge. Either way the processes are communicative: there is another arguer involved in the process for whom one must tailor the argument, and whom one expects will argue back.

According to Mirza and Perret-Clermont (2009), argumentation is partly a specific set of skills that can be learnt in order to develop views and justify them. In this sub-field, argument is a cognitive task that requires the explicit teaching of skills and knowledge specific to the task (Newell et al., 2011). Students in Newell’s investigation were taught an argument grammar based loosely on Toulmin’s hierarchy of position, claim, warrant and data (see for example Felton & Herko, 2004). The teaching involved a typically metacognitive analysis of the nature of evidence and its relationship with contentions that lack backing. Although all three cited studies here argue for a balance between the cognitive and social aspects of writing, it is important to note that some theorists in the field believe that “in order to construct effective arguments students must be able to analyse relationships among reasons in support of a position, interpretation or action” (Llosa et al., 2011, p. 258).

The argumentation research literature supports a thesis that argumentative practices framed in a collaborative and dialogic learning environment, especially one in which problem-solving and reasoning are facilitated, can lead to conceptual gains (Schwarz & De Groot, 2007). Moreover, the field is explicit about how ‘talk’ can be structured to facilitate less rigid forms of argumentative writing. Pirie (1997), for example, describes a carefully facilitated progression of classroom dialogue, moving from initial personal response (to a novel for example), through pair-based written ‘conversation’ and on to a collaboratively written dialogic essay. The template here is neither debate nor point-scoring, but friendly exchange focused on improving ideas, not destroying them. This is of course challenging to orchestrate in the classroom. One suggestion, again according to Pirie, is for teachers to value internal dialogue and thereby give legitimacy to and actively facilitate a less authoritative voice and way of thinking. The current model of the essay is seen to
require from students a pretence of certainty which leaves little room for hesitancy. Pirie cites teachers’ impressions that their students’ essays were more thoughtful and energetic when they had written after a cognitive-style exercise of dividing their own thoughts into either a ‘sure’ or ‘hesitant/what if’ column.

If, according to Andrews (1994), language forms like the essay are learnt through dialogue, then fixed forms or genres need not be the focus of the curriculum. Interactions using forms, learning through collaboration, interaction and dialogue rather than the reciting of templates or learning of grammatical skills, is the way forward. In this socio-linguistic imagining, while an individual can be his or her own audience to a significant degree, it is dialogic argument with others that encourages progress in thinking and writing: “[i]n dialogue we use the discipline of others’ responses to move forward” (Andrews, 1994, p. 65). The learning implications for Andrews involve both real audiences (within as well as outside of the classroom) and the authenticity of the written products of activities. In one example he compares the typical decontextualised book report to one actually given to a school librarian in an effort to influence the allocation of funds. “Whereas students would be inclined to agree with each other, often for the sake of getting through an exercise, now they were arguing with each other in order to reach a consensus and thus put their collective resolution into action” (Andrews, 1994, p. 66). The implications here of such task authenticity for the nature of collaboration during learning activities are also highly significant: it is the nature of the task that will lead to effective collaboration and not vice versa.

Fullan and Langworthy’s new pedagogy model emphasizes learning tasks that involve the “[a]pplication of new knowledge in real contexts” (2014, p. 23). Such authenticity is repeatedly stressed in the literature on literacy and writing and technology; for Hicks (2009, p. 8) “real writing tasks” not only engage students but complement their “innate need to find purposes and audiences for their work.” Hillock’s (2011) large-scale literature overview emphasizes the impact of authentic tasks on learning generally, while Purcell-Gates, Duke and Martineau (2007, p. 12) observe that learning genres successfully depends on both explicit teaching and “authentic reading and writing activities.”

It is a key contention of this dissertation that argumentation can be a vital element in realising authenticity in literacy education. It is one thing to recognise the
importance of diversifying audiences and purposes beyond school genres, as well as the disconnect between writing and communication that arises from no or pretend audiences (Andrews & Smith, 2011), but it is another to effectively prepare students for this kind of writing. Finding a ‘real world’ problem or audience is one thing, but mastery over the “rhetorical context” (Andrews & Smith, 2011, Chapter 10, Rhetorical Contexts, para. 1) – the function of a text and the needs of an audience – requires explicit development. Here, discrete skills, and even cognitive strategies, may be inadequate. Argumentation orients towards a sense of context and audience, and in its focus on evidence and reasoning is perhaps a more authentic process than either formal debate or general discussion. For Andrews and Smith, “genre study of pre-set forms” is insufficient in a digital age of “constantly shifting rhetorical contexts” (Chapter 10, Framing, para. 2). Instead, developing proficiency in argumentation and argumentative writing would allow students to deploy their skills in a range of contexts to suit a range of authentic needs – including the school-mandated essay.

The practices available to students and teachers within this field range from the explicit teaching of argumentation grammar to the development of dialogic and collaborative environments. Partly because the existing research literature is relatively strong in these areas, this investigation has chosen to focus on classroom tasks involving argument mapping instead because this brings into focus a key element of the digital age writing classroom. Argument mapping scaffolds the organisation of ideas during the planning stage of a process writing approach. The extent to which educational technology can facilitate such processes so that students are engaged and the products of their preparation are effective should be of great interest to educators in a context of both concern about student writing and excitement at the potential of digital culture.

In Andrews and Smith’s (2011) recent overview of the teaching and learning of writing in a digital context, the contention is made that the school use of writing to provide evidence of learning has resulted in a reductive focus on what they term “production skills” (Chapter 1, Relations between speaking and writing, para. 8). In their view the focus of pedagogy needs to shift to the “act of framing and shaping that is at the heart of composition” (Chapter 1, What we know about writing practice, para. 4). This act involves the formation of ideas, guidance for choices in structure, the bearing of dialogue on decision-making, the maintenance of
engagement through the process and the support of collaborating learners. Digital argument mapping aims to scaffold this process in a way that fits with Andrews and Smith’s sense that what students most need is support in marshalling their ideas in the writing classroom.

A focus on student interactions facilitated by educational technology also aligns with Clark and Martinez-Garza’s (2015) analysis of recent directions within the technology-argumentation field. Recognising that research and classroom practice need to move beyond teaching and testing Toulmin’s argument ‘moves’, they applaud research that focuses on “epistemic moves, conceptual quality, participation, affect, rhetorical style… co-construction” as providing a “much more interesting and informative foundation on which to explore learning in any context” (p. 617).

2.5.3 Digital argument mapping.

In an overview of previous research (Nussbaum et al., 2007), graphic organizers aimed at scaffolding argument were expected to act as a prewriting planning device and, as such, show some success in successfully addressing this typical deficiency in the student writing process. Research in a specifically technological domain, where the visualisation of the argument has been developed and supported by dedicated program (see for example Twardy, 2004) has suggested, on the other hand, that students’ critical thinking, and not just planning, can be significantly improved.

The research literature suggests that in the negotiation of multiple perspectives, taking place in information rich settings focused on “authentic learning tasks” (Kirschner et al., 2003, p. vii), a constructivist space is opened up around the argument map where the co-construction of knowledge is enabled and valued (Nussbaum et al., 2007). For van Bruggen, Boshuizen and Kirschner (2003) the evolving argument map creates “a problem-solving context where multiple actors, having different representations of the problem, are trying to solve the problem” (p. 26). This sub-field in the literature has focused on the way ill-structured problems, addressed through collaboration over a surface representation in the form of an argument map, have allowed students to develop a shared language with which to approach the task. Literature that has specifically explored collaboration between
students over a digital argument map (Scheuer, McLaren, Harrell, & Weinberger, 2011), reports better critical thinking than students working alone.

At a time when process writing has been squeezed of its pre-writing stages of planning and dialogic idea development, and when the genre approach has forgotten about authentic purpose, audience and context, it is imperative that educators explore options that refocus on more communicative processes in the students’ preparation for writing. The research literature suggests that argumentation and argument mapping have much to offer, particularly so in the digital realm, where the argument representation can be edited, designed and shared on a platform recognisable to and engaging for the contemporary learner.

Research on longer term effects on reasoning of “argumentative representation tools” (Shwarz & de Groot, 2007) is, however, still in its infancy. For Kirschner et al. (2003) “Computer-Supported Argumentation Visualisation (CSAV) tools are designed to assist in collating, and then making sense of, information and possible narratives that weave threads of coherence” (p. viii). The CSAV research suggests that this kind of planning works best in relation to real world situations and when the problem at hand has been sufficiently defined. In this scenario CSAV can help make sense of "multiple perspective problems and disparate information sources" (p. viii).

While Schwarz and de Groot (2007) outline the potential successes of programs that promote reasoning in a digital context, for example the ITCOLE program, they acknowledge several deficits of the research. Firstly, key elements of the learning environment, such as collaboration and participation, are not fully evaluated. Secondly, the “general objective of construction of knowledge… needs to be translated into expectations in the specific context” (p. 298). Similarly to recent work on digital argument mapping at Princeton (Noden, 2015), Schwarz and de Groot’s research values the heightened student reasoning and clarified organisation of ideas. It does not, however, measure or analyse the processes of transformation from argument map to student writing, and not within high school settings that demand the inclusion of studied texts and concepts.

Similarly Harrell (2005, 2008, 2011, 2012) has reported on improvements to critical thinking of undergraduate students as a result of their creation and evaluation of argument maps. In more recent work (Harrell & Wetzell, 2013) she has reported on
the effects of digital argument mapping on the *writing* of undergraduate students, though her study acknowledges the many questions that are left unanswered. For future research directions, she suggests work on the cognitive basis for argument mapping activities, the precise role of map construction during the process of argumentation, and the influence of other skills such as peer collaboration.

It is in this research gap, particularly in a high school setting, that the present investigation situates itself.
Chapter 3 – Methodology

This chapter outlines the methodology used in this investigation. A mixed methods methodology incorporating an embedded quasi-experimental intervention has been set up under a design-based research approach. Design-based research creates an empirical framework that explores the credibility of a learning intervention and the interpretations given to that process by its participants. While drawing important elements from both, it is thus contrasted to pure experimental research and ethnography. This chapter explains and justifies the approach, then discusses the methods utilised as well as related issues of trustworthiness and generalizability. The following chapter, the Enacted Research Design, documents the intervention process, with the particular aim of outlining how the intended design described in this chapter eventuated under actual school and classroom conditions.

3.1 Introduction

Chapters 1 and 2 have established that the impetus for this investigation was a problem evident in the theoretical and pedagogical connections between literacy and educational technology. Student writing of opinion, characterised here as argumentative writing, is understood to have limited effectiveness. It is a practice with which students have limited engagement. It is taught in ways that suggest a focus on attaining competencies for exams rather than with a view to the exploration of ideas as part of an authentic dialogue with a student’s society.

Educational technology meanwhile, promises a communicativeness which has proven difficult to connect to learning in the research literature. Moreover, the conception of much research in the area has started with the desire to explore what a tool can do, and focused on what teachers do – or think they are doing – with that tool, rather than the extent to which a tool can be part of a learning environment that aims to facilitate a capacity, such as argumentation, that is valued by subject English.

In order to explore fertile avenues for both research, and learning and teaching in the overlap between argumentative writing, communication and digital technology,
this investigation has sought to address the potential for digital technologies, designed to enhance students’ skills in argumentation, to foster sustained writing which is effective and learning practices with which students are engaged. This research aim has been divided into three objectives that can be evaluated in a controlled classroom setting:

1. To identify and evaluate changes in students’ argumentation skills evident in essay-writing after participating in a unit of work involving the digital scaffolding of argumentation.

2. To evaluate attitudes to working with argument in order to distinguish this approach from other contemporary approaches and therefore explain changes in students’ writing and attitudes to writing.

3. To evaluate the extent to which digital technologies used in the classroom facilitate learning interactions that are valued by students, and may therefore explain their engagement with digital argument mapping.

In the following sections the three components of the research methodology used in the investigation, design-based research, mixed methods research and quasi-experimental research are introduced and justified. For each, its place in the conceptual framework of this investigation, together with relevant issues in epistemology, are clarified.

### 3.2 Design-based Research

Perhaps the key guiding metaphor of the emergent field of design-based research is the desire to put theory “in harm’s way” (Cobb, Confrey, DiSessa, Lehrer, & Schauble, 2003, p. 10). Design-based research (DBR) involves the introduction of a theoretically grounded innovation into the real-world mess of a working classroom, followed by rigorous and systematic data collection aimed at exploring the impact of the intervention on student learning and teaching practice. In the present investigation, the researcher and participating teachers co-designed a ten week unit of work for middle secondary English classrooms aimed at exploring the effect on student writing of digital argument mapping program. The aim of the designed
intervention, however, is not an experimental style summative assessment of whether the program ‘works’. Following the seminal work of Collins (1992) and Brown (1992), the research described here involved an attempt to capture the essence of the interacting participants and their context in order to develop a practically useful profile of the design intervention, and a pedagogically useful discussion of the ways in which educational technology is being used in classrooms more generally.

For the purposes of this study, the term ‘design-based research’ will be inclusive of common synonyms in the field: design research, formative and design experiments and design studies in education. Since Brown’s (1992) original work, the field has experienced a surge of interest in the first decade of this century, marked by special issues in three key journals: Educational Researcher (Kelly, 2003), Journal of the Learning Sciences (Barab & Squire, 2004) and Educational Psychologist (Sandoval & Bell, 2004). In addition a Dutch volume (van den Akker, Gravemeijer, McKenny, & Nieveen, 2006) has appeared, followed by the Handbook of Design Research Methods in Education (Kelly, Baek, Lesh, & Bannan-Ritland, 2008) published by Routledge in New York. The developing interest of the DBR field in literacy, after many key studies exploring science and mathematics education, was marked by a National Conference on Research in Language and Literacy volume (Reinking & Bradley, 2008). An analysis of the five most cited articles in the DBR field each year between 2002 and 2010 (Anderson & Shattock, 2012), concluded that although still pre–paradigmatic, the field promises a ‘best practice’ stance with tangible results on student learning and pedagogical understandings about outcomes in real–world settings.

Whether this developing field can be described as a methodology, a paradigm or an approach is still open to debate (see for example Andriessen, 2007). For the purpose of this investigation, particularly because of the limitations imposed by the PhD timeframe and resources, DBR is viewed as an approach which provides an orientation towards a certain type of research and epistemology. The approach benefits from a mixed methods methodology, in this case one that involves a quasi-experimental intervention, which can then be explored for the meanings associated with it by participants.
This mix between a quasi-experimental intervention and interpretivism as a theoretical perspective for this investigation is particularly significant in terms of both learner cognition and learner engagement. While the approaches to literacy that characterize this investigation are clearly sociocultural in orientation, learner cognition is conceived as a combination of behavioural, personal (cognitive and affective) and environmental factors as per social cognitive theory (Bandura, 1986). An intervention focused on a set of cognitive argumentation practices which are then explored in a setting of classroom dialogue, collaboration and relationships, depends on – and calls into question - the mix of theory and practice that characterises a DBR approach.

In particular, social cognitive theory posits the notion of self-efficacy (Pajares, 2006), whereby the learner improves newly acquired skills by putting them into practice. The DBR approach allows for an investigation of this entire process, from the pre-teaching design phase to a final discussion of student voice exploring the experience and its meanings for the learner. The question of the level and type of student engagement with the process is also considered through this DBR lens. Measuring student engagement depends on both academic progress and their “affective connections with the academic environment” (Christensen, Reschly & Wylie, 2012, p. v). The DBR approach sets out to investigate both changed learning behaviors as instigated by the intervention, and student interpretations of their environment through the qualitative phase of the investigation.

The focus of DBR has been on challenging educational problems that require complex solutions developed across multiple research sessions enacted in working educational settings. Both the intervention and the subsequent development of theory aimed at analysing the findings of the intervention, are motivated by the importance of studying and documenting emergent learning behaviours. The field employs two useful metaphors to explain and justify this type of approach. Gorard, Roberts and Taylor (2004), firstly, see the provenance of the DBR field in the design sciences such as aeronautics and artificial intelligence with their interest in producing and improving designed objects or interventions, and exploring their working in specific conditions. The testing, retesting and modification approach framed by these design fields equates to a classroom context where research continues until a product or practice version develops that satisfies both educational
needs and allows for practitioner and academic reflection on the educational process involved in achieving that level of usefulness.

The second metaphor, that of a “learning ecology” (Cobb et al., 2003, p. 9), describes the expected benefits in terms of the understandings that will come from a DBR approach. Hence a learning ecology connotes a complex interacting system with multiple variables including tasks, technology, relationships, discourses in play and participation types. DBR is focused on developing knowledge about what will work in such settings and is thus ecumenical in both its epistemology and methods. It favours a mixed–methods approach that can build rich descriptions of this process of testing and subsequent analysis, with a view to exploring whether designed interventions will work in analogous settings.

The iterative cycles of testing and evaluation suggested by both metaphors, however, provide a challenge to the Ph.D. student. The design process is longitudinal and can involve multiple sites and data collection methods. One widely accepted representation of the process of DBR (Reeves, 2006) sets out four phases, moving from the collaborative analysis of problems, through solution development to cycles of testing and refinement followed by reflection. The problem of situating meaningful research that can be undertaken by a single investigator within this model has necessitated the adoption of Middleton, Gorard, Taylor and Bannan-Ritland’s (2008) notion of a three-phase feasibility type study. This limited approach to DBR involves:

1. First Phase: the design of the intervention based on theory.

2. Second Phase: the design of the artefact.

3. Third Phase: a feasibility study involving essentially qualitative methods to formatively evaluate the intervention in order to “identify how the intervention is working, barriers and facilitators… and how it might be improved.” (Middleton et al., 2008, p. 30)

The results of this third phase would then determine progress towards larger scale prototyping and trialling experiments that are beyond the scope of a Ph.D. timeframe and resources.
By situating my investigation as such a limited three-stage feasibility study I have structured a realisable design process that takes up Herrington, McKenney, Reeves and Oliver’s (2007) call to Ph.D. students to engage with design research which is both “exploratory and speculative” (p. 8) and does the “hard science” (p. 9) of developing realistic, context-specific, theory-informed principles around the educational use of technology.

At the completion of the third – feasibility – phase, this investigation returned to Reeves’ (2006) fourth step in the design-process: “reflection to produce new design principles and enhance future implementation” (p. 271). The Discussion chapters, 8 and 9, of this dissertation fulfil this role.

3.3 **Mixed Methods**

A mixed methods research design is a perfect fit for design-based research as the two share a fundamental pragmatic focus; the choice, timing, interaction and analysis of data from quantitative and qualitative strands is governed by the need to investigate and explain what works in the school settings, rather than by adherence to a particular research paradigm.

The mixed methods approach, now often raised to the status of paradigm itself (see for example Johnson & Christensen, 2013), applies quantitative and qualitative research methods to “obtain a more complete picture of human behaviour and experience” (Morse, 2003, p. 189); a systemic investigation of practices and worldviews.

3.3.1 **The rationale for using a mixed methods approach in this investigation.**

By taking student scores on writing pre- and post-tests and statistically analysing this quantitative data, useful information about trends for the sample as a whole can be described. The observations of technology in use and the interpretations of teachers and students about using it, drawn out through semi-structured interviews, on the other hand, set up a “very powerful mix” (Miles & Huberman, 1994, p. 42) where the qualitative detail yields “more holistic insights into educational processes” (Johnson & Christensen, 2013, p. 429) and the meanings participants give to them.
My investigation therefore seeks to obey the fundamental principle of mixed research: the strategic mix of qualitative and quantitative methods with “complementary strengths… and nonoverlapping weaknesses” (Johnson & Christensen, 2013, p. 432). My questionnaire data allows for statistical generalisations about the views, experiences and behaviours of the student sample that are crucial for building the context required to accurately document the design intervention. Together with the pre- and post-test writing data, this will allow both the partial explanation of some confounding variables such as ability grouping, as well as the testing of hypotheses constructed before the data was collected. This data provides no useful exploration, however, of the students’ and teachers’ experiences of using the digital mapping technology. This kind of detailed information about why a phenomenon occurs, in the words of the participants themselves, is especially responsive to the local setting and the complex interplay of technology, learning and personality that is missing from the quantitative data.

There is considerable debate within the literature about whether this interweaving of data from different methods constitutes triangulation. For example, in his widely-used typology, Bryman (2006) refers explicitly to the mutual corroboration through qualitative and quantitative research as stronger validity or triangulation. According to Morse (2003), on the other hand, data which provide only a “glimpse of another perspective” (p. 192) and cannot be confirmed independently of other data within the single project, are better thought of as supplementary. The aim here, however, is to “increase the scope and comprehensiveness of the study” (p. 192), by utilising data from the qualitative strand to further explore the valuable but limited insights of the quantitative strand.

The following table draws on the work of Bryman (2006) and Greene, Caracelli and Graham (1989) to summarise the major reasons for the choice of a mixed method approach. Each point is illustrated in the right-hand column with a specific element of my investigation.

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8 In the sociological sense based on the work of Denzin (2006) for example, to refer to the use of more than one method to gather data, with the aim of expanding the credibility and validity of results.
Table 3.1 Summary of the key strengths of the mixed methods approach as applied to this investigation

<table>
<thead>
<tr>
<th>Rationale</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complementarity:</strong></td>
<td>Results from one method are elaborated on, clarified or enhanced by results from another</td>
</tr>
<tr>
<td></td>
<td>Interview data elaborates on writing data to explore student interpretations of their work with the technology</td>
</tr>
<tr>
<td><strong>Expansion:</strong></td>
<td>Different methods widen the breadth of investigation</td>
</tr>
<tr>
<td></td>
<td>Questionnaire data from students about their learning activities in English classes is given breadth by the integration of teacher views on the same topic drawn from interviews</td>
</tr>
<tr>
<td><strong>Offset:</strong></td>
<td>Weaknesses are offset by the strengths of complementary methods</td>
</tr>
<tr>
<td></td>
<td>The writing data may reveal a statistically significant change in the use of argumentative writing techniques. However, without observation data, for example, it is difficult to form an account of student and teacher activity during the use of the technology in order to help explain the change.</td>
</tr>
<tr>
<td><strong>Utility:</strong></td>
<td>In applied studies, the combination of approaches is seen to be more useful to practitioners</td>
</tr>
<tr>
<td></td>
<td>Teachers have a growing interest in issues of lesson design and pedagogy around the use of educational technology. These practitioners would see observation and teacher interview data as at least as useful as quantitative data from the writing tasks</td>
</tr>
<tr>
<td><strong>Diversity:</strong></td>
<td>The way quantitative and qualitative research allows for a combination of researcher and participant perspectives respectively</td>
</tr>
<tr>
<td></td>
<td>Quantitative writing data essentially reflects a researcher perspective through the predetermined rubric. Interviews allow for the diversity of teacher and student perspectives on that writing to be recorded and integrated.</td>
</tr>
<tr>
<td><strong>Illustration:</strong></td>
<td>The use of qualitative data to fill out the bare bones of quantitative findings</td>
</tr>
<tr>
<td></td>
<td>A relationship between variables such as ability grouping and writing effectiveness can be uncovered through my quantitative data, but the meanings given to these apparent changes by the participants themselves is best obtainable through qualitative research.</td>
</tr>
</tbody>
</table>

In summary, the main advantages of a mixed methods approach for this investigation are, firstly, the complementarity of methods to ensure there are no significant data gaps and that the breadth of possible explanation is expanded. Secondly, the collection of a diversity of data types so that different aspects of the problem can be explored utilising the strengths of respective methods.

### 3.3.2 Framework.

Pragmatism is described by Johnson and Onwuegbuzie (2004, p. 14) as “an attractive philosophical partner for mixed methods research.” It is thus an attractive epistemological orientation for design–based research in that it rejects traditional dualisms such as rationalism vs empiricism and subjectivism vs objectivism, and privileges philosophical paradigms based on how well they work in solving problems. Johnson and Onwuegbuzie’s (2004) work on the pragmatism of mixed methods can be further aligned with DBR by noting that pragmatism endorses a strong and practical empiricism as the path to determining what works.
While a general philosophical orientation towards pragmatism is a valid starting point, Morse (2003), among others, strongly urges that the researcher recognise the “theoretical drive” (p. 193) of different phases of the project. Hence my qualitative phase, aimed at exploring attitudinal change, has an inductive theoretical drive that has resulted in the ethnographic descriptions in Findings chapters 6 and 7. A deductive theoretical drive, on the other hand, is evident in the attempt to confirm a hypothesis about digital argument mapping and student writing. Morse (2003), however, does note that “fishing trips” (p. 193), where quantitative methods proceed with an inductive drive in order to explore a phenomenon – questionnaires exploring the school contexts for the design intervention for example – are also valid.

For the mixed methods design of this investigation, Creswell and Plano Clark (2011) note that a pragmatic worldview can also reflect both the postpositivist (Phillips & Burbules, 2000) and constructivist frames of individual components. This investigation therefore recognises the postpositivist subjectivism implied by the choice of target construct, questions, and analytical tests for quantitative data (Johnson & Onwuegbuzie, 2004). My study also aligns itself with the constructionist (Crotty, 1998) epistemology called for by a pragmatic mixed methods approach which views classrooms and the teachers and students who interact in them, as emergent through the interaction of subjective reality and the bounds of external reality. There are therefore strong resonances here with both interpretivism and critical inquiry.

Johnson and Christensen (2013) label the openness to “multiple paradigms and interdisciplinary perspectives” (p. 431) as dialectical pragmatism. This involves not only the reporting and honouring of the worldviews held by the researcher and participants, but provides an opening for a more “transformative research perspective” (Creswell, 2012, p. 537) that aligns my approach to DBR with critical theory. Dede (2004, p. 111) sees design-based research as an “interventionist ethnography [which] perturbs typical learning settings”. An important aspect of this investigation will be to ‘perturb’ current narratives about the democratisation of knowledge possible through digital technologies, and the simplistic dichotomy between print-based and multimodal literacies. This study will investigate the extent to which ICT in the English classroom is an embodiment of oppressive power dynamics, and the extent to which, under particular conditions, ICT can be
harnessed to empower; to "establish a critical democracy, to engage marginalised people in the rethinking of their sociopolitical role" (Kinelsey & McLaren, 2002, p. 93). A mixed methods design, reflecting a critical qualitative research worldview, therefore values both the subjective realities that teachers and students are constructing for themselves in contemporary English classrooms, and extends the interpretivist paradigm to a critical consideration of wider social and political processes that frame identities (Neuman, 2011). The embedded mixed methods design.

In their typology of mixed methods research designs, Johnson and Christensen (2013) envisage both a time dimension and a paradigm dimension for each study. The investigation described in this dissertation has a concurrent time order dimension, with the qualitative strand having paradigm dominance. This is represented in the accepted notation (Creswell, 2012; Morse, 2003) by the use of capitalisation to denote dominance and the plus sign for concurrence:

QUAL + quan

In this investigation, the qualitative and quantitative strands are therefore enacted at the same time, but the qualitative strand is emphasized as providing the key understandings on which findings are based.

The paradigm dominance of the qualitative strand acknowledges two important assumptions of this investigation. Firstly, that ethnographic studies of students and teachers interacting with and then expressing their attitudes to educational technology are vital to any useful understanding of what a digital program might be able to do. Secondly, while the usefulness of measuring the effectiveness of an intervention is accepted by the inclusion of the quantitative strand, this investigation posits that previous studies limited to the experimental approach both undervalue insiders’ interpretations of the process and overvalue the potential understandings gained from a statistical analysis of participants’ performances.

According to Morse (2003), the additional paradigm – in this case the quantitative strand – does not need to be a complete study in itself; it may be used to “develop indicators” (p. 195) that are then explored more comprehensively by the dominant strategy. The element of the design which can be measured, with an acceptance of

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9 As opposed to, for instance, QUAL > QUAN, in which both terms capitalised denotes equal paradigm importance and the arrow suggests a sequential rather than concurrent design.
postpositivist epistemology, can then “enhance the qualitative description” (p. 202). Crucially for the present investigation, this process does not involve the sequential feeding in of data results from one component to another during the investigation itself. Data sources have been combined only during the interpretation stage in order to supplement each other in the development of theory and innovative practice as envisaged by the design-based research methodology. For Creswell and Plano Clark (2011), therefore, the “point of interface” (p. 66) is during the synthesis of results so that a synthesis is possible even though the two strands have been kept separate during the process.

The present investigation fits Creswell and Plano Clark’s (2011, p. 70) “embedded design” prototype. Here, the concurrent collection of supporting data, with separate data analysis processes, works to scaffold the feasibility style design-based research that seeks both “preliminary exploration” (p. 73) before an experimental design and “a more complete understanding of an experimental trial” (p. 73). Common variants of this prototype include both an embedded experiment and a mixed methods ethnography, both elements of this investigation that are illustrated in the following figure.
Embedded design proceeds on the premise that different research questions require different data sets. The literature includes various studies within the broad umbrella of experimental mixed methods design, where qualitative data either explores the process of the intervention (for example Victor, Ross, & Axford, 2004) or evaluates the reactions of participants to the intervention (for example Evans & Hardy, 2002). Embedded design is distinguished from other prototypes in that the purposes for collecting qualitative data (attitudinal change) are connected to, but different from, the purposes of the quantitative data collection (the assessment of whether the intervention has had a significant statistical effect).

An embedded mixed methods design therefore allows the combination into one coherent investigation of data that would not otherwise be obtainable using either a qualitative or quantitative approach alone. Because of the messiness of the
classroom as a research setting, and the complex interplay between students and teachers and technology, the strategic mixing of data sources makes insights about the phenomenon being observed more plausible. Morse (2003) identifies this as the “comprehensiveness” (p. 192) of the study, and goes on to argue that the mutual interdependence of the strands – data from neither qualitative or quantitative phase is saturated in terms of the overall research problem – is far from a disadvantage: it is in the synthesis of data during the discussion stage that tentative design solutions become “intelligible and interpretable” (p. 193)

3.4 Quasi-experiment

The intervention that forms one element of the embedded mixed methods design is a Mixed Between-Within Design or Non-equivalent group Before-After Design whereby seven classes across two year groups and two school settings worked with the technology innovation, and are compared to three control classes who experienced no change to their usual instructional method. This method is commonly represented (see for example Morse, 2003) in one of the two ways set out in figure 2 below.

Figure 3.2 Common notations to describe the mixed between-within design.

<table>
<thead>
<tr>
<th>Time</th>
<th>Experimental group:</th>
<th>Control group:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>pre-test</td>
<td>pre-test</td>
</tr>
<tr>
<td></td>
<td>intervention</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>post-test</td>
<td>post-test</td>
</tr>
</tbody>
</table>

Or

\[
X_1 \quad 0 \quad X_2 \\
X_1 \quad - \quad X_2
\]

The notation ‘X’ refers to the test, while ‘0’ refers to the intervention.

A quasi-experiment has two fundamental differences to the kind of experiment usually associated with medical or applied science contexts. Firstly, because of the nature of the school settings, randomisation is not possible. Pre-existing groups, in this case Year 9 and 10 English classes, were utilised for both logistical reasons and because the existing class social contexts are an important element in understanding the real-world application of the intended design. Secondly, such a quasi-
experiment cannot control for variables in the same way that a laboratory can. The following figure presents the dependent, independent and other variables as conceived at the outset of this investigation:

**Figure 3.3 Variables for this experiment**

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent variable</th>
<th>Extraneous variables$^{10}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student scores on the argumentative writing rubric</td>
<td>Digital argument mapping program</td>
<td>Streaming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>School culture, especially teacher-student relationships</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Year (9 or 10)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pre-existing attitudes to writing and technology</td>
</tr>
</tbody>
</table>

Unlike the tightly-controlled laboratory settings of experimental research, however, DBR takes up the challenge of the extraneous or confounding variables of the classroom setting. Brown’s (1992) initial movement to design experiments came as a result of her frustration with the translation possibilities of reading comprehension meta-strategies developed in the lab. Although quasi–experimentation loosens the strict randomisation and control protocols explicit in this field, the quantitative focus of both is seen as one element of design-based research’s interest in developing thick descriptions of setting and intervention. In other words a pragmatic approach focused on what works, how and why, rather than experimental trials predicated on ideal conditions, means that DBR is willing to sacrifice “standardisation for realism” (Gorard et al., 2004, p. 584). Citing the work of Moore, 2002, however, Gorard et al. (2004, p. 585) go on to state that quantitative data has a vital role, ensuring that "an unbiased estimate of the average effect of the intervention is obtained" while the qualitative data enriches understanding of "the external factors that support or attenuate this effect.”

Shields (2102, p. 2) suggests that a recent drive towards “quasi-experimental scientific studies” aligns less with a concern for pedagogy than a focus on management, efficiency and institutional control and surveillance. This investigation therefore seeks to ground the quasi-experiment, with its focus on statistically significant change, in a critical theory framing and post-positivist epistemology that remind us of the limits to the conclusions that can be reached

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$^{10}$ As theorised as part of this ‘intended design’. This investigation assumed that other variables might come to light as a result of the intervention.
from these kinds of numbers. While the DBR objective is to develop theory which is empirically grounded, this theory is appraised “by the extent to which principles inform and improve practice” in “real world settings” (Wang & Hannafin, 2005, p. 8). It therefore weaves together aspects of pragmatic, critical and ethnographic approaches.

3.5 Methods

The following sections introduce the research instruments used in this intervention. The discussion begins with a presentation of the participants and then outlines the quantitative and qualitative phases. A description of the research settings as well as the pilot studies is included in the research design in Chapter 4.

3.5.1 Participants.

The potential population for this study is all teachers of subject English in secondary schools, particularly in NSW, but with wider relevance to the whole profession. Theoretical and practical benefits of the study may apply to all Humanities teachers. As English is a compulsory school subject in NSW, the potential population also includes all students, with a particular focus on middle secondary (Years 9 – 10, aged 14 – 16 years).

The participants in this investigation are English teachers and upper secondary students in Years 9 and 10 at two comprehensive State schools on the mid-North Coast of NSW. When this project was proposed to the two schools, every English teacher on staff indicated a desire to participate. Framed by the time and cost limitations of a Ph.D. project, typical case sampling (Patton, 2002) was used to construct a research design suited to the embedded mixed methods design. Hence, from RCHS, six teachers were chosen so that their classes represented both high and mixed ability streaming and the two year groups, nine and ten. This type of purposeful sampling (Patton, 2002) was a purely logistical procedure based on timetable considerations and the need to set up a treatment and control structure within the streaming and year levels. The intention was to ensure that there were control classes at each level and a wide spread of ability groupings. In total
therefore, RCHS involved six teachers, five treatment and two control classes, with a total sample of 150 students who completed the initial questionnaire.

Of this total sample, every treatment and control student who was present for the questionnaire and both the pre- and post-test writing tasks was included in the sample for the argumentative writing assessment. This came to 62 students. Typical case sampling (Patton, 2002) was then used again to invite four students from each of the five treatment classes to participate in the semi-structured interviews. This choice was made by the researcher in consultation with the teacher to ensure a representative mix of gender, and that the interview sample contained a breadth of student interests and experiences with both writing and educational technology. According to Morse (2003), different sampling strategies are necessitated by the corresponding theoretical drives of the quantitative and qualitative phases. Participants used in the larger sample may also be selected in the smaller qualitative sample as each project is “methodologically… independent” (Morse, 2003, p. 202), with linking of data from each student case only taking place in the post-intervention data analysis stage.

In PTHS, this logic and procedure was repeated on a smaller scale that resulted in two treatment and one control class yielding 54 questionnaires, 24 writing pre- and post-tests and six interviews. These totals are represented in Table 3.4 below.

Table 3.4 Overview of participant numbers and class arrangements

<table>
<thead>
<tr>
<th>School</th>
<th>Classes</th>
<th>Treatment</th>
<th>Control</th>
<th>Yr9</th>
<th>Yr10</th>
<th>Qu.</th>
<th>Wr.</th>
<th>Int.</th>
<th>Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCHS</td>
<td>7</td>
<td>5 (3H, 2M)a</td>
<td>2 (1H, 1M)</td>
<td>4 (1H, 3M)</td>
<td>3 (2H, 1M)</td>
<td>150</td>
<td>62</td>
<td>20</td>
<td>10b</td>
</tr>
<tr>
<td>PTHS</td>
<td>3</td>
<td>2 (1H, 1M)</td>
<td>1 (1M)</td>
<td>-</td>
<td>3</td>
<td>54</td>
<td>24</td>
<td>6</td>
<td>4b</td>
</tr>
<tr>
<td>Totals</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>204</td>
<td>86c</td>
<td>26</td>
<td>14</td>
</tr>
<tr>
<td>Teachers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6d</td>
</tr>
</tbody>
</table>

a H = High ability stream, M = Mixed ability stream; b two formal observations per each treatment class; c 86 students yielding 172 total pre and post writing scripts; d one teacher at RCHS had two treatment classes
Following the logic of typical case sampling, these class sizes, participants and settings are representative of mixed-ability, comprehensive, non-Selective high schools in regional NSW. The recruitment strategy is aimed at setting up a valid and reliable quasi-experimental setting where, despite the absence of randomization, a mixed between-within groups analysis of repeated measures (the writing pre- and post-test) is developed and evaluated using statistics software, and can then be explored for rich descriptions of the setting and process in the qualitative strand.

Student participants were involved in the investigation on the basis of class groups to which they had been assigned by their school, and primarily according to their teacher’s involvement in the project. Hence this study makes use of intact groupings typical of research in educational settings that is unable to randomise for experimental purposes (Creswell, 2012). The class cohort, which would have been functioning as a unit for six months before the intervention, is – in any case - a key context for this study and has been explored as such by the questionnaire, observation and interview instruments described below. Students between the ages of 14 and 16 cover school Years 9 to 10 and comprise the two years of Stage 5. Stage 5 teachers are particularly aware of the challenge of non-fiction writing at this level with the pressure to prepare students for Higher School Certificate (HSC) subjects in the final two years of schooling. This study is aimed at exploring argumentative writing at an age when engagement in school writing is acknowledged as being a challenge. The alignment of classroom contexts, including streaming, social dynamics and pedagogical choices, as well as stage of schooling and school type, govern the sampling strategy in place for this investigation.

Characteristics of setting that affect the sample, for example regional location, school ethos or class streaming are described in the next chapter on the intervention, then carefully discussed in the Findings chapters as extraneous or potentially confounding variables that impact on the research. The potential for self-selection of teachers for the investigation is a danger to the validity of results and is considered in the following discussion.
3.5.2 The Quantitative Phase

This section includes the presentation of the writing test and questionnaire methods. These instruments are discussed and issues of validity and reliability specific to each method are explored. A more general appraisal of the trustworthiness of the entire embedded mixed methods design – using Lincoln and Guba’s (1985) framework – is made in the final section of this chapter, after the qualitative phase is outlined.

3.5.2.1 Writing pre- and post-test rubric.

Various rubrics for argumentative writing are used and discussed in the literature. This investigation has utilised an adapted and pilot-tested rubric based on Morgan and Beaumont’s (2003) criteria drawn from the British Esmee Fairbairn research project. For the purposes of this project, these criteria were modified with elements drawn from Schwarz and de Groot’s (2007) claim-reason/evidence criteria and Kelly and Takao’s (2002) epistemic levels in argument, both based at least in part on Toulmin’s 1958 argumentation ‘grammar’ (discussed for example in Mirza & Perret-Clermont, 2009). From these sources a grading rubric was developed and used to grade students’ pre- and post-treatment skills by two independent and ‘blind’ assessors whose results have been statistically compared. A copy of this rubric, in the form used by the writing assessors, has been included as Appendix 4.

Using a five-point Likert style scale the rubric reports seven elements of argumentation. These are:

- Development of a thesis
- Paragraph structure
- Use of evidence to support ideas
- Inclusion of alternative viewpoints
- Persuasive techniques
- Personal voice
- Conceptual orientation
Each element was given a score representing a range of possibilities from Not Evident to Skilful.

It is important to note that this type of scoring represents a quantification which reflects the judges’ subjective assessment of quality. This move is reported by Johnson and Turner (2003) as a component of the Scholastic Aptitude Test (SAT) since 1994. It is a strategy that has been used in combination with questionnaires to explore the relationships between attitudes and performance (Papanastasiou, 2000, as cited in Johnson & Turner, 2003), to test the effects of peer review on writing (Lundstrom & Baker, 2009), the effectiveness of peer correction (Bitchener, 2008) and in an intervention study that framed pre- and post-test writing improvements with an exploration of motivation (Hidi, Berndorff, & Ainley, 2002).

As the rubric in question is an adapted one, results were tested for instrument reliability through the calculation of Cronbach’s alpha in SPSS. The writing rubric was found to be highly reliable (7 items; $\alpha = 0.93$). This high level of instrument reliability was confirmed by bivariate correlation analysis across the seven elements which confirmed two constructs in play. The first involves the grouping of thesis, structure, evidence, voice and conceptual orientation, while the second includes persuasiveness and alternative viewpoints. The significance of this construct grouping is discussed in the Findings chapters.

3.5.2.2 Data collection.

Students at each school wrote essays on topics set by the school as part of the normal unit of work structure. Both pre and post-writing tasks were undertaken by students under assessment conditions in the classroom in one 50-minute period. Since explainable variability is the key to the validity of results from this instrument, the following steps were taken to minimise “uncontrolled variability” (Calfee & Chambliss, 2011, p. 390). All students wrote under the same time and preparation conditions; all essay questions were of the same type\(^\text{11}\): requiring a personal response based on textual evidence, in other words a typical high school literary criticism essay. While different classes pursued different thematic topics and studied different texts, the structure of theme, texts as evidence and essay as summative assessment of sustained personal response was consistent throughout. Moreover, all essays had the same value to students: in-class assessment tasks.

\(^{11}\) See Appendix X for task sheets for pre and post-test writing essays.
which students knew would be used for both research purposes as part of this project, and to obtain school marks relevant to their reports.

3.5.2.3 Marking.  
All scripts were de-identified, photocopied and sent to two independent and experienced markers for assessment. Steps taken to maximise the internal validity of this process included the use of identical lined paper for all classes in both schools on both writing tests, and the fact that the essays were hand-written. Markers therefore had no knowledge of the nature of the intervention, the provenance or identity of the papers or whether the scripts were pre or post-intervention essays.

A moderation session held between researcher and markers established benchmarks. Each marker assessed each student (n= 172; 86 students by two essays each) so that two scores were developed for each of the seven argumentation elements for each student in the writing sample. A Pearson product-moment correlation coefficient was computed to assess the relationship between the scores given by the two markers. There was a positive correlation between the two sets of variables, $r = 0.81$, $n = 86$, $p = 0.000$ for the writing pre-test, and $r = 0.89$, $n = 86$, $p = 0.000$ for the writing post-test. In addition, the interrater reliability for the two raters was found to be Kappa = 0.82 ($p<0.001$), 95%CI (0.762, 0.872), indicating substantial agreement (Landis & Koch, 1977). On this basis, marks from the two assessors were averaged to provide a single score for the analysis of variance (ANOVA) reported in Findings chapter 5.

3.5.2.4 Data analysis.  
The pre- and post-test data collected by this instrument have been used to develop a response to Objective 1:

*To identify and evaluate changes in students’ argumentation skills evident in essay-writing after participating in a unit of work involving the digital scaffolding of argumentation.*

In order to explore this objective a series of ANOVAs were run with the student writing scores as the dependent variable and the following factors as extraneous variables coupled with involvement in the argument-mapping software (the independent variable): class streaming (high or mixed ability), year group (9 or 10) and school (RCHS or PTHS). Hence the Findings chapters report on the differences
in intervention effect on treatment and control classes, across ability groupings and year levels, and between the two schools.

### 3.5.2.5 Validity issues.

Key threats to internal - or “causal validity” (Johnson & Turner, 2003, p. 301) – are addressed by the systematic treatment of the data described above, both the internal validity of the instrument and the scores given by the markers. Furthermore, several of Campbell’s (as discussed in Johnson & Turner, 2003) widely elaborated threats to validity are controlled for as best as possible through this research design. Testing effects are not present because the topics have changed from pre- to post-test and essay-writing itself is a widely used assessment strategy not specific to this investigation. Instrumentation effects are discounted because the measurement of variables does not change. History effects and maturation are important to monitor in this investigation; one term of ten weeks should not significantly affect natural maturation, but unplanned events during the course – such as internet breakdowns – are discussed as context features during the Discussion chapters.

Of the validity problems described by Webb, Campbell, Schwartz and Sechrest (1996) the key one of concern regarding the writing test is the varieties of sampling error. In this investigation it is not possible to obtain a perfect sample, as only a certain population was accessible to the researcher, and it is a population that is unstable. While the entire sample participated in the questionnaire, the segment of that sample which was used for the writing test is an accidental sub-group based on attendance at three key research events, the questionnaire and both writing tasks. The question of whether absence from any one of these is purely random and hence does not affect validity, or represents underlying patterns such as school absenteeism which may skew results, is impossible to answer from information obtained from the sample of school settings. Neither school has an abnormal absenteeism rate however.

The degree to which patterns in the data can be made sense of, or “conceptual clarity” (Calfee & Chambliss, 2011, p. 396) is another useful synonym for internal validity in the literature. Here this clarity depends on the visibility of the key concepts, argumentation, evidence, alternative viewpoints for example, the size and simplicity of the effects demonstrated by statistical techniques and the awareness of inadvertent confounding. While none of these can be controlled for perfectly in this
investigation, the following research methods are intended to be compensatory so that the principle of non-overlapping weakness (Johnson & Christensen, 2013), where the strengths of interviews for example make up for the weaknesses of questionnaires, is not violated.

3.5.2.6 Student questionnaires.
According to Vogt, Gardner & Haefele (2012) survey questionnaires are justified if the research questions require broadly representative answers, structured Likert-style questions can provide rich data, and a high proportion of intended respondees can be expected to complete the process. These conditions apply in this investigation for the sample of students from the two high school settings.

This investigation has utilised a component of the Formative Evaluation Process for School Improvement: Technology Package (FEPSI/TP) developed by the Centre for Research in Educational Policy (CREP) and used in several hundred schools and research projects, particularly in the USA (Lowther, Inan, Strahl, & Ross, 2008). The questionnaire element of this package aims to develop quantitative data on the experiences of and skills in the use of educational technology of teachers and students. The adaptation applied in this investigation extends the range of questions to cover experiences, views and skills in the learning and teaching of argument, writing, and essay-writing in particular.

The questionnaire instrument (a copy of which is included as Appendix 5) has been used as the initial stage of the embedded mixed methods design in order to develop a response to research objectives 1 and 2:

*To identify and evaluate changes in students’ argumentation skills evident in essay-writing after participating in a unit of work involving the digital scaffolding of argumentation.*

and

*To evaluate attitudes to working with argument in order to distinguish this approach from other contemporary approaches and therefore explain changes in students’ writing and attitudes to writing.*

In the form of a “cross-sectional survey design” (Creswell, 2012, p. 377), the questionnaire measures current attitudes and practices in order to fulfil two aims.
Firstly, the description of general trends in the research settings is vital to the design-based research objective of documenting the design context. Secondly items or groups of items in the questionnaire can act as potential independent variables or covariants to the writing test and be statistically tested against. For example, questions 6 and 7 asked students to note their use of different types of technology in and out of school. By collating scores, students who ‘never’ or ‘not very often’ use web 2.0 type technology can be checked for variance in their writing scores to those who reported a high use of this kind of collaborative or participatory technology.

According to Johnson and Turner (2003), questionnaires are “an important component in intermethod mixing” (p. 304) in order to generate participant attitudinal trends that can be later qualitatively explored. This component can also then be combined with in-depth interviews to construct a “more complete and interesting depiction of the differences across the samples” (p. 305); the mixed ability versus high ability streamed groupings for example.

3.5.2.7 Data collection.
Questionnaires were completed on paper during school time by all students in treatment and control classes. The main constructs measured by this questionnaire and utilised in the Findings chapters were:

- Relationships with peers and teachers
- Attitudes to learning
- Experiences of technology used by teachers
- Attitudes to learning with educational technology
- Activities on school or home computers
- Attitudes to and experiences of English lessons
- Attitudes to and experiences of school writing
- Attitudes to working with other students

3.5.2.8 Data analysis.
The Medical Research Council’s (MRC) model for interventions in complex health education settings (discussed in Gorard, Roberts, & Taylor, 2004), provides not
only a widely-accepted basis for a phase by phase mixed-methods approach, but a clear rationale for using quantitative data at an early stage in the process to prepare for the latter formative, qualitative evaluation of the design intervention.

Data from the questionnaires has therefore been utilised in two ways. Firstly descriptive statistics provide central tendency and variability information on key characteristics of the research settings. These “climate [and] learning” variables (Collins, Joseph, & Bielaczyc, 2004, p. 36) include self-assessed levels of school engagement, attitudes toward cooperation, relationships with teachers, and the extent of student use of technology. For example, on the basis of the questionnaire my Findings chapters can make use of valuable contextual information such as the extent to which students agree that computers improve the quality of their school work. Similarly, I am able to quantify the extent of student involvement in web 2.0 technologies.

The second application of the questionnaire data has been in the provision of additional extraneous variables against which the writing data can be tested for statistical significance and variation. For example, it is possible to identify from the questionnaire data those students who self-identify as disliking writing, and then compare their writing results to those students who have a positive relationship with school-based writing. This type of analysis does not have causational power but if there are significant correlations with this and other school centred activities and attitudes, then there are important caveats that have to be placed on findings and recommendations from the writing data.

3.5.2.9 Validity.
The questionnaire has been adapted, with minor additions to cover the essay-writing and argumentation focus of this investigation, from a widely used instrument that has been employed to evaluate school systems across the United States, and reported in a growing number of peer-reviewed studies (Lowther et al., 2008). The instrument has been tested for reliability and psychometric validation (Sterbinsky & Ross, 2003). The questionnaire used in this investigation has been tested for instrument reliability through the calculation of Cronbach’s alpha in SPSS, and was found to be highly reliable (113 items; $\alpha = 0.88$).
3.5.3 The Qualitative Phase

In this section the interview and observation methods are presented. Justifications, procedures and data analysis are discussed for each. Issues of validity and reliability specific to these methods are explored jointly in the final section in preparation for the more general discussion in the section on mixed methods trustworthiness that follows.

The questionnaire and observation instruments have been used in the embedded mixed methods design in order to develop a response to research objectives 2 and 3:

*To evaluate attitudes to working with argument in order to distinguish this approach from other contemporary approaches and therefore explain changes in students’ writing and attitudes to writing.*

and

*To evaluate the extent to which digital technologies used in the classroom facilitate learning interactions that are valued by students, and may therefore explain their engagement with digital argument mapping.*

As opposed to the baseline measures of change explored through skills in students’ writing (objective 1) the focus here is on the attitudes of students and teachers.

3.5.3.1 Student and teacher semi-structured interviews.

At the heart of the inductive theoretical drive of this project is the series of interviews conducted with the teachers and students who taught or learnt with the digital argument mapping software. The orientation of qualitative inquiry towards discovery and exploration is addressed in this investigation by the open-ended, “semi-structured” (Creswell, 2012; Flick, 2009) or guide interviews (Patton, 2002) conducted with 26 students and 6 teachers. Also referred to as partially –structured interviews (Krathwohl, 1998) this method allowed for the use of pre-formulated prompts and questions (attached as Appendix 6) to be used in order to maintain a systematic approach while allowing for some freedom to probe and explore. Crucial to rapport-building with the sample age-group, the semi-structured approach also allowed a more informal tone to be developed in the interview room.

The mixed methods literature includes many examples of interviews being combined with both observation and documents including school records and
quantitative tests to explore the meanings that participants associate with the behaviour under focus. Johnson and Turner (2003) describe Pena’s case study into parental involvement in schools which included participant observation and interviews as well as school records. Turner (as cited in Johnson & Turner, 2003) explored the beliefs of children with learning difficulties using open-ended interviews to drill more deeply into the thinking behind responses they had given in close-ended questionnaires.

The use of interviews in the related field of evaluation research has led to the development of the sub-field of responsive evaluation (Patton, 2002) which aims to humanise the process of evaluation through the “capture [of] the deep-felt opinions of those most affected by the program” (House, 1991, p. 113). Although in some ways evaluation type approaches like design-based research sit uneasily with a naturalistic approach, Lincoln and Guba (1981) have suggested that naturalistic inquiry – in this case the classroom as setting and the interview designed to explore the ways participants experienced the unfolding events – can be integrated with responsive evaluation to ensure that stakeholders are at the centre of research, thereby enhancing the usefulness of recommendations arising from the intervention.

3.5.3.2 Data collection.

All interviews were conducted on-site at participating schools. Students were withdrawn from classes by arrangement, while teachers used free periods. Interviews lasted between 30 and 45 minutes and were digitally audio-recorded for transcription purposes. All participating teachers of treatment classes were interviewed, while three to four students were chosen (typical case sampling, see section 3.5.1) from each class by arrangement with the teacher in order to represent the widest possible range of backgrounds, attitudes and experiences.

The interview topics for both teachers and students covered the following constructs:

- Experiences of the topic and strategies used during the term
- Attitudes to the digital argument mapping software
- Attitudes to and experiences of teaching and learning writing in school
• Attitudes to and experiences of using educational technology generally (split into interactions with technology itself, interactions between students while using the technology, and interactions between teachers and students while using technology)

• Attitudes to collaboration amongst students

The significance each individual attaches to his or her experience of a situation is of great importance to the overall design-based research approach. The design ecology metaphor (Cobb, Confrey, DiSessa, Lehrer, & Schauble, 2003) employed by the DBR field emphasizes the interactions within a learning environment that are a key to judging the impact of the design intervention and the potential for its generalizability. The interviews have therefore given the researcher the opportunity to explore, with participants, key issues related to the second and third research objectives: attitudes towards writing and writing instruction and attitudes to the in-class use of educational technology. The interviews comprise a key element of the ethnographic approach of DBR which attempts to pursue rigour by extended and systematic inquiry into an educational setting through the combination of observation and interview (Reedy, 2008).

3.5.3.3 Data analysis.
The eclectic nature of DBR allows for the discovery of themes in the data along the lines of a grounded theory approach (Strauss & Corbin, 1997), as well as elements of a qualitative content analysis approach (Flick, 2009) for exploring pre-determined issues such as the teachers’ and students’ experiences of using educational technology in learning environments.

The thirty-two interviews in this investigation have been manually coded (by the principle researcher) along the lines of the constant comparison method originally proposed by Glaser (as discussed for example in Flick, 2009). Initially interviews were open coded so that key concepts, such as students’ attitudes to working with others on educational technology, could be developed from the data. Evaluation coding (Saldana, 2009), which can be described as a more traditional qualitative content analysis method, allowed me to include participants’ judgments about the merit of the argument mapping software.
Codes were constantly compared and reintegrated as categories developed. Axial coding (Patton, 2002; Saldana, 2009) was then used to refine categories and select themes that were most relevant to the research question. These were then linked back to passages in the text of the interviews to act as evidence for the Discussion chapters. This final stage of theory development from the data, or selective coding (Strauss & Corbin, 1997), has been used to develop a narrative to explore possible causes for the changes in writing effectiveness and engagement that are suggested by the writing test data.

Finally the coding of interviews has been heavily influenced by the more constructivist stance of Charmaz (2000), which attempts to balance the objectivist focus of Strauss and Corbin (1997) on describing facts and acts, with an orientation towards the meanings ascribed by participants. Hence the codes are weighted towards values, beliefs and assumptions, such as student preferences in relation to working with others on computers, and result in discussion that is more suggestive than summative or conclusive.

A discussion of limitations and validity issues follows the observation section below.

3.5.3.4 Observation.
According to Vogt et al. (2012), naturalistic observation is particularly suited to developing rich descriptions of a context, exploring social processes and identifying new variables (as opposed to measuring established ones). The “rich descriptions of the contexts” (Anderson & Shattock, 2012, p. 22) in which a designed intervention is situated, have been developed in this design-based research investigation through a nonparticipant observer (Creswell, 2012) method. In particular, the embedded mixed methods design calls for the unobtrusive collection of observational contextual data during an experiment in order to provide supplementary information – beyond what participants say they do (Johnson & Turner, 2003) – about their actions and interactions while using the argument mapping software.

The technique of combining qualitative observation that is “exploratory and open-ended” (Johnson & Turner, 2003, p. 313) with questionnaires and/or interviews is widely reported in the mixed methods literature. Johnson and Turner (2003) for example, report research by Eisenberg in which observational measures were related to questionnaire data as part of a longitudinal study. Similarly, Dordick’s
research into homelessness employed both observation to pick up on practical challenges, and then the incorporation of these researcher insights into interviews which were therefore more responsive to the experiences of the participants, and more likely to “provide a relatively complete view” (Johnson & Turner, 2003, p. 314) of the phenomenon.

3.5.3.5 Data collection.

In total each treatment class was formally observed twice, once at the approximate mid-point of the process and once near the end. The 14 observations were recorded on an observation protocol (see Appendix 7 for an example) in which the combination of descriptive and reflective field notes (Creswell, 2012; Patton, 2002) were organised. As the researcher I was familiar to students from the earlier project introduction and questionnaire stage. I had also assisted some classes to log in and set up accounts for the treatment programs. During formal observations, however, I remained at the back of the classroom or observed (and audio-recorded, with permission) various teacher-student and student-student interactions. There are clearly limitations to this last technique, with students possibly less than completely themselves, however I believe that because of my sustained involvement with the classes, the students (and teacher) were used to my “ongoing nonthreatening presence” (Johnson & Turner, 2003, p. 314). Certainly, as my field notes make clear, some students did not refrain from playing games on their computers when their teacher was not watching, even though they knew I could see their ‘misbehaviour’ from my vantage point.

3.5.3.6 Data analysis.

Following the intervention, field notes were processed in the same cycle of open and axial coding described for the interviews above. Themes developed from observational data include:

- The practical processes of working with the software
- Interactions between students while working with the software
- The lesson designs employed by teachers
- Interactions between teacher and students while working with the software
3.5.3.7 Validity and limitations of qualitative methods.
According to Patton (2002), interviews allow the researcher to explore the feelings behind observed behaviour, while on the other hand observations “provide a check on what is reported in interviews” (p. 306). In this way the mixed methods approach allows for the weaknesses of interviews – reactive and investigator effects for example – and the weaknesses of observation – observer effects and the focus on external behaviour for example – to be balanced by the respective strengths of both qualitative and quantitative methods.

This overlapping of the strengths of both methods is a key aspect of the qualitative validity of this investigation. The accuracy, in the pragmatic sense applied by commentators such as Johnson and Turner (2003) for example, is heightened by the use of multiple sources and resources to minimise the “weaknesses of any single approach” (Patton, 2002, p. 307). Furthermore, to address Maxwell’s (1996) three validity types - descriptive, interpretive and theoretical validity – for qualitative research, I have taken the following steps.

Interview transcripts and summaries of key findings have been member-checked with all participating teachers and a sub-group of participating students. The use of complementary data drawn from several sources and using different methods has been discussed previously. Negative case analysis or “disconfirming evidence” (Creswell & Plano Clark, 2011, p. 212) is presented through the Findings chapters. Data has been peer and supervisor reviewed at multiple points in the collection and analysis process; a data bank including all coded interviews and observations has been created. Researcher reflexivity supported by the use of a fieldwork journal is documented as an integral part of this investigation. Finally, the extended fieldwork required by the design-based research approach, in which the researcher spent almost half an academic year at each site (from the beginnings of professional development to the completion of interviews) allows for both “persistent observation” in the two schools and the “thick description” (Johnson & Turner, 2003, p. 300) employed in the Findings chapters.
3.6 Trustworthiness and Generalisability

The mixed methods field deploys fittingly pragmatic definitions of valid research centring on notions such as plausibility and defensibility. In Lincoln and Guba’s (1985) work, the sense that a researcher needs to persuade the audience that findings “are worth paying attention to” (p. 290) is at the centre of the idea of trustworthiness. While initially a pragmatic solution in the qualitative field to avoid the futility of debates around objectivity and subjectivity (Patton, 2002), the application of trustworthiness criteria to mixed methods research is now an accepted and perhaps required move (Johnson & Turner, 2003).

Of the eight verification strategies suggested by Lincoln and Guba (1985), this investigation utilised, firstly, persistent observation over a prolonged engagement in order to develop rich and plausible understandings the classroom cultures involved. Secondly, the potential of questionnaires, interviews, and observation to provide rich, thick description has been established. Thirdly, member checking and peer review, utilising both university and co–designing teachers, is a vital aspect of the participatory nature of DBR and has been used throughout this project. Finally, triangulation is evident in the multiple collection methods, data types and theoretical perspectives utilised and under examination as part of the self-reflexive process. This investigation involves the “systematic triangulation of perspectives” (Flick, 2009, p. 50), not just a combination of different kinds of data, but a purposeful inter-relation so that threats to validity can be counteracted.

In order to explore this inter-relation and summarise trustworthiness criteria, I would like to return briefly to the methodological approach and then the discussion from within the mixed methods field around the strengths and weaknesses of data combination strategies that I have employed.

3.6.1 Anne Brown and design science.

In her seminal work in the field, Brown (1992) sets out a powerful argument for the trustworthiness (although she does not use that word) of “complex intervention studies” (p. 152). For her, realism depends on the trade-off between experimental control and the richness of the field that comes from the move from the lab to the classroom. In developing a nomothetic focus, I am thus able to develop general principles that are plausible from the manipulation of a single variable – digital
argument mapping – across multiple subjects. This “microgenetic” (p. 156) approach is focused on observing students closely over a short period of time as “they acquire a certain form of understanding” (p. 156). Brown then recommends the combination of this data with larger scale quantitative data as part of her preference for a mixed methods design. "Our routine practice is to take fairly traditional pre-test and post-test data from all the experimental and control students and combine that with in-depth analyses of some of the students” (p. 156). For Brown, in situ or naturalistic studies are inherently multiply confounded, but clear “evidence of the effectiveness of the intervention” (p. 157) which can also be easily shared, is developed from this combination of control data with tests.

In response to Brown’s discussion of threats to trustworthiness, my report on this investigation undertakes firstly to honestly report the gold to dross ratio. In order to combat this “Bartlett Effect” (as discussed in Brown, 1992, p. 162) the Findings chapters (Chapters 4, 5 and 6) clearly set out the tension between the selective and potentially exhilarating, but not necessarily representative, and the general, reliable and repeatable.

Secondly this investigation takes a realistic approach to the degree to which interventions are “readily transportable to settings outside the innovator’s control” (Brown, 1992, p. 171). The all-too-common cycle of exhilaration, followed by scientific acceptance, then disappointment and blame that Brown identifies, is addressed in this investigation by the treatment of confounding variables. The aim in design-based research (DBR) is not to attempt the impossible job of unconfounding all variables in such complex school settings, but to describe carefully their effects so that “the necessary and sufficient aspects of the intervention can be disseminated” (p. 173). Brown’s focus becomes the identification of the absolutely essential elements without which there is no reasonable hope of change under normal school conditions. Careful documentation of the planned and enacted design and the changes over the stages of intervention is therefore critical to the validity and reliability of the research (Wang & Hannafin, 2005).

In summary, the DBR field builds on Brown’s work to suggest that the internal and external validity of the experimental components of the research are based on the rigorous group design, including adjustment for variables and the inclusion of
control groups to ensure statistical validity. For the ethnographic components, DBR is focused on scalability, a commonly used synonym within the field for external validity. Here it is the combination of quantitative data relating to design principles, with rich description of the context and intervention procedures that leads to the possibility of application of outcomes to analogous settings (Steketee & Bate, 2013). The determination of relevance and applicability of study results to one’s own context is therefore based on the way that design principles are framed by substantive and accurate procedural knowledge.

3.6.2 Generalisability.

In the DBR literature, the terms generalisability, scalability, repeatability, replicability, transportability and applicability are used as synonyms to describe the extent to which a context-specific intervention can be practically useful to practitioners in other settings.

According to Dede (2004), the key challenge of DBR is to meaningfully scale up educational innovations so that educational practice in general can benefit from the relevance achieved through the pragmatic focus on actual classroom settings. The value of DBR is measured not only by its potential to improve educational practice (Design-Based Research Collective, 2003), but also by its potential to be transformative; “not to teach reading, but to build readers” (Kelly et al., 2008, p. 12). According to Barab and Squire (2004) this means that “theoretical constructs must transcend the environmental particulars of the context” (p. 5); the aims of this investigation therefore straddle both an improved understanding of how to orchestrate the innovative learning of argumentative writing in the educational settings in which the research takes place, and also the development of new insights about the nature of learning, writing, argumentation and technology that are "readily transportable to settings outside the innovator's control" (Brown, 1992, p. 171).

While these objectives are laudable, there is no doubt that relevance benefits have costs associated with generalisability: design-based research results are only tentatively generalized because of intimate links to local contexts. In order to strengthen claims to replicability DBR orients itself toward systemic validity: the extent to which “the research and the inferences drawn from it inform the questions that motivated the research in the first place… To achieve true systemic validity as
educational researchers, our studies must inform our theories, which must inform practice" (Hoadley, 2004, p. 205). To this end, this investigation has been designed and implemented with the following DBR approaches to generalisability.

3.6.3 **Documentation.**

The importance of record-keeping, rigorous documentation and the recording of multiple data types is repeatedly stressed in the DBR literature (see for example Cobb et al., 2003). This is due largely to the way that the 'problem' of context is treated as essential; as we have seen DBR acknowledges the difficulty of controlling variables and assuming that the outcomes are generalisable in educational research. DBR "views outcomes as the culmination of the interaction between designed interventions, human psychology, personal histories or experiences, and local contexts" (Hoadley, 2004, p. 204). These variables affect the outcomes which, significantly, are then seen as enacted outcomes rather than the designed ones. The intervention may not go according to plan: the enacted intervention is therefore a dependent, not an independent variable. Careful documentation of the planned design and the changes over the stages of intervention is therefore critical to the validity and reliability of the research (Wang & Hannafin, 2005). Chapter 4, the research design, aims to fulfil this requirement.

3.6.4 **Quasi-experimental design.**

Internal and external validity of the experimental components of the research are based on the rigorous group design, including adjustments for extraneous variables and the inclusion of control groups to ensure statistical validity. It is the combination of quantitative data relating to design principles, with rich description of the context and intervention procedures that leads to the possibility of application of outcomes to analogous settings (Steketee & Bate, 2013).

3.6.5 **The learning trajectory.**

The conception of a classroom as a collection of independent variables that can be manipulated or measured by the researcher is inadequate. The learning trajectory (Bielaczyc, 2013) refers to the way DBR documents the tools which are actually used, not just their absence or presence. Meaning is created as teachers and students interact with each other and technology, and bring to bear discourses and norms specific to their learning space. The learning trajectory therefore involves a clear delineation of the features of the context that are necessary rather than contingent in
developing the skills that are under investigation. Generalisability therefore does not require strict fidelity to an intended research design. DBR accepts and welcomes the adjustments made by professional participant teachers as they enact the intervention in their complex classrooms. It is a well-documented learning trajectory which can guide other practitioners in their use of argument mapping software and its possible applications to student writing.

3.6.6 Sampling.
DBR depends on careful sampling. In this investigation, typical case sampling resulted in the choice of two schools, and within them a range of ability groupings across Years 9 and 10, that strengthen claims that these settings are representative of both provincial and urban comprehensive secondary schools.

Finally, in DBR methodology validity is strengthened, according to Hoadley (2004), by encouraging the same person to engage the theory, implement design, and measure outcomes. This is seen to ensure the validity of theory and a tighter fit between treatments and the “theory-interpreted conditions they were standing in for” (p205). Thankfully, this concentration of jobs is one of the few inherent benefits of conducting DBR methodology as a sole Ph.D. researcher!

3.6.7 The validity of the mixed methods approach to data.
According to Teddlie and Tashakkori (2009) the mixed methods approach improves the quality of inferences that can be drawn from the existing research paradigms. In this investigation data sets are first analysed independently and used to answer separate aspects of the research questions. Data are then consolidated to construct new variables such as attitudes to working independently on computers which are drawn from both interview and questionnaire data. Data from different sources are compared and then integrated to form a coherent narrative in the Findings chapters (Teddle & Tashakkori, 2009).

The complementary strength of broad questionnaire data on attitudes to working independently balances out the weakness of interview data in being rich but selective. It is this strategic combination that is the main strength of mixed methods research (Johnson & Christensen, 2013) and its most powerful argument for trustworthiness. The possibility of cause and effect relationships suggested by my quasi experiment for example (a strong measure for internal validity) require
corroboration from survey and interview data in order to make up for deficiencies in the external validity of this kind of data.

Validity in mixed methods research is thus related to stages in the process of the research, especially in the separate stages of data collection, analysis and interpretation. Using Creswell and Plano Clark’s (2011) summary of potential threats, I have outlined here the strategies employed in this investigation to enhance the trustworthiness of conclusions.

- Data is comparable since quantitative and qualitative samples are drawn from the same population.
- Potential bias from one data collection method to another is avoided by using separate collection procedures.
- Quantitative and qualitative data is used to address the same research problem.
- Illogical comparisons are avoided by finding interview quotes that match statistical results from the questionnaires.
- Distributions of all scores are examined.
- The same individuals are followed across questionnaire, writing and interview data.
- New instruments have been rigorously developed and tested.
- The constant comparative method is used with qualitative data in order to maintain both a grounded approach and connect data to the overarching research problem.

### 3.7 Limitations of the methodology

As previously stated, design-based research is usually conceived of and enacted as a complex and long term process. Perhaps the key limitation of the present investigation is that it is unable to fully take on the multiple phase or iterative nature of most design research. As such the results are best viewed as a snapshot
that provides a delimited discussion of a specific stage of the process and which could be used to develop further research questions and design interventions.

In some ways one term’s intervention can be viewed as prolonged engagement; in other ways it is difficult to judge the impact of an intervention in that time space. Teachers from both schools have demonstrated an interest in longitudinal studies that could measure the influence of skills and attitudes developed as part of this investigation, particularly as students move into the senior years of schooling where engaged essay-writing is the key to higher achievement.

The shift that Brown (1992) initially made from decontextualized tests of learning to socially contextualised design experiments opens up new opportunities for educational research. It also opens up a Pandora’s box of confounding variables all agitating for researcher attention in the typical classroom. Loudest of them all, in this investigation, is the school-wide focus on paragraph structure evident in both research settings. Interviews made clear that most teachers and students see these structures as useful, and that the long-term process of embedding the approach has taken root in both schools. Statistically significant main effects on argumentative writing, therefore, may be due to some degree to this approach. Attitudes from students, in particular, to the paragraph templates, are complex and the Findings chapters attempt to disentangle the types of gains attributable to this technique. In addition, the fact that this approach is a long term factor, evenly distributed to all school classes, and focused on a different teaching philosophy, will help to unconfound it as a variable.

Finally, the researcher-teacher co-design phase of this investigation was necessarily truncated. In a larger scale project with more time and money for professional development, a higher degree of communal discussion, workshopping and unit development would have been possible. In this instance, much was achieved in the time that we had, and a model developed that can act as a solid foundation for internal and external validity, but what is possible over approximately two days cannot compare with the six-month timespan often described in full scale DBR projects. Fortunately, as I will argue, teachers implemented this design in a way that is realistic in terms of the usual professional development timeframe for practising teachers. Hence the results and recommendations are also more likely to bear the
Chapter 3 – Methodology

mark of authenticity perhaps missing from interventions that have the benefit of a longer but unrealistic development timeframe.

3.8 Summary

This investigation takes as its focal point the need to engage with both theory and classroom practice in the area of writing instruction. The claims that writing approaches and the proponents of educational technologies make about the challenges and opportunities for engaged and effective writing in school settings are deserving of scrutiny. They need to be tested in real world contexts, and should be explored with the participants – both students and teachers – who interact with each other and technology in those learning environments.

It is, above all, for these reasons that a design-based research approach was adopted. With its invitation to explore existing theories by constructing classroom interventions that then contribute to practice and pedagogy, this approach was taken in order to frame an intervention into high school writing classes. The digital argument mapping program, the artefact, was considered to be one element in a learning environment. In order to assess its impact in a realistic way, the software was then considered to be the central element in an embedded mixed methods methodology.

This chapter has outlined the four key methods that were utilised as part of that research design: a pre-intervention questionnaire; writing pre- and post-tests; classroom observations; and semi-structured interviews. Data collection and analysis procedures, as well as issues related to validity and trustworthiness have been considered in order to suggest opportunities for – as well as the limitations of – the generalizability of this intervention. Design-based research is less interested in whether something worked than in what it would take to make something work as and where it is needed. Hence the methodology introduced here is intended to synthesize quantitative and qualitative data in order to present findings and analyses that would be of use to educators in their aspirations to make technological innovations work to support effective student writing.
Chapter 4 – The Enacted Research Design

This chapter outlines the digital argument mapping intervention which sits at the heart of this investigation. The intervention is a catalyst for quantitative and qualitative data collection within the framework of a design-based research methodology. As such, trustworthiness and replicability depend on the careful documentation of the enacted design. This chapter situates the research within the DBR feasibility type study introduced in the methodologies chapter, and then explores each element of the research process as it took place in the school settings.

4.1 Introduction

This investigation has been designed as a three phase design-based research feasibility type study outlined by Middleton et al. (2008). This DBR frame acts as an umbrella for the embedded mixed methods methodology built around a classroom intervention involving digital argument mapping.

In order to document the enacted intervention and its relationship to the intended design, the three phases are used as a guide to the process undertaken by researcher, co-designers and participants. The first phase, the design of the intervention based on theory, has been outlined in the literature review. In short, the argument mapping program was chosen as the focal point of the intervention for three main reasons. One, the communicative nature of argument has been identified as a potential response to the ineffective and disengaged nature of much high school argumentative writing. Second, research suggesting the benefits of learning-to-argue and arguing-to-learn needs to be tested in actual high schools settings oriented towards typical issues-based English topics which end in a piece of writing or textual production. Third, digital argument mapping would appear to address several key theoretical and pedagogical needs of the writing instruction field: mapping as an element in a process writing planning stage, mapping as creating a shared space and representation for collaboration and dialogue, and specifically digital mapping as a scaffolding technology that fits uneasily into the multiliteracies conception of where digital text production in classrooms should be heading.
Table 4.1 The enacted research process

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<th>Term 1</th>
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<td>Ethics</td>
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<td>Artefact preparation</td>
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<td>Pilot study</td>
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<td>Pre-test writing</td>
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<td>Post-test writing</td>
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<td>Interviews</td>
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<td>Data analysis</td>
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The entire process, from ‘Units co-designed’ onwards was repeated over terms 3 - 4 at the second school setting.

The second and third phases, the design of the artefact and a feasibility study to formatively evaluate the intervention\(^\text{12}\), are described in the following sections and outlined in figure 1, above. In this investigation these phases involved a largely chronological movement from planning the intervention to its implementation in the research settings. This involved: preparation of the settings, ethics submission, pilot study, preparation of the technology artefact, co-design of units of work, cycles of design and analysis with participant teachers, introduction of the project to students, administration of initial questionnaires and writing pre-tests, extensive classroom observations, administration of writing post-tests, interviews and data analysis.

\(^{12}\) From this point in this dissertation, the term ‘intervention’ is used generally to refer to that aspect of the design-based research investigation that involved planning for and implementing the digital argument mapping in the school settings. The term ‘treatment’, especially in the sense of ‘treatment classes’ is used to distinguish those classes that used the digital mapping program from the control classes that did not – but were still part of the intervention.
4.2 The Design of the Intervention\textsuperscript{13}

As opposed to the fixed procedures of experimental research from which it is
descended, design research starts "with planned procedures and materials, which
are not completely defined, and which are revised depending on their success in
practice" (Collins et al., 2004, p. 20). In conjunction with its co-design aspect, this
design flexibility means that there is an important distinction between intended and
enacted design. As part of validity strengthening measures this flexibility must be
strictly documented. Moreover, while the aim of this documentation is partly to
assess the outcomes of the intervention, DBR extends this shared aspect with
evaluation research\textsuperscript{14} to see

"successful innovation as a joint product of the designed intervention and
the context… The value of attending to context is not simply that it
produces a better understanding of the intervention, but also that it can
lead to improved theoretical accounts of teaching and learning.” (Design-

4.2.1 Research settings.

This investigation was conducted at two comprehensive (Years 7-12) high schools
on the mid north coast of the state of New South Wales (NSW), Australia.

\textsuperscript{13} Despite the use of the term ‘Artefact’ here in the DBR literature, I have altered the phrasing after Examiner advice.
Artefact can be an ambiguous term in this context as it can be used both to reduce a learning environment to a problem
concerning an educational ‘tool’, or to expand such discussion to encompass the range of environmental features at
play around the educational use of a ‘tool’ for learning.

\textsuperscript{14} Research "conducted to determine the value or impact of a policy… with a view to making recommendations for
change” (Clarke, 1999, p. vi).
4.2.1.1 School A.
Regional City High School (RCHS)\textsuperscript{15} has an enrolment of 990 students and is the oldest of four government and two private high schools in a regional city of over 70000 people. The school socio-economic status (SES) figure, or ICSEA rating, of 977 places it just below the national average of 1000 (Myschool, 2014). The distribution of students according to the Australian Bureau of Statistics (n.d.-b) socio-economic data, is at the national average for the middle quartiles but below in the top quartile (12% compared to the national distribution of 25%) and above in the bottom quartile (36% to 25%). RCHS is located at the geographical heart of a city whose population has an average wage of $40300 (National average equals $58000). 71% of residents report having the internet at home (79%), 7% identify as

\textsuperscript{15} As required by the ethics application for this project (see Section 4.2.2) all research settings, towns and schools, as well as participating teachers and students, have been de-identified by the use of generic codes such as this.
indigenous (3%) and 10% report a language other than English being spoken at home (15.6%) (Australian Bureau of Statistics, n.d.-b).

A snapshot of literacy for RCHS is taken from the National Assessment Plan, Literacy and Numeracy (NAPLAN) figures for 2013 (ACARA, 2013), the year at which most student participants in the study were last assessed. The mean results for Year 9 reading were positioned in the top quartile of band 7 which is at the average for statistically similar schools, and at the level described as “at the national minimum standard” (ACARA, 2013, p. 205). Year 9 persuasive writing, on the other hand, had a mean in mid band 6, placing the school below the average of statistically similar schools, and the national minimum standard.

4.2.1.2 School B.

Provincial Town High School (PTHS) has an enrolment of 626, and is the only high school in a town of approximately 3000 residents. The school ICSEA rating, of 939, places it significantly below the national average of 1000 (Myschool, 2014). The socio-economic distribution of students (Australian Bureau of Statistics, n.d.-a) is significantly below the national average in the top quartile (5% to national average of 25%) just below national average in the middle quartiles, and significantly above average in the bottom quartile (48% to 25%). At the time this research was conducted PTHS was receiving National Partnerships funding as a low SES school. PTHS is a key community institution in a town located 58 km from the nearest regional city. Its population has an average wage of $37402. 63% of residents report having the internet at home, 13% identify as indigenous and 2% report a language other than English being spoken at home (Australian Bureau of Statistics, n.d.-b).

The mean results for Year 9 reading from the 2013 NAPLAN data were positioned in the middle of band 7 which is slightly above the average for statistically similar schools, and at the level described as “at the national minimum standard” (ACARA, 2013, p. 205). Year 9 persuasive writing, on the other hand, had a mean in the bottom quartile of band 6, placing the school below the average of statistically similar schools and behind the Australian mean represented by the national minimum standard (Myschool, 2014).
4.2.1.3 Discussion.
These two schools are broadly representative of the two types of non-urban provincial\textsuperscript{16} – as opposed to remote – school in NSW. RCHS is culturally and academically diverse with a broad mixture of streamed higher and mixed ability classes that are a key component in this research design. The school is currently held in high esteem by the city, an impression reflected in the high demand for places. The regional city in which it is located is a tourist centre with a growing population serviced by a base hospital and a university campus.

PHTS is culturally homogenous, outside its significant indigenous population. Its small town community character is suggested in the way its facilities are utilised by a range of local organisations, and in the way it is one of the key community hub institutions in the town. Its location in a Local Government Area (LGA) with a nationally significant low SES rating (Australian Bureau of Statistics, n.d.-a) explains the extra funding commitment from the national government, but should not obscure the existence of a range of academic ability, including a high streamed ‘opportunity class’ in some year groups.

The challenges to literacy teaching for both schools that are suggested by the data are similar to other regional and indeed urban schools. Both of the study schools have responded over recent years with whole school programs focusing on paragraph structure which usually take the form of a template represented by an acronym such as WHY (What – How – Why) or PEEL (Point – Elaboration – Example – Link). The significance of this teaching history is described in the Intervention section of this chapter, and discussed in the methods and findings sections as it is a key potential confounding variable in the research design.

While the characteristics of these research settings align most evidently with other regional schools, there are enough features of the student body and the way it is streamed and taught, to make comparisons appropriate with urban schools, and in particular, suburban comprehensive high schools with diverse populations.

4.2.2 Ethics.
Ethics approval for this project was received from the university in February of the intervention year, and from the New South Wales Department of Education and

\textsuperscript{16} The term provincial is used by the NSW Department of Education and Communities, where perhaps ‘regional’ might be the colloquial variant.
Communities in May of that year. This investigation was approved as presenting minimal risk to participants in respects to both experimental treatment and psychological harm. The following processes were put into place to maintain participant safety and confidentiality:

- Questionnaire and interview topics were non-controversial, non-personal and non-intrusive.
- Observations were in public situations only and focused on non-sensitive issues
- Inclusion in all intervention phases, especially interviews and observations was voluntary, and participants understood that they could withdraw from the project at any time
- All data was de-identified and then held in secure storage at the university
- While there were students from vulnerable groups in the treatment classes, the topics under investigation do not touch in any way on the personal backgrounds of these students.

The introduction letter to students outlining the project and seeking their participation is included as Appendix 1. The student consent form is included as part of this appendix.

4.2.3 The pilot study.

Student questionnaires, the writing rubric for the pre- and post-test of student essay-writing and the program were all piloted in a comparable school setting prior to the intervention stage of the investigation\(^\text{17}\). Data from these pilots was not included in the analysis. However, the following adjustments were made as a result of this process:

- The argument mapping program was switched from Digalo, the proposed intervention program that had been developed as part of the EC-funded DUNES project (see for example Schwarz & De Groot, 2007), when it was discovered that installation on State school computer systems was impossible due to technical issues. Draw.io and Rationale, both web-based and requiring no installation on school hardware were trialled successfully in classroom settings.

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\(^\text{17}\) With permission from the Principal, the researcher’s own school was used as the pilot setting.
• The wording of four questions in the student questionnaire was simplified as a result of student and teacher feedback that identified confusing or needlessly overlapping information.

• One of eight elements from the writing rubric was dropped after teacher feedback that it was not clearly distinguishable from one of the other elements.

4.2.4 The program used in the Intervention.
As we have seen in the literature review of Chapter 2, both Activity Theory and a Critical Theory of Technology emphasize that technology use is always situated, always sociocultural. As such it is not useful to discuss an electronic program, app or artefact as a disembodied tool. While the treatment or independent variable in this investigation is the argument mapping program, it is a key contention of this study that this technology can only be understood in its enactment by particular teachers with particular instructional goals, styles and techniques, working in complex classroom settings with particular students, norms and behaviours in play. These contextual factors and the way they played out during the intervention are discussed in the following sections. Here I will describe the programs involved in the investigation.
4.2.4.1 **Draw.io**

*Draw.io* is a freely available app licenced by JGraph Ltd. By clicking and dragging shapes from a side bar into the central workspace, users are able to construct diagrams of many kinds. These include flowcharts, mind maps and pictograms. By double-clicking inside a shape users are able to add text, while arrows and other connecting shapes can be manipulated within the workspace to construct and manipulate a variety of visual representations. Students can save their diagrams via Google Drive, Dropbox or onto their server. These saving options then open up the possibility of sharing maps and working collaboratively on them. Figure 4.2 is a screenshot of a student constructed argument map made with *Draw.io*. Illustrated are the ways in which shapes have been used to represent different aspects of the hierarchy of argument: the thesis, reasons or premises, then supporting evidence. All of these are held together in the distinctive argument map inverted tree diagram. Arrow types, colours and directions as well as shape types allow for a complex
visual language to be jointly developed by students and teachers. In figure 4.2, for example, the red arrow signifies an opposing view, while the cloud bubble contains a direct quote from the text used as supporting evidence.

4.2.4.2 Rationale Online.
Rationale Online is commercially held program originally developed from the research of Tim van Gelder (2003) and colleagues at the University of Melbourne. It is now distributed by Critical Thinking Skills BV, a Dutch educational company. While the full version of Rationale is only available via a paid individual account or institutional site license, the organisation supports trials and research.

A limited number of user accounts were made available for this project on the understanding that it was for Ph.D. purposes and that results of the investigation would be reported without bias through the usual academic channels. Rationale’s argument maps are constructed on the same logic and through the same processes as Draw.io. They too can be saved and shared. In addition, with Rationale it is possible to click and drag an argument scaffold into the workspace and then fill boxes that include an alternative or opposing argument. Of course it is possible to do this manually on either program. Rationale, however, provides an additional feature where the argument created in the scaffold is automatically filled into an essay template in a right-hand panel. This pre-fabricated essay can then be exported, to Microsoft Word for example, and developed from there by the student. Figure 4.3 is a screenshot of a student-developed argument map using Rationale. Illustrated is the argument template with the automatically developing essay at right.
4.2.4.3 Discussion.

There is a variety of graphics, diagramming or mapping tools available on the internet. The two used as the treatment in this investigation are analogous to each other and the many others. Differences, which include pricing, system requirements and appearance are considered to be irrelevant for the purposes of this study. While Rationale is a dedicated argument mapping program which allows pre-designed argument templates to be utilised by students, the participants using Draw.io were able to reconstruct such features ‘manually’ with ease. It is thus possible to conclude that for the purposes of this study the two programs were used in very similar ways and that the findings are relevant to all variants available to students and schools. The two investigated in this study were chosen for the following logistical reasons:

- Two programs were necessary as (a) Draw.io was found to work better on the networked PCs in computer labs while Rationale was more stable on the Digital Education Revolution (DER) laptops, and (b) only a limited number – appropriate for three of the seven treatment classes – of user accounts were available in Rationale.
• As they are both web-based, neither program needed to be installed onto the restricted Department of Education and Communities (DEC) system.

• While there were several hardware-specific technological problems that affected the study (see Section 4.5.1 below) these two programs were found to be relatively stable on the system after a process of pilot testing alternatives.

• Both of these alternatives provided the potential for students to share their argument maps.

While *Rationale* does provide the essay template feature that is not found on *Draw.io*, the students’ and teachers’ use of and impressions of this feature are carefully documented in the description of process below, and during the Discussion chapters of this report.

### 4.2.5 Researcher role.

The documentation of the activities of the researcher during the intervention is vital for both the potential of generalisability and trustworthiness. The researcher was involved in the intervention in the following ways:

• An initial professional development capacity in order to introduce concepts and tools.

• An ongoing professional support role, especially during the first few weeks, focused on advising teachers on how best to weave argumentation into their existing units of work.

• An initial technical support role focused on ensuring the smooth operation of the program on school computers. I was present in this capacity, as invited by the teachers, to assist with account creation and log in procedures on most classes’ first uses of the program.

• A formal observation role during the latter stages of the intervention where I observed each treatment class twice. Although the ethics approval permitted it, I opted against videoing but I did make audio recordings of teacher-student and

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18 While power dynamics between researcher and participating teachers can impact on the DBR process, this intervention was couched form the beginning as a fellow professional exploring a problem rather than an expert instructing or testing teachers. The extent to which this framing was successful can only be speculative, but the collegial atmosphere was positive in both research settings and participant teachers certainly felt confident to discuss concepts and practices and then adapt to their own teaching styles.
student-student discussions while working on the program. My passive ‘fly-on-the-wall’ status was made clear to all students during the project introduction, and was successful judging by the way I was ignored by those students who knew I was aware of them playing video games when the class teacher was occupied! Students had been told that I was a teacher, but that I was present only in a research role. The investigation was presented to students as a chance to improve their writing skills and help other teachers and students via the dissemination of results. Aside from the interviews I had no formal or informal contact with students.

• A note on researcher background and impartiality. Prior to commencing my PhD studies I was working in the same region as the teachers involved in this study, although I had never worked in either research setting school. One participating teacher had briefly been a colleague at my school four years prior to this study. I therefore had professional relationships with some participating staff through occasional collegial professional learning events, but not of a close personal nature. These relations perhaps smoothed my initial approach to the schools19, but were not a factor in the ongoing investigation; all communication is documented and supports the notion that the participants behaved as naturally as possible through the process.

As a practising teacher I have clearly had practical classroom experience with all the key elements under investigation: essay-writing, student collaboration, educational technology. I had had no experience of argumentation or argument mapping. This Ph.D. was undertaken not to test a particular approach but because of my generalised concerns that writing instruction at this age was problematic, and the response through educational technology under-explored in practical classroom ways. Hence I began this investigation with doubts and concerns that would have impacted on impartiality but no particular axe to grind. I wanted to explore the pedagogical issues connected to these elements, not prove any particular theory or product as ‘right’.

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19 I initially approached every State school in my district, bar my own, via letter to Principal and Head Teacher English. From this pool of eight, initial discussions took place with the six who replied. Of these an initial two were chosen for logistical reasons: numbers of available students, class structures and the nature of units being taught to the target age groups. One school setting was later changed due to staff movement causing disruption unrelated to this project. This change to a back-up school explains the staggered nature of the intervention as it was too late to set up for the chosen term and had to be postponed at the new school until the following term.
4.2.6 **Researcher and participant-teacher co-design.**

A successful partnership between researcher and practitioner is a key tenet of design-based research. The aims behind this strategy include both the strengthening of validity (Design-Based Research Collective, 2003) and the desire to increase the plausibility of scaling up educational innovations. According to Dede (2004), DBR seeks a productive middle ground between overly context specific teacher-driven problems, and “theoretically promising interventions” (p. 113) whose scale makes them dauntingly removed from actual teaching contexts.

Cobb and Gravemeijer (2008) label this aspect of DBR “Preparing the Experiment” (p. 69) and identify four aspects necessary for a careful researcher documentation of the co-design process:

1. Clarify instructional goals. This Ph. D. investigation was presented to both sets of English staff as an attempt to develop more effective practices in the teaching of non-fiction writing. Appendix 2 includes a snapshot of Powerpoint slides used to introduce the project to participating teachers. The initial half-day professional development session then extended to a presentation of argumentation theory and an introduction to digital argument mapping. The following goals were developed by the researcher and participating teachers:

   - To investigate whether digital argument mapping program could improve student essay writing.
   - To investigate student impressions of working in this type of educational technology environment.

2. Delineate an envisioned learning trajectory. Participating teachers were encouraged to weave theory and practice into existing units of work and to adapt as necessary for their particular classes. Individual differences of lesson design and their implications are presented in subsequent sections and discussed throughout this dissertation. Overall, however, every participating teacher maintained the following design features:

   - An extended period of topic development prior to argumentation work. Each participating teacher maintained the focus on the existing unit of work for that

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20 Note change of dissertation title from this early stage, and change of digital program to be used. At this stage I had had discussions with the developers of ‘Digalo’ but subsequent technical testing in State schools revealed that installation of the software required to run that program would not be possible.
Figure 4.4 Overview of Typical Student Experience of 10-week Intervention

<table>
<thead>
<tr>
<th>Week</th>
<th>Instruments</th>
<th>Teaching and learning activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Project introduction and Questionnaire</td>
<td>Content and concept focus.</td>
</tr>
<tr>
<td></td>
<td>Writing pre-test</td>
<td>Introduction to argument mapping</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Orientation to argumentation.</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Introduction to DAM</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Introduction to DAM</td>
</tr>
<tr>
<td>5</td>
<td>Observation</td>
<td>Use DAM to develop critical thinking.</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td>Use DAM to prepare for essay Writing task.</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Observation</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Interviews</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Writing post-test</td>
<td></td>
</tr>
</tbody>
</table>

class. These were thematic units based on conflict, power or ambition in *Macbeth*, *Romeo and Juliet* and *Of Mice and Men*. Co-design led to the decision that argumentation terminology would be gradually introduced over the reading and concept discussion stage of each unit. See Figure 4.4 (above) for timeline and frequency.

- The development of a shared argumentation language including the terms contention, evidence, supporting and opposing viewpoints. Over the initial three week unit development stage these were explicitly taught to students then woven into class discussion as relevant so that they became a classroom norm.

- An extended period, over three to four weeks, of sessions with the program developing argument maps, interwoven with continuing classwork on the topic. Argument mapping was introduced to all classes on paper first. Classes used both existing topics to practice, for example the ethics of healthy canteen food (see figure 4.3) or discussion points from their developing understanding of the texts under study, for example Juliet’s parents’ role in the unfolding tragedy. During week 5 these ‘practice’ maps were used to introduce the digital argument mapping over two preliminary sessions. Over the ensuing five weeks each class had two sessions per week using the digital argument maps to develop their thinking and eventually essay plans.
• The discussion of developed argument maps as part of a process writing approach to the essay assessment task due at the end of the unit. Students were given the essay question for their final task two weeks before the due date. They were aware that this task would be used for normal in-school assessment and reporting purposes, as well as for this research. See Appendix 10 for task sheets, noting that essay questions were not identical but of very similar nature. All post-writing tasks were completed in-class under supervision over one 50 minute period with no access to supporting material, including the argument maps they had developed.

• The inclusion of argumentation and digital argument mapping as a basis for activities, for example developing an engagement with the topic, beyond merely preparing students for their assessment task.

3. Document the instructional starting points. There are three aspects of participating teachers’ and students’ experiences and framing in their respective school cultures that warrant explanation here:

• Participating Year 9 students were writing their first formally assessed essays in the pre and post-writing phases of this investigation. Year 10 students in both schools were involved in year-long programs focused on essay writing that emphasized both genre and process writing approaches.

• All students had been part of long term, systematic and whole-school strategies focused on paragraph structure. At RCHS this involves the WHY template for scaffolding a body paragraph into three sections; the W (what) which sets out the topic, the H (how) which supports this statement with textual evidence, and the Y (why) which explores the significance and links back to the overall question and thesis statement. At PTHS, the acronym PEEL (Point-Elaboration-Example-Link) performs the same function.

• Both schools have an ethos of high academic expectation and attainment at the higher ability range. Both schools have a long tail of academic underachievement in their mixed ability classes (NAPLAN, 2013). The pre-intervention questionnaires provide a rich source of data about attitudes to writing, use of technology and feelings about learning that can be used to document not just typical skills in these two learning contexts but “the
consequences of [students’] prior instructional histories” (Cobb & Gravemeijer, 2008, p. 69) that characterise the participants. This data is used extensively to develop and explore conclusions in the Findings chapters.

4. Place experiment in theoretical context. This has been explored in preceding sections. Professional development discussions with the participating teachers led to the following as theoretical orientations:

- Pedagogy around the use of digital technologies to support learning generally and writing specifically
- Argumentation as an alternative approach to genre and process writing models

4.3 The Enacted Design

The purpose of the following sub-sections is to carefully document the enacted design in the complex educational settings in which it occurred.

4.3.1 Two schools.
The intended design was a concurrent study at the two participating schools. This was not possible in the end due to both the time requirements on the researcher during the process, complicated by the physical distance between the two schools, and a change of staff at the original comparison school B (PTHS), which necessitated a change in setting that could not be organised for the third school term of the year.

It is important to note that the movement from school A (RCHS) to school B does not represent an iterative cycle in the usual sense within DBR. It was a purely logistical manoeuvre with no input from the first setting into the conception or design of the research instruments used in the second. Identical professional learning materials were used for both sets of teachers and the process was not adjusted in any way for the second school. Technical issues identified during the intervention in school A, such as more streamlined log-in techniques, were used in school B but these do not affect the validity of comparisons between the two settings.
4.3.2 **Student introductions.**

All treatment students at both schools were introduced to the project by the researcher during a single scripted fifty minute session. A video of crash-test dummies followed by discussion introduced the idea of university research into educational effectiveness. This was followed by a presentation about the uses and challenges of writing at upper secondary level, and the fact that this research would involve the use of educational technology. Introductions to argumentation, argument mapping and the program itself were left to individual teachers.

4.3.3 **Cycles of design and analysis.**

Because this is a Ph.D. investigation, it is by its very nature a limited feasibility type design. The iterative cycles of evaluation and collaborative re-design that mark traditional DBR within longer timeframes have been restricted here to ongoing discussions and adjustments within the one intervention cycle. This occurred early in the school A intervention and the minutes of one team meeting are included as Appendix 3.

- A lesson template was developed with teachers to scaffold the introduction of argument terms such as premise, contention, opposing and supporting as well as alternative viewpoints. These were explicitly taught in the first week of the intervention and woven through class activities and discussions during the reading stage of each unit. The aim was the development of a shared language, and particularly an orientation towards the role of evidence and counter-argument, both contextualised into the thematic study in each classroom.

- The relative merits of having students working on the program alone as opposed to pairs or small groups, was the focus of design analysis. After an early stage where students were allowed to choose, researcher-teacher discussions led to the decision to limit choice here. The key design variable in this case was the desire to facilitate a collaborative approach as one of the variables to be analysed. Teachers then organised students into pairs or small groups as much as possible. In the end across all intervention classes there were three students who developed individual digital argument maps.

- A discussion took place about the timing and use of the argument program within the overall term structure. Teachers were encouraged to see the process as more than merely an assessment task preparation, and to use argumentation
as a way to develop engagement and content knowledge as well as plan students’ final essays. Over the second two-thirds of each term, therefore, all classes were organised into two weekly computer sessions to work on argument maps. Before the post-test writing stage of two weeks this led to approximately six sessions where the argument maps were used to support critical thinking about the topic. Initially topics and map structure were guided by the teacher via her map projected as a model, but this guidance was eventually faded. Argument maps as scaffold for the essay task were developed under student direction with cycles of teacher-student dialogue in both computer and non-computer lessons.

The resolution of these factors is of vital importance to any analysis of this investigation. Bearing in mind that the aim of DBR is not to unconfound all variables, but to tease apart the key aspects of “enticing learning environments” (Brown, 1992, p. 173), these three teacher-focused variables, along with other messy classroom decisions and events documented during the observation phase, are factored into the Discussion chapters. The following generalisations can be made about teacher behaviour and lesson design during the intervention:

• The program was used extensively rather than intensively, for example twice a week over a five or six week period.

• All teachers set up learning activities to develop content and concepts specific to their unit of work (for example ‘ambition’ in Shakespeare’s *Macbeth*) before they moved to argumentation generally or the program.

• All teachers set up learning activities to develop ideas and vocabulary around argumentation before using the program

• While using the program was to prepare for the assessment task (which was also used as the writing post-test), discussions between students and between teacher and students during the process of using the program, had a much wider focus than merely essay-planning.
4.4 A Feasibility Study to Formatively Evaluate the Intervention (Phase 3)

The evaluation of the intervention is the primary focus of the Findings and Discussion chapters of this dissertation. The aim of this section is to document the process of data collection during the embedded mixed methods design that made up the body of the feasibility study.

4.4.1 Questionnaires.
A total of 204 students, comprising both treatment and control participants at both high schools, completed the questionnaires during the introductory sessions when the project was introduced. The 113 items on the student questionnaire were then entered into SPSS program in order to be analysed as part of the mixed methods research.

4.4.2 Writing pre- and post-test.
During class time in the first two weeks of the intervention, each treatment class wrote a pre-test essay. The same classes wrote post-test essays in the final week of the intervention. 86 valid scripts were used for the analysis process, based on the student having written both pre- and post-test essays, the student having completed the questionnaire, and the student having submitted the permission note for the writing section of the research as part of the ethics process.

4.4.3 Observations.
Non-participant observations were conducted on two occasions with each treatment (non-control) class. The first observation was made at an approximate mid-point of the process with the follow-up near the completion. The intention here was to give classes time to get to know the program but still be in the process of using it to work out their arguments and maps, then see the same class again as ‘mature’ digital argument map users as they neared the point of transition to argumentative writing. Observation records were made for each class, numbering fourteen, with an exemplar included as Appendix 7.

4.4.4 Interviews.
Interviews were conducted at the conclusion of the intervention with three to four students from each treatment class, and with every teacher. This made a total of 32 interviews with 26 students and 6 teachers. Interviews took between 25 and 45
minutes, were audio recorded then transcribed. The process of coding described in the methodology chapter was then begun. A copy of the interview questions and prompts is included as Appendix 6.

4.5  The ‘Difficult’ and the ‘Unexpected’ During the Intervention

4.5.1  Technology.
The investigation was disrupted by expected computer infrastructure problems and participant attrition at both settings. The first involved hardware failures that meant that PCs and laptops being used by students crashed or malfunctioned, as well as network connection problems which meant that internet connections were sometimes unreliable. As any teacher would attest, these are unfortunately characteristics of all technology use in schools. Neither had a significant impact, beyond frustration levels at certain junctures, on the investigation.

4.5.2  Personnel.
Two teachers at each school either chose not to continue with the project or were reassigned by the school in such a way that they were not able to participate. Neither decision was related to the research in any way. The original organisation of the participant teachers and classes took into account this possibility and the remaining six teachers and seven treatment classes were sufficient to complete the investigation as planned.

4.6  Summary

A feasibility study of the type described in this chapter is seen by Middleton et al. (2008) as one necessary stage in a larger design-based research (DBR) project that would move, from this point, to repeated iterations where the intervention is refined and retested. While there was certainly interest in such an ongoing investigation from participants at both settings, an ongoing investigation of this type is beyond the capacity and timeframe of a PhD project.
In some ways DBR provides more of a philosophical orientation for this project rather than a practical structuring. Indeed the requirement from within the field for cycles of evaluation, redesign and retesting was present within each research setting to the limited extent that researcher and participating teachers refined approaches to the mapping program and lesson design during the first weeks of the intervention. Other than this, theory and pedagogy from within the DBR field provides a framework for the conception of this investigation, particularly to distinguish it from action research, evaluation studies, experiments and ethnographic methodology. There are elements of each of these, but their alignment here, especially the way in which quantitative and qualitative data are used as complementary modes within a mixed methods methodology to focus attention on implications for both theory and classroom practices, differentiates this investigation from its methodological cousins.

The purpose of research within this DBR framework is not to prove that one approach is better than another. The aim is to explore how and why the mapping approach can work, and indeed how it can be made to work. Hence the documentation of the process in this chapter, particularly the relationship between a quasi-experimental intervention and the ethnographic frame of interviews and observations that attempt to make sense of it, suggests neither a clinical trial that can ‘prove’ success, nor an interpretive approach that attempts to show technological improvement through the attitudes of teachers who used it. We have instead a classroom intervention that throws theory in harm’s way, and in the following chapters, attempts to pick apart the implications for learning and teaching argumentative writing with and without digital technology in a way that is useful, and critically aware.
Chapter 5 – Findings 1: Writing Pre- and Post-tests

Figure 5.1 The quantitative phase of this investigation I

- Explore literature approaches to writing in a digital age classroom
- Identify and evaluate changes in argumentation skills evident in essay writing
- Argument as communicative impetus for sustained writing
- Evaluate implications for writing pedagogy and educational technology
- Analyse attitudes to learning with educational technology
- Analyse attitudes to writing, existing writing pedagogy and DAM
- Evaluate the impact of streaming, school, year and attitudes on treatment group results

Arguing with Technology
This chapter presents the findings related to students’ pre- and post-test argumentative writing in order to explore the first research objective: the identification and evaluation of changes in students’ argumentation skills evident in essay-writing. In this chapter a description is presented of the gains made by the treatment students as compared to control groups in general, and in each of the argumentation elements such as counter-argument. Gains are then assessed against variables such as streaming level and predispositions towards writing. By examining changes over time and between treatment and control groups, a picture based on quantitative data is developed to describe the digital argument mapping program’s effect on argumentative writing. This chapter also acknowledges the limitations of conclusions that can be drawn from the writing sample alone.

5.1 Introduction

Argument, argument mapping and digital argument mapping have been established as potentially useful approaches to the teaching of the writing of opinion in the contemporary English classroom. In essence, these more communicative practices aim to facilitate students’ conception of their writing as a practice that matters, developed through a process that matters, centred on an authentic (either real or imagined) purpose, audience and context. How to develop these practices in classrooms, and then encourage the transfer of such communicativeness to the writing of students, as well as then enhance student engagement with classroom writing strategies, is the focus of this dissertation. As an initial step towards that aim, the findings outlined in this chapter have been organised in order to explore the first research objective:

*To identify and evaluate changes in students’ argumentation skills evident in essay-writing after participating in a unit of work involving the digital scaffolding of argumentation*

The instrument used for this purpose, the argumentative writing rubric, consisted of seven writing elements: thesis development, structure, use of evidence, incorporation of alternative viewpoints, persuasive techniques, personal voice and conceptual approach. Scores from these seven elements, all out of a possible high
score of eight, have been combined to form an ‘overall mean’, and this is presented and discussed in the first of the following sections. Each writing element is then assessed individually. Following these sections, the treatment groups’ scores are evaluated in relation to streaming level (high or mixed), school and year (nine or ten). The impact of key dispositions, towards non-fiction writing, ICT and collaboration for example, is then evaluated. The quantitative data analyses are therefore used to supplement each other in order to avoid potentially simplistic findings from individual elements. Together with trends apparent from the survey data, and then opinions expressed during the interviews, this approach will help develop careful and “humble” (Rowan, 2012, p. 9) interpretations of the nature and extent of the change in students’ abilities.

5.2 Presentation of Treatment vs Control Writing Results

As a first statistical step, each student’s score on each writing element was added together and averaged to create an overall writing mean. The mean of these scores and the means of all the writing element scores were applied in the following analyses. Table 5.1 reports these means, as well as numbers of students and standard deviations (shown in brackets).

<table>
<thead>
<tr>
<th></th>
<th>Treatment Groups (n = 60)</th>
<th>Control Groups (n = 26)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test</td>
<td>Post-test</td>
</tr>
<tr>
<td>Overall Mean</td>
<td>3.11 (1.5)</td>
<td>4.31 (1.5)</td>
</tr>
<tr>
<td>Thesis</td>
<td>3.8 (2.2)</td>
<td>5.1 (1.8)</td>
</tr>
<tr>
<td>Structure</td>
<td>4.2 (2.0)</td>
<td>5.3 (1.7)</td>
</tr>
<tr>
<td>Evidence</td>
<td>4.13 (2.1)</td>
<td>5.62 (1.8)</td>
</tr>
<tr>
<td>Alternative PoV</td>
<td>0.53 (.9)</td>
<td>3.22 (2.4)</td>
</tr>
<tr>
<td>Persuasion</td>
<td>1.92 (1.4)</td>
<td>1.73 (1.9)</td>
</tr>
<tr>
<td>Voice</td>
<td>3.12 (1.7)</td>
<td>3.9 (1.9)</td>
</tr>
<tr>
<td>Concept</td>
<td>4.08 (2.1)</td>
<td>5.25 (1.8)</td>
</tr>
</tbody>
</table>

Means were used to develop between-within groups analysis of variance (ANOVA) data in the SPSS program package. Descriptive statistics have been used to further refine results and develop interpretations about the nature of observed changes. All results are presented in the light of ANOVA assumptions: all tests conformed to the required significance (>0.05) of Box’s Test of Equality of Covariance Matrices; the
p values of Levene’s test showed that the variances of the two groups tested in each ANOVA were approximately equal; Mauchly’s Test of Sphericity, finally, was most often violated by these procedures, leading to the use of multivariate statistics to provide valid F ratios. For the overall writing mean, I have presented ANOVA results in their full form. Thereafter, supporting statistics are reported in individual tables with additional information in appendices as required. Effect sizes throughout are reported using Cohen’s (1988) accepted guidelines (.01 = small effect, .06 = moderate effect, .14 = large effect).

5.2.1 Changes in overall writing means for argument skills.

(Group = treatment students vs control students; Time = pre- vs post-test)

A mixed between-within subjects analysis of variance was conducted to compare scores on overall means for the writing pre- and post-test between the treatment and control groups. For the overall writing means there was an interaction between group and time, Wilks’ Lambda = .90, F (1, 84) = 9.42, p < .05. There was a significant main effect for time, Wilks’ Lambda = .80, F (1, 84) = 20.91, p < .001, partial eta squared = .199, indicating a large effect. The main effect comparing the two groups was also significant, F (1, 84) = 11.83, p < .001, partial eta squared = .123, suggesting a large difference in gains in argumentative writing between the treatment and control groups. Because of the interaction effect a one-way repeated measures ANOVA was conducted to compare treatment and control groups individually from pre writing to post writing. There was a significant difference with a very large effect size for the treatment groups [Wilks’ Lambda=.55, F (1, 59)= 48.67, p,.0005, multivariate partial eta squared .45.] while the control groups did not change significantly over time [Wilks’ Lambda=.97, F (1, 25)= .797, p,.0005, multivariate partial eta squared .031.]

These results indicate that, on this general measure, students in the treatment groups made significant gains in their ability to incorporate argumentation skills into their essay-writing. The difference in results to those students who were in the control groups points to the influence of the digital argument mapping program, and the ways in which it was deployed and used in these classrooms as a key intervention. However, because the mean score used here is an amalgamation of individual writing elements, and because such an amalgamation may obscure variations between writing elements, it is necessary to drill more deeply into these results. Not
all writing elements were equally focused on by teachers and the overall mean does not allow for an analysis of changes within writing elements that could reveal significant teaching and learning practices.

5.2.2 Changes in students’ thesis development skills.

(Group = treatment vs control students; time = pre- vs post-writing for thesis development)

The first writing element measured was the student’s ability to develop and maintain a thesis throughout their essay. Argument mapping is seen to facilitate this ability by the way a hierarchy of ideas is visually represented. This may then enable the student, perhaps with the dialogic support of peers or the teacher, to develop and hold to a line of argument, or thesis, for the piece of writing to come.

Table 5.2 ANOVA results for thesis development: time and between-subjects effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig*</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.802</td>
<td>1</td>
<td></td>
<td>20.69</td>
<td>.000*</td>
<td>.198</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>59.15</td>
<td>1</td>
<td></td>
<td>59.15</td>
<td>11.84</td>
<td>.001*</td>
<td>.124</td>
</tr>
</tbody>
</table>

^Significance, *Alpha level < .05

There was no significant interaction of group and time in this writing element, so it is reasonable to report from these figures that there was both a significant main effect for time and between groups on this measure. Judging from the descriptive statistics (see Table 5.1) and a supporting one-way repeated measures ANOVA (Table 5.2), the treatment groups had a significant improvement from pre- to post-test in their ability to develop a thesis. This was not the case for the control groups.

5.2.3 Changes in Structure.

(Group = treatment vs control students; time = pre- vs post-writing for structure)

The second writing element measured was the student’s ability to deploy common features of essay-writing structure, particularly paragraphing, in order to present ideas fluently.

Table 5.3 ANOVA results for structure: time and between-subjects effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig*</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.781</td>
<td>1</td>
<td></td>
<td>23.5</td>
<td>.000*</td>
<td>.219</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>38.74</td>
<td>1</td>
<td></td>
<td>38.74</td>
<td>8.76</td>
<td>.004*</td>
<td>.094</td>
</tr>
</tbody>
</table>

^Significance, *Alpha level < .05
From Table 5.3 it is evident that both main effects, for time and between groups, were significant, with a very large effect size for time and a moderate effect size indicating the difference between groups. There was no significant interaction effect between time and group for this writing element. Although these results suggest that there were changes from pre- to post-test on this writing element, the one-way repeated measures ANOVAs reveal that both treatment and control groups improved on this measure. In many ways this is not a surprising result considering that a focus on structure, in the form of paragraph templates such as WHY and PEEL, was maintained by control classes during the intervention period. This means that improvements in treatment groups’ structure cannot be accredited to the argument mapping program. It does, however, help to distinguish argumentation and writing skills that are developed – either explicitly or as a result of – a traditional pedagogical focus on structure, genre and process, as compared to those that are facilitated by a combination of those pedagogies with ones incorporating argumentation. These points are taken up in discussion sections later in this dissertation.

5.2.4 Changes in the use of evidence.

(Group = treatment vs control students; time = pre- vs post-writing for evidence)

The third writing element measured was the student’s ability to use evidence in a judicious way to support the development of their ideas. This is a particularly important test for the argument program because of the way the mapping process encourages the user to organise evidence in support of each sub-topic.

Table 5.4 ANOVA results for evidence: time and between-subjects effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig^</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.78</td>
<td>23.75</td>
<td>1</td>
<td>1</td>
<td></td>
<td>.000*</td>
<td>.22</td>
</tr>
<tr>
<td>Group</td>
<td></td>
<td>47.5</td>
<td>1</td>
<td>47.5</td>
<td>9.66</td>
<td>.003*</td>
<td>.103</td>
</tr>
</tbody>
</table>

^Significance, *Alpha level < .05

Table 5.4 indicates that both main effects, for time and between groups were significant, with a large effect size for time and a moderate between groups effect. There was no significant interaction effect between time and group for this writing element. Further analysis, through a one-way repeated measures ANOVA reveals that treatment groups improved dramatically in their use of evidence, while control

21 During the co-design phase, this term was developed to signify a careful choice of the amount of supporting evidence, the kind of evidence (a quote for example), and placement of evidence. These ideas were passed on to assessors during the marking phase.
groups’ changes cannot be attributed confidently to factors beyond chance (Significance = .045). Students who used the digital argument mapping program, therefore, were more able than those who did not, to deploy evidence in a well-considered way to support their ideas in their post-test essay-writing.

5.2.5 Changes in the incorporation of alternative viewpoints.

(Group = treatment vs control students; time = pre- vs post-writing for alternative viewpoints)

The fourth writing element measured was the student’s ability to incorporate alternative or divergent points of view as either a rhetorical device in their essay-writing, or to develop a more balanced piece of writing. As we have seen, this skill is acknowledged as both a marker of higher level writing ability and one that students of all academic levels find difficult to master. It is a particular focus of the argument mapping program and therefore an element of great significance to this investigation.

Table 5.5 ANOVA results for alternative viewpoints: time and between-subjects effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig*</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.73</td>
<td>1</td>
<td></td>
<td>30.56</td>
<td>.000*</td>
<td></td>
<td>.27</td>
</tr>
<tr>
<td>Group</td>
<td>72.48</td>
<td>1</td>
<td>72.48</td>
<td>25.1</td>
<td>.000*</td>
<td></td>
<td>.23</td>
</tr>
</tbody>
</table>

*Significance, *Alpha level < .05

The information represented in Table 5.5 indicates that on this writing element there were significant main effects for both time and between groups. The effects sizes for both are very large, but it is important to note that there is also a significant interaction effect on this measure. According to the one-way repeated measures ANOVAs, therefore, it is the treatment group that shows a dramatically large effect size for a change from pre-test to post-test. The control groups did not change in their ability to incorporate alternative viewpoints. It can therefore be suggested that working with this program has enabled the treatment group of students to develop skills in this area which they were then able to transfer to their essay-writing.
5.2.6 Changes in use of persuasive techniques.

(Group = treatment vs control students; time = pre- vs post-writing for persuasion)

The fifth writing element measured was the student’s ability to deploy a range of appropriate persuasive techniques in their essay-writing. Two contextual factors are important to note here, and will be discussed further in following chapters. Firstly, all NSW students are prepared for the persuasive writing element of the NAPLAN tests in Years 3, 5, 7 and 9. Interviews with all participating teachers confirmed that students in both years and both schools had been involved in units of work and targeted activities focused on developing skills in a range of persuasive techniques, for example rhetorical questions and emotive language. A second contextual factor is that persuasion as a purpose or a set of skills, whether social or cognitive, was not a focus of this intervention and was consequently not touched on by teachers in either treatment or control groups. Far from persuasion therefore being tangential to this investigation, it is actually important to consider how this aspect of writing has been utilised by students when it is not explicitly called for.

Table 5.6 ANOVA results for persuasive techniques: time and between-subjects effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig^</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.938</td>
<td>1</td>
<td></td>
<td>5.591</td>
<td>.020*</td>
<td>.062</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>2.979</td>
<td>1</td>
<td></td>
<td>2.979</td>
<td>1.08</td>
<td>.302*</td>
<td>.013</td>
</tr>
</tbody>
</table>

^Significance, *Alpha level < .05

The statistics reported in Table 5.6 and supported by descriptive analysis (the comparison of means) and the repeated measures ANOVAs suggest a curious set of results. The difference from pre-test to post-test is significant, with a moderate effect size for a downward change. There is no interaction effect and no significant difference between the two groups. However, the one-way repeated measures ANOVA makes it clear that it is the control group that experienced the more significant deterioration in their skills in this area.

While it was expected that skills measured by this element would not improve because of the intervention, a drop in scores was not anticipated. Neither was the fact that, aside from the alternative viewpoints element, initial (pre-test) scores for persuasive techniques were the lowest of all the elements measured. This makes sense for the inclusion of alternative viewpoints, which is a thinking and writing skill that students have had little or no prior exposure to in classrooms. The low
initial scores and then the drop in post-test for persuasion does not sit easily, however, with the school contexts for persuasive techniques. The relationships between persuasion, argument and essay-writing are integral to this investigation and will be further discussed. Most especially it is interesting that yet another contemporary practice, in this case the decontextualized and test-specific teaching of ‘persuasive techniques’, is revealed by these results as ineffective in terms of student ability to transfer knowledge, skills and frames of mind to later writing tasks.

It is useful to note here, however, that aspects of the research design, most especially differences in student perception of and preparation for the two writing tasks, may have influenced these results. It is also important that the participating students were not explicitly asked to ‘be persuasive’ or include persuasive techniques. While this may explain the absence of persuasion, it does not adequately explain why students have either not internalised skills which are the focus of widespread classroom attention, or do not see their place in an essay assessment task.

5.2.7 Changes in Voice.

(Group = treatment vs control students; time = pre- vs post-writing for voice)

The sixth writing element measured was the student’s ability to develop and maintain a personal voice through their essay-writing. This is a contentious aspect of writing to teach and assess. The moderation process therefore acknowledged the subjectivity of this element and took care to note that any attempt to enliven the writing, for example humour or varied sentence length, could be counted as ‘personal voice’.

<table>
<thead>
<tr>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig^</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.998</td>
<td>1</td>
<td></td>
<td>.151</td>
<td>.698</td>
<td>.002</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td>28.927</td>
<td>1</td>
<td></td>
<td>28.927</td>
<td>6.093</td>
<td>.016</td>
<td>.068</td>
</tr>
</tbody>
</table>

^Significance, *Alpha level < .05

Table 5.7 shows that for the writing element of Voice, there was no significant effect for time and a significant between groups effect. The interaction between

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22 Co-design discussions and moderation work both used elements of Jeffery’s (2010) overview. Writing voice here is conceived of expressing passion, authenticity, doubt or values that represent the writer behind the writing.
time and group was also significant. The one-way repeated measures ANOVA therefore reveals a significant improvement for the treatment groups, with a large effect size, and no change for the control groups. Add to this the information from the descriptives in Table 5.1, that on this measure treatment and control classes were almost identical in the pre-test, and it is reasonable to report that the digital argument mapping had a positive impact on this writing element. While it is not an explicit feature of the program, and was not a focus of classroom activities during the period of the intervention, it is instructive that working with argument in this way, particularly the focus on appropriate evidence and the incorporation of alternative viewpoints, may have had a flow-on effect to students’ abilities in producing more enlivened writing.

5.2.8 Changes in conceptual orientation.  
(Group = treatment vs control students; time = pre- vs post-writing for conceptual)

The seventh writing element measures the student’s ability to maintain a largely conceptual – as opposed to descriptive for example – focus through their essay-writing.

Table 5.8 ANOVA results for conceptual orientation: time and between-subjects effects

<table>
<thead>
<tr>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig*</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>.802</td>
<td>1</td>
<td></td>
<td>20.741</td>
<td>.000*</td>
<td></td>
<td>.198</td>
</tr>
<tr>
<td>Group</td>
<td>41.576</td>
<td>1</td>
<td>41.576</td>
<td>8.147</td>
<td>.005*</td>
<td>.088</td>
<td></td>
</tr>
</tbody>
</table>

^Significance, *Alpha level < .05

Table 5.8 reveals that there was a significant difference between time periods with a large effect size. There was also a significant main effect for the between-group measure with a moderate effect size. For this writing element there was no interaction effect between time and group. The one-way repeated measures ANOVAs show that Conceptual Orientation is only the second writing element, after Structure, in which the control group also improved during this timeframe. Although the p-value is only just significant, this may again point to the confounding influence of variables like the nature of the topic studied for the two writing tasks. Interviews, conducted at the completion of the intervention, have revealed how much emphasis students place on their interest in the topic when it comes to their self-evaluated ability to think and write conceptually.
5.3 Discussion of Treatment vs Control Writing Results

The analysis of changes from writing pre-test to post-test, and between groups, on the seven writing elements and the overall means suggests that working with the digital argument mapping program did have significant effects on students’ argumentation skills. Importantly, the writing post-test measures the transfer of skills developed and practised in a digital environment, to a traditional print literacy one involving an essay assessment task. For elements such as thesis development and the deployment of evidence, the instructions and criteria for the writing task explicitly required students to demonstrate these skills. For the demonstration of personal voice and particularly the inclusion of alternative viewpoints, there appears to have been an unsolicited transfer from the activities and interactions (including but not limited to those between students and technology) of the intervention period, to the post-test writing task. It is vital to remember that while students understood that the second writing task was part of the research project, its primary role for them was as an in-school assessment task. Any choice to include an alternative viewpoint therefore, can be seen as a success for the use and interaction with the technology in developing this skill. Furthermore, the improvements in thesis, evidence, voice and alternative viewpoints hint at the success of the associated learning environment in fostering both an interest in these aspects of argumentation, and an acceptance by the students of their relevance as elements of effective and sustained writing.

5.4 Evaluation of Treatment Groups’ Writing Results: Streaming, School and Year Group

The questionnaire completed by students prior to the writing pre-test makes it possible to explore the influence of other factors on the writing results reported here. In order to prepare the data that is reported and discussed in this section, a new data set was created in SPSS comprising only students involved in the treatment classes who then participated in the writing pre- and post-tests (n=60). On four key writing elements: overall mean, alternative viewpoints, persuasion and evidence use, the treatment group was then assessed for variations due to streaming
(high or mixed ability), school (A = Regional City High School, B = Provincial Town High School) and year group (Year 9 or 10).

5.4.1 Streaming.

Both participating schools stream students in Years 9 and 10 into high ability and mixed ability classes. Although random assignment was not possible, it was a key feature of the quasi-experimental structure of this investigation that classes at both streaming levels be included in the intervention. With the data reported here, it is possible to further explore the impact of the digital argument mapping program on students in different circumstances. Philosophical and practical issues related to streaming as a practice are beyond the scope of this dissertation, though it is noted that a student’s place in either ability grouping can be the result of many factors and is not always correlated to academic or behavioural background.

Table 5.9 ANOVA results for streaming: time and between-subjects effects

<table>
<thead>
<tr>
<th>Writing Element</th>
<th>Effect</th>
<th>Wilks' Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig*</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mean</td>
<td>Time</td>
<td>.531</td>
<td>51.831</td>
<td>1</td>
<td>18.484</td>
<td>51.313</td>
<td>.000*</td>
<td>.570</td>
</tr>
<tr>
<td></td>
<td>Group#</td>
<td></td>
<td>51.831</td>
<td>1</td>
<td>18.484</td>
<td>51.313</td>
<td>.000*</td>
<td>.570</td>
</tr>
<tr>
<td>Alt. POVs</td>
<td>Time</td>
<td>.430</td>
<td>59.934</td>
<td>1</td>
<td>20.423</td>
<td>59.934</td>
<td>.000*</td>
<td>.260</td>
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<tr>
<td></td>
<td>Group</td>
<td></td>
<td>59.934</td>
<td>1</td>
<td>20.423</td>
<td>59.934</td>
<td>.000*</td>
<td>.260</td>
</tr>
<tr>
<td>Pers. Techs</td>
<td>Time</td>
<td>.999</td>
<td>1</td>
<td></td>
<td>.040</td>
<td></td>
<td>.843</td>
<td>.001</td>
</tr>
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<td>Group</td>
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<td>2.021</td>
<td>5.145</td>
<td>.161</td>
<td>.034</td>
</tr>
<tr>
<td>Evid. 3</td>
<td>Time</td>
<td>.624</td>
<td>106.562</td>
<td>1</td>
<td>27.708</td>
<td>106.562</td>
<td>.000*</td>
<td>.376</td>
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<tr>
<td></td>
<td>Group</td>
<td></td>
<td>106.562</td>
<td>1</td>
<td>27.708</td>
<td>106.562</td>
<td>.000*</td>
<td>.376</td>
</tr>
</tbody>
</table>

In this table the possible values for ‘group’ are mixed ability vs high ability. The possible values for time are pre- vs post-writing for the overall mean and the three specific writing elements reported here.

23
Figure 5.2 The quantitative phase II

- Explore literature approaches to writing in a digital age classroom
- Identify and evaluate changes in argumentation skills evident in essay writing
- Evaluate the impact of streaming, school, year and attitudes on treatment group results
- Analyse attitudes to writing, existing writing pedagogy and DAM
- Analyse attitudes to learning with educational technology
- Evaluate implications for writing pedagogy and educational technology

Argument as communicative impetus for sustained writing
In the comparison between treatment and control groups we have seen that students involved in the intervention made significant gains in key argumentation skills, except for the inclusion of persuasive techniques. Table 5.9 confirms this result and suggests, through the combination of interaction effects and main effects for between-groups differences, that there were important differences between high ability and mixed ability classes. Although mixed ability classes, as expected, scored lower at both pre-test and post-test levels, the proportional gains made by mixed ability students – in relation to their starting points – are greater than for high streamed students. This is true for the overall mean as well as the inclusion of alternative viewpoints and the use of evidence. While the main effects for time are highly significant at very large effects sizes for both groups, it is interesting that students in the mixed ability classes have either reacted even more positively to the approach, or have been even more able to take on key skills. While the low starting points of many of these students helps to explain some of the dramatic statistical differences, it is evident from these results that the program has a strong appeal to students at all levels and may be particularly suited to students in mixed ability classes.

### 5.4.2 School.

Key indicators from the questionnaire reveal that students at the two participating schools have similar attitudes to their schools, teachers and learning. In terms of

<table>
<thead>
<tr>
<th>Writing Element</th>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig*</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mean</td>
<td>Time</td>
<td>.634</td>
<td>42.681</td>
<td>1</td>
<td>14.41</td>
<td>.000*</td>
<td>.199</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>.366</td>
<td>1</td>
<td>1</td>
<td>13.2</td>
<td>.000*</td>
<td>.199</td>
<td></td>
</tr>
<tr>
<td>Alt. POVs¹</td>
<td>Time</td>
<td>.420</td>
<td>3.452</td>
<td>1</td>
<td>.930</td>
<td>.000*</td>
<td>.199</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>.580</td>
<td>1</td>
<td>1</td>
<td>.930</td>
<td>.000*</td>
<td>.199</td>
<td></td>
</tr>
<tr>
<td>Pers. Techs²</td>
<td>Time</td>
<td>.959</td>
<td>13.2</td>
<td>1</td>
<td>5.483</td>
<td>.023*</td>
<td>.086</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>.016</td>
<td>1</td>
<td>1</td>
<td>5.483</td>
<td>.023*</td>
<td>.086</td>
<td></td>
</tr>
<tr>
<td>Evid.³</td>
<td>Time</td>
<td>.787</td>
<td>61.534</td>
<td>1</td>
<td>13.313</td>
<td>.001*</td>
<td>.187</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>.213</td>
<td>61.534</td>
<td>1</td>
<td>13.313</td>
<td>.001*</td>
<td>.187</td>
<td></td>
</tr>
</tbody>
</table>

*Significance, *Alpha level < .05, # School A (RCHS) vs School B (PTHS)

1. Incorporation of alternative viewpoints, 2. Use of persuasive techniques, 3. Use of evidence

---

24 Percentage of students at each school who agreed or strongly agreed that:
   a) I get on with my teachers – RCHS: 75%, PTHS: 80%
   b) Most students at my school follow class rules – RCHS: 49%, PTHS: 59%
   c) In class, I am usually doing the task the teacher has set – RCHS: 77%, PTHS: 91%
   d) My teachers are confident users of technology – RCHS: 53%, PTHS: 52%

25 In this table the possible values for ‘group’ are School A vs School B. The possible values for time are pre- vs post-writing for the overall mean and the three specific writing elements reported here.
factors that might reasonably be expected to have a bearing on the success of an intervention, such as relationships between students and teachers and the school ‘ethos’ (the existence of an academic culture for example), the contexts in which the intervention took place can therefore be considered broadly analogous.

While results generally support the notion that the schools are similar, and therefore that school ethos is not a key variable in explaining the impact of the argument mapping program, there are important statistical differences between the schools that need to be reported and evaluated. On the overall mean, there was a significant difference between groups, with RCHS making a proportionally stronger improvement. PTHS began with a higher mean, however, which is possibly a function of a smaller sample and a larger proportion of high ability streaming students in the treatment group. Therefore these differences need to be treated with caution. This is particularly so when the results indicate that on the writing element of alternative viewpoints, PTHS students improved at almost three times the rate of RCHS students! PTHS students also improved in their ability to use persuasive techniques while RCHS students’ skills in this area deteriorated slightly. There was no significant change in PTHS students’ (already relatively high) ability to use evidence, while RCHS students improved on this measure to a significant degree.

On the whole these complex and at times conflicting results work to remove school as a confounding variable. While there are degrees of difference between changes, the overall trends suggest that students in the two schools reacted to using the program in similar ways. Apart from differences in the sample as a potential explanation for the extent of effects, there is one other intriguing possibility. If PTHS students, because of either teaching focus or sampling, began this intervention with higher abilities in key argumentation skills such as the use of evidence (and thesis development and structure not reported in this section) then it is interesting that they responded so positively to the two aspects of argumentation, alternative viewpoints and persuasion, that are the most communicative. These elements of argumentation were comparatively weak in their repertoire, so their statistically significant improvement on these measures could indicate their appetite – or ‘ripeness’ – for a more communicative approach. Regardless of school of origin, the results continue to suggest that the classroom use of this program is effective at helping to develop such an approach.
5.4.3 **Year.**

The year group of participating students is an important variable to consider here for two reasons. Firstly, it is interesting to note the potential variations in impact of the argument mapping program on students at different stages of the development of their overall literacy and writing skills. Secondly, Year 9 students have had only a limited exposure to the school-wide focus on paragraph structure templates. Considering this variable therefore allows us to continue developing an understanding of the role of such methods as well as their interaction with digital technologies of the type being studied here.

<table>
<thead>
<tr>
<th>Writing Element</th>
<th>Effect</th>
<th>Wilks' Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig*</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mean</td>
<td>Time</td>
<td>.537</td>
<td>50.070</td>
<td>1</td>
<td>48.737</td>
<td>.000*</td>
<td>.463</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group¹</td>
<td></td>
<td>48.737</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>.227</td>
</tr>
<tr>
<td>Alt. POVs¹</td>
<td>Time</td>
<td>.413</td>
<td>82.605</td>
<td>1</td>
<td>19.286</td>
<td>17.056</td>
<td>.000*</td>
<td>.587</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td></td>
<td>19.286</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>.088</td>
</tr>
<tr>
<td>Pers. Techs²</td>
<td>Time</td>
<td>.985</td>
<td>14.483</td>
<td>1</td>
<td>30.537</td>
<td>5.611</td>
<td>.021</td>
<td>.105</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td></td>
<td>30.537</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>.015</td>
</tr>
<tr>
<td>Evid.³</td>
<td>Time</td>
<td>.647</td>
<td>9.970</td>
<td>1</td>
<td>48.348</td>
<td>31.646</td>
<td>.000*</td>
<td>.147</td>
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<tr>
<td></td>
<td>Group</td>
<td></td>
<td>48.348</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>.353</td>
</tr>
</tbody>
</table>

*Significance, *Alpha level < .05, # Year 9 vs Year 10
1. Incorporation of alternative viewpoints, 2. Use of persuasive techniques, 3. Use of evidence

On all elements reported here apart from persuasive techniques, Table 5.11 shows that there were significant changes from pre-test to post-test for both year groups. The ANOVAs also indicate that on all measures there were significant differences between the groups and significant time by group interactions. All of these calculations confirm a basic theme: the Year 10 groups improved at a greater rate than their younger counterparts. While it was expected that Year 10 students started at a higher pre-test level, it is interesting that their proportional improvement was almost double that of Year 9 students. This may well be a function of their greater experience with conceptual topics and the types of school writing required when assessing them. In the end it is a reasonably uncontroversial result and should not obscure the fact that Year 9 students also improved significantly through the process.

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26 In this table the possible values for 'group' are Year 9 vs Year 10. The possible values for time are pre- vs post-writing for the overall mean and the three specific writing elements reported here.
Chapter 5 – Findings 1: Writing Pre- and Post-tests

5.5 Discussion of the Impact of Streaming, School and Year

Students at both participating schools, at both year levels and both streaming levels improved skills in consistent ways through this process. These results confirm the effectiveness of the program and particularly its usefulness for a range of student abilities.

The similarities in patterns between the two schools can allow us to discount school ethos as an important variable. While differences in starting points suggest the influence of non-equivalent groups on the research, they also point to significant interactions between the argumentation skills developed through use of the digital program and pre-existing essay-writing skills that need to be teased apart through the analysis of interview data. Differences between the year groups point towards expected differences in the developmental stage between Year 9 and 10, but are not significant enough to suggest that these two groups of learners approached the program in different ways, or that it had a markedly different effect on them.

Perhaps of most import are the differences between streaming levels. While it is encouraging that mixed ability students were clearly able to relate to the program and the learning process in meaningful ways that transferred to their essay-writing, the slightly more limited gains of high ability streamed classes may emphasize characteristics of the program or argumentation that are important to note with all students. Some students from high streamed classes note in their interviews, for example, that the digital scaffolding of argument may have been useful to an extent, but that at an eventual point in the process it was felt to constrain the development of their thinking. In response to this criticism, it is worth noting that the argument mapping strategy, especially in its digital format, has the potential to work as a scaffold that can be faded in response to the needs of particular students. This was not a variable measured in this intervention, and would be a useful target for further evaluation in the follow-up stages to this kind of feasibility study.

Meanwhile, for students in the mixed ability classes, perhaps with less confidence, motivation or skill in terms of constructing an argument, the manipulation of argument in a digital platform was felt to be more enabling than constraining.
5.6 Evaluation of Treatment Groups’ Writing Results: Personal Preferences

The questionnaire instrument also allows for the analysis of writing results against personal preferences for learning and participating in class. The five preferences, chosen in order to explore variables that are potentially significant for the evaluation of gains in writing are:

- An enjoyment of collaboration
- An enjoyment of group and class discussion
- A positive view of ICT for learning
- An enjoyment of non-fiction writing, and
- A high use of web 2.0 platforms

Once again the four key writing elements: overall mean, alternative viewpoints, persuasion and evidence use were used to create mixed between-within subjects analysis of variance to evaluate changes over time and differences between groups as a result of this intervention.

5.6.1 Enjoyment of collaboration

On the SPSS package, treatment students who had participated in the writing pre- and post-tests \((n=60)\) were divided into two groups based on whether they had indicated a general preference for working alone \((n=19)\) or in a collaborative environment \((n=41)\). Since the argument mapping intervention involved a collaborative process, it was considered important to test whether this variable had any impact on the students’ results. Would students who already had a preference for working together have a more significant improvement in their writing?
Table 5.12 ANOVA results for enjoyment of collaboration: time and between-subjects effects27

<table>
<thead>
<tr>
<th>Writing Element</th>
<th>Effect</th>
<th>Wilks(^*) Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig(^*)</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mean</td>
<td>Time</td>
<td>.617</td>
<td>1</td>
<td></td>
<td>35.976</td>
<td>.000*</td>
<td>.383</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group(^*)</td>
<td>.494</td>
<td>1</td>
<td></td>
<td>59.294</td>
<td>.000*</td>
<td>.506</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alt. POVs(^1)</td>
<td>2.621</td>
<td>1</td>
<td></td>
<td>2.621</td>
<td>.704</td>
<td>.405</td>
<td>.012</td>
</tr>
<tr>
<td>Pers. Techs(^2)</td>
<td>Time</td>
<td>.993</td>
<td>1</td>
<td></td>
<td>.426</td>
<td>.516</td>
<td>.007</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group(^*)</td>
<td>.070</td>
<td>1</td>
<td></td>
<td>.070</td>
<td>.027</td>
<td>.871</td>
<td>.000</td>
</tr>
<tr>
<td>Evid.(^3)</td>
<td>Time</td>
<td>.624</td>
<td>1</td>
<td></td>
<td>35.022</td>
<td>.000*</td>
<td>.376</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>106.562</td>
<td>1</td>
<td></td>
<td>106.562</td>
<td>27.708</td>
<td>.000*</td>
<td>.323</td>
</tr>
</tbody>
</table>

^Significance, \(^*\)Alpha level < .05, \(^\#\) students who do vs students who do not enjoy collaborating
1.Incorporation of alternative viewpoints, 2. Use of persuasive techniques, 3. Use of evidence

Table 5.12 shows that on the three writing elements that showed the most improvement for the general treatment group, there has been – as expected – a corresponding improvement here. What is significant is that only on the ‘use of evidence’ variable has there been a statistically significant difference between the groups. On the overall mean (a very general measure and so of limited usefulness here) and the ability to incorporate alternative viewpoints, students who did not self-report as enjoying collaboration were statistically similar in their improvement to those students who did like working together. On the contrary, those students who prefer to work collaboratively were better able to use evidence to support their ideas in the post-test writing; and at a very large effect size.

One interpretation of this finding is that, as we have seen, a very wide range of students saw the advantage of including alternative viewpoints, and became much more effective at doing so. This generalised improvement may be working to negate the effects of the collaborative variable. On the other hand, the qualitative data reported in the next chapter suggests that the collaborative environment around the argument mapping program was found by students and teachers alike to promote the purposeful gathering and use of evidence to support contentions. It is reasonable to conclude that those students already predisposed to working in this way, may have been even more willing to consider the evidence in play and incorporate it into their later writing as a result of their predisposition to working collaboratively with others.

27 In this table the possible values for ‘group’ are ‘those who enjoy collaboration’ vs ‘those who do not enjoy collaboration’. The possible values for time are pre- vs post-writing for the overall mean and the three specific writing elements reported here.
5.6.2 Enjoyment of discussion

The pre- and post-test writers in the treatment group were divided into those who self-reported as enjoying class discussions \( (n = 35) \) and those who did not \( (n = 25) \). Again, since the dialogic aspect of the learning environment is one of the main variables under assessment, it was considered useful to see if a disposition towards discussion would have a bearing on the extent of improvement in the effectiveness of student writing.

Table 5.13 ANOVA results for enjoyment of discussion: time and between-subjects effects\(^{28}\)

<table>
<thead>
<tr>
<th>Writing Element</th>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig(^*)</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mean</td>
<td>Time</td>
<td>.553</td>
<td>1</td>
<td></td>
<td>46.847</td>
<td>.000*</td>
<td>.447</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group(^#)</td>
<td></td>
<td></td>
<td></td>
<td>19.788</td>
<td>5.895</td>
<td>.018*</td>
<td>.092</td>
</tr>
<tr>
<td>Alt. POVs(^1)</td>
<td>Time</td>
<td>.443</td>
<td>1</td>
<td></td>
<td>73.000</td>
<td>.000*</td>
<td>.557</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>17.745</td>
<td>1</td>
<td></td>
<td>5.124</td>
<td>.027*</td>
<td>.081</td>
<td></td>
</tr>
<tr>
<td>Pers. Techs(^2)</td>
<td>Time</td>
<td>.996</td>
<td>1</td>
<td></td>
<td>.248</td>
<td>.621</td>
<td>.004</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>6.019</td>
<td>1</td>
<td></td>
<td>2.378</td>
<td>.128</td>
<td>.039</td>
<td></td>
</tr>
<tr>
<td>Evid.(^3)</td>
<td>Time</td>
<td>.640</td>
<td>1</td>
<td></td>
<td>32.567</td>
<td>.000*</td>
<td>.360</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>34.562</td>
<td>1</td>
<td></td>
<td>6.794</td>
<td>.012*</td>
<td>.105</td>
<td></td>
</tr>
</tbody>
</table>

\(^{a}\)Significance, \(^*\)Alpha level < .05, \(^#\) students who do vs students who do not enjoy discussions

1. Incorporation of alternative viewpoints, 2. Use of persuasive techniques, 3. Use of evidence

On the figures reported in table 5.13, all three writing elements, the overall mean as well as the inclusion of alternative viewpoints and the inclusion of more judicious evidence, improved over time. Most significantly, on all three measures there was a statistically significant difference between the two groups of between a moderate and large effect size. Students who self-reported as enjoying discussion not only started with stronger skills in all measures but had a stronger improvement in their skills across the intervention. According to the descriptive statistics (see Appendix 9) this effect was most pronounced for the inclusion of alternative viewpoints. This finding should not detract from the fact that students in the ‘don’t like discussion’ sub-group also improved, but it points to the importance of a disposition to interact verbally on the effects of a strategy that involves the interplay between technology and writing. This is an important warning about simplistic judgments about the efficacy of the intervention. Clearly the possession of an interest in discussion, as well as the consequent skills in this area, improved student uptake of argumentation strategies. The statistics reported here triangulate with interview responses about

\(^{28}\) In this table the possible values for ‘group’ are ‘those who enjoy discussion’ vs ‘those who do not enjoy discussion’. The possible values for time are pre- vs post-writing for the overall mean and the three specific writing elements reported here.
the importance of talk before writing, and should encourage educators to focus on discussion skills and activities as an integral part of writing instruction.

5.6.3 Positive view of ICT for learning

The pre- and post-test writers in the treatment group were divided into those who self-reported as having a positive view of ICT in relation to their learning (n = 24), and those who did not have such a positive view (n = 36).

Table 5.14 ANOVA results for positive attitude towards ICT: time and between-subjects effects

<table>
<thead>
<tr>
<th>Writing Element</th>
<th>Effect</th>
<th>Wilks' Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig*</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mean</td>
<td>Time</td>
<td>.634</td>
<td>33.555</td>
<td>1</td>
<td>33.555</td>
<td>.000*</td>
<td>.366</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group†</td>
<td></td>
<td>6.513</td>
<td>1</td>
<td>1.649</td>
<td>.019*</td>
<td>.092</td>
<td></td>
</tr>
<tr>
<td>Alt. POVs1</td>
<td>Time</td>
<td>.555</td>
<td>46.530</td>
<td>1</td>
<td>46.530</td>
<td>.000*</td>
<td>.445</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>20.069</td>
<td>5.862</td>
<td>1</td>
<td>5.862</td>
<td>.019*</td>
<td>.092</td>
<td></td>
</tr>
<tr>
<td>Pers. Techs2</td>
<td>Time</td>
<td>.952</td>
<td>2.926</td>
<td>1</td>
<td>2.926</td>
<td>.093</td>
<td>.048</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>4.225</td>
<td>1.649</td>
<td>1</td>
<td>1.649</td>
<td>.204</td>
<td>.028</td>
<td></td>
</tr>
<tr>
<td>Evid.3</td>
<td>Time</td>
<td>.696</td>
<td>25.335</td>
<td>1</td>
<td>25.335</td>
<td>.000*</td>
<td>.304</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>40.669</td>
<td>8.163</td>
<td>1</td>
<td>8.163</td>
<td>.006*</td>
<td>.123</td>
<td></td>
</tr>
</tbody>
</table>

*Significance, *Alpha level < .05, # students who do vs students who do not feel pos towards ICT
1.Incorporation of alternative viewpoints, 2. Use of persuasive techniques, 3. Use of evidence

On the figures shown in Table 5.14, once again, there was a statistically significant improvement over time for both groups, but also a difference with a moderate to large effect size, between the two groups. On all three measures (again the inclusion of persuasive techniques did not improve) the sub-group who had a negative view of ICT for learning started with higher pre-test scores. Both sub-groups improved on the measured elements, but on the inclusion of alternative viewpoints the negative sub-group had a significantly stronger improvement.

While it is beyond the remit of this investigation to explore the reasons for the higher initial skill level of students who do not see ICT as generally useful for learning, it is instructive that those students appear to have reacted positively to this process involving technology. Is there something about this particular use of technology for learning that appealed to this sub-group? Was it used and experienced in ways that are different to previous uses that led this sub-group to form a negative impression of the usefulness of technology for learning? Perhaps most intriguing, given the striking difference of improvement in the area of

---

29 In this table the possible values for ‘group’ are ‘those who have a positive view of ICT for learning’ vs ‘those who do not’. The possible values for time are pre- vs post-writing for the overall mean and the three specific writing elements reported here.
alternative viewpoints, is the possibility that for a generally resistant sub-group, the opportunity to work constructively on new skills that they valued in a digital environment was grasped energetically. Chapter 7 explores the possibility that it is not ICT in itself that is viewed negatively, but the particular ways it is currently being used in the interpretations of these students.

5.6.4 Positive feelings towards non-fiction writing

The pre- and post-test writers in the treatment group were divided into those who self-reported as being generally positive towards non-fiction writing (n = 29) and those who were generally not positive (n = 31). In a similar vein to the interest in differences between higher streamed and mixed ability students, the difference in experiences of those students who are positively pre-disposed to this kind of writing and those who are not, may be useful in helping to account for changes, as well as suggest teaching approaches for the more disengaged students.

Table 5.15 ANOVA results for positive attitude towards NF writing: time and between-subjects effects

<table>
<thead>
<tr>
<th>Writing Element</th>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig*</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mean</td>
<td>Time</td>
<td>.547</td>
<td>47.938</td>
<td>1</td>
<td></td>
<td>.000*</td>
<td>.453</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alt. POVs</td>
<td>Time</td>
<td>.429</td>
<td>77.069</td>
<td>1</td>
<td>10.806</td>
<td>.085</td>
<td>.050</td>
<td></td>
</tr>
<tr>
<td>Group</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pers. Techs</td>
<td>Time</td>
<td>.992</td>
<td>1.143</td>
<td>1</td>
<td>4.223</td>
<td>.290</td>
<td>.019</td>
<td></td>
</tr>
<tr>
<td>Group</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evid.</td>
<td>Time</td>
<td>.645</td>
<td>31.989</td>
<td>1</td>
<td>4.223</td>
<td>.000*</td>
<td>.355</td>
<td></td>
</tr>
<tr>
<td>Group</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.072</td>
<td>.055</td>
<td></td>
</tr>
</tbody>
</table>

*Significance, *Alpha level < .05, # students who do vs students who do not feel positive towards Non-Fiction Writing
1. Incorporation of alternative viewpoints, 2. Use of persuasive techniques, 3. Use of evidence

However, the figures from Table 5.15 suggest very little difference between the two groups. A pre-disposition towards non-fiction writing is therefore negated as a significant causative variable in the results reported in this investigation. Both students who do and those who do not self-report as enjoying non-fiction writing improved on key measures and improved at very similar rates.

5.6.5 High use of web2.0 platforms

Finally, the pre- and post-test writers in the treatment group were divided into those who self-reported as participating to a high degree in web 2.0 platforms (n = 33)

---

30 In this table the possible values for ‘group’ are ‘those who have a positive feeling towards non-fiction’ vs ‘those who do not’. The possible values for time are pre- vs post-writing for the overall mean and the three specific writing elements reported here.
and those who have a low level of web 2.0 use \((n = 27)\). This grouping is considered here for two reasons. One, it was considered useful to explore the relationship between an interest and involvement in online communities and the effectiveness of writing strategies. Two, as discussed in the literature review, there is an assumption in some quarters that the use of educational technology to facilitate print culture skills, the ‘old wine in new bottles’ analogy, is a limited approach that will under-nourish the learning needs of digital age students. Would those students who were most at home in the inter-networked digital sphere resist a scaffolding type program that focused on print culture literacy skills and a traditional text type in the form of the essay?

Table 5.16 ANOVA results for high use of web 2.0: time and between-subjects effects\(^{31}\)

<table>
<thead>
<tr>
<th>Writing Element</th>
<th>Effect</th>
<th>Wilks’ Lambda</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig(^{a})</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Mean</td>
<td>Time</td>
<td>.538</td>
<td>58.000</td>
<td>1</td>
<td>.000*</td>
<td>.462</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group(^{#})</td>
<td></td>
<td>2.011</td>
<td>2.011</td>
<td>1</td>
<td>.549</td>
<td>.462</td>
<td>.009</td>
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<tr>
<td>Alt. POVs(^{1})</td>
<td>Time</td>
<td>.433</td>
<td>75.988</td>
<td>1</td>
<td>.000*</td>
<td>.567</td>
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<tr>
<td>Group</td>
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<tr>
<td>Pers. Techs(^{2})</td>
<td>Time</td>
<td>.995</td>
<td>295</td>
<td>1</td>
<td>.589</td>
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<td>Group</td>
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<tr>
<td>Evid.(^{3})</td>
<td>Time</td>
<td>.641</td>
<td>32.433</td>
<td>1</td>
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<td>.359</td>
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<tr>
<td>Group</td>
<td></td>
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<td>5.911</td>
<td>1</td>
<td>1.059</td>
<td>.308</td>
<td>.018</td>
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\(^{a}\)Significance, \(^{#}\)Alpha level < .05, \(^{\#}\)students who do vs students who do not use web 2.0

1. Incorporation of alternative viewpoints, 2. Use of persuasive techniques, 3. Use of evidence

According to the figures in Table 5.16, the answer would be no. While there was the expected improvement across time for these students, on the between-groups measures reported in Table 5.16, there was no difference in performance between those students with a preference and involvement in web 2.0 practices, and those who self-reported as uninvolved.

5.7 Summary

This chapter has explored the quantitative data drawn from the argumentative writing pre- and post-test instruments. Through ANOVAs on the overall means and the means of the seven writing elements, it has been established that students in the

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\(^{31}\) In this table the possible values for ‘group’ are ‘high use of web 2.0 platforms’ vs ‘low use of web 2.0 platforms’. The possible values for time are pre- vs post-writing for the overall mean and the three specific writing elements reported here.
treatment classes at both schools, at both year levels and both streaming levels improved in their ability to develop argumentation skills and transfer them to their essay-writing.

The conclusions are necessarily tentative, and the variety of interweaving analyses reported here are intended to enhance the care with which specific gains are advanced. The cross-tabulations, for example, allow us to note not only the absence of all-round gains in the use of persuasion, but that this phenomenon is more pronounced in both lower ability and Year 9 students, as well as students at RCHS. While the cross-tabulations reveal certain patterns and therefore allow a degree of evaluation, this chapter has essentially set up a foundation for analysis based on the attitudes expressed in questionnaires and interviews. It is in this way only that reasons underlying the differing gains might be explored.

The conclusions drawn here are also necessarily limited because of the acknowledged role of variables only partly attended to in the research design. Digital argument mapping is only one element in a learning environment that involves a complex interplay of values, communication and technology. In fact the very strength of the program is that it encourages dialogue between students and between students and teacher. This makes gains in an aspect of argumentation like the inclusion of alternative viewpoints difficult to pin to the technology; perhaps the discussion with the teacher facilitated by the developing map on screen was more important than the actual digital representation? If those discussions are seen as part of the learning environment in which the technology-as-artefact also exists, then it is therefore a strength of this approach rather than a flaw in the research design. We may not know (and do not presume to know through the methods available here) which aspect of the environment led to a particular gain, but we can at least conclude that the interaction of students, teacher and technology of this kind can have a positive bearing on the ways, and extent to which, students incorporate argumentation in their essay-writing.

With these caveats in mind it is possible to conclude that students in the treatment classes:

• improved their ability to develop and maintain a thesis,

• improved their ability to deploy evidence,
• improved their ability to incorporate alternative viewpoints and

• improved the liveliness of their writing through personal voice.

It is also apparent that:

• those students who do not value ICT highly in terms of learning, or those who enjoy collaboration, or those who are positively predisposed towards discussion, all improved in the effectiveness of their argumentative writing to a higher degree.

• variables such as a liking for non-fiction writing and an involvement in web 2.0 practices have been discounted as influences on the improved writing results.

• students were able to transfer these skills to essay-writing in a test that was separate to the digital intervention that helped to develop those skills.

• the use of digital argument mapping program did not motivate students to incorporate persuasive techniques into their essay-writing.

• students in control groups, over the research timeframe, did not significantly develop skills in thesis, evidence, alternative viewpoints and personal voice development but they did improve in the structure of their essays and their ability to write conceptually. While these two writing elements also developed for treatment group students it is clear that this may have been in part due to factors beyond the intervention, a whole-school focus on paragraph structure in particular.

The relative strengths, in essay-structure for example, and weaknesses, in persuasive techniques and the incorporation of alternative viewpoints, revealed in the findings reported in this chapter suggest that accepted essay-writing practices may have blind spots that are holding back the effectiveness of students’ argumentative writing. In particular, persuasion and counter-argument depend on and necessitate some awareness of dialogue, of purpose and intended audience. The extent to which these more communicative elements of argument were engaged with by the students in this intervention will help to explain the effectiveness of this approach. These attitudes of students are the focus of the next Findings chapter.
Chapter 6 – Findings 2: Attitudes to Writing

Figure 6.1 The qualitative phase of the investigation

- Argument as communicative impetus for sustained writing
- Explore literature approaches to writing in a digital age classroom
- Identify and evaluate changes in argumentation skills evident in essay writing
- Evaluate the impact of streaming, school, year and attitudes on treatment group results
- Analyse attitudes to learning with educational technology
- Analyse attitudes to writing, existing writing pedagogy and DAM
- Evaluate implications for writing pedagogy and educational technology
The previous Findings chapter reported that improvements were observed in argumentative skills evident in student writing. While these improvements were statistically significant, especially in the key areas of evidence support and counter-argument, it is now crucial to explore these findings through the interpretations of students and teachers. Only through the attitudes of participants to both existing practices and the novel practices associated with argument mapping can the reasons for improvements reported in the data presented in Chapter 5 be understood.

This chapter establishes a context of student disengagement with writing generally, and student uncertainty about the writing self, especially in relation to analytical writing. Current approaches, particularly involving paragraph templates, are found to be useful but restricting. With this context in mind, students’ and teachers’ interpretations of their experiences with digital argument mapping are assessed in order to differentiate this strategy from current approaches and thus make an evaluation of the reported improvements.

6.1 Introduction: Writing to Intervene in the World?

This dissertation seeks to understand the impact of digital argument mapping on both the effectiveness of student writing, and on students’ engagement with classroom practices that seek to develop skills in this area. In a context of student disengagement with writing, the aim is to evaluate whether argumentation can provide the communicative purpose that will lead to an engagement with classroom writing strategies and then effective sustained writing itself. The previous chapter reported on changes to the effectiveness of argumentative writing, particularly in communicative elements such as the development of alternative viewpoints. This chapter seeks to evaluate students’ and teachers’ attitudes to working with argumentation in order to understand and reliably evaluate those reported results.

It is therefore focused on the second research objective:

To evaluate attitudes to working with argument in order to distinguish this approach from other contemporary approaches and therefore explain changes in students’ writing and attitudes to writing.
In order to work towards an understanding of why gains were made in argumentation skills evident in essay-writing, as well as what these gains might suggest about contemporary teaching practices in this area, this chapter seeks to distinguish practices related to argumentation from contemporary process writing and genre approaches to the teaching of analytical writing in general and essay writing in particular. In order to do so, the first section of this chapter reports the findings of the initial student questionnaire in terms of general participant student engagement with non-fiction writing. This brief quantitative context establishes some key patterns in relation to student choice and connection to authenticity in relation to writing. Having established this context the remainder of this chapter reports on qualitative data taken from the post-intervention semi-structured interviews in order to assess students’ and teachers’ attitudes to writing as a practice and the strategies utilised in classrooms to develop that practice. The second section of this chapter then reports findings from the classroom observations and post-intervention interviews on student and teacher experiences of practices and strategies centred on argumentation and argument mapping.

The interest in attitudes to writing arises from a number of interacting concerns that mark the contemporary English teaching field. As described in the Literature Review, students do not enjoy argumentative writing, and cannot transfer an interest in verbal argument to their written work. Beyond the school context, universities and workplaces are bemoaning limited student skill and interest in this kind of written expression.

These concerns are addressed by a variety of approaches within subject English. These range from a critical pedagogy interest in the way writing back to institutional power depends on the empowerment of finding a voice and identity (see for example Morgan, 1997), through to a broadly constructivist interest in how factors such as motivation and authentic practices impact on students’ engagement with learning. The literature suggests that students’ employment and life-long learning prospects, as well as the creation of a healthy public space (Clark & Ivanic, 1997), depend to some extent on student engagement with writing as a useful activity that they feel can change the world.

If there is a sense in the community and in academia that students are disengaged from writing as a real-world practice, then this is mirrored by concerns that both the
forms of argumentative writing (the structured paragraph, the essay and the persuasive text type) and associated teaching practices have become arid and formulaic. This intervention sought to assess how teachers and students would respond to working in ways that asked them to conceive of learning and teaching writing outside of contemporary mainstream approaches.

6.2 Student Experiences Of and Engagement With Writing.

As a foundation for exploring student experiences of and attitudes to learning analytical writing, the pre-intervention questionnaire and the post-intervention interviews explored students’ conceptions of writing as a social practice, as well as their self-conception as writers. It is a fundamental tenet of this investigation that parallel to questions about writing pedagogy, are wider questions about the way students think of themselves as writers. Extending the critical pedagogy critique of the expressive-self model (Morgan, 1997), which is seen to privilege a humanist subject who merely articulates his or her inner world, Misson (2012) sees the role of subject English as guiding students to produce texts with which “they might intervene in the world for their own purposes” (p. 34). I was interested in finding out how close the students in this study were to being interested in this possibility. Additionally, I wondered whether the intervention would enlighten educators as to how students’ attitudes to writing generally might influence their responses to contemporary teaching practices.

6.2.1 Student perceptions of writing as a social practice.

A snapshot of student self-perception was provided by the pre-intervention questionnaire (Refer to Appendix 5). Figures 6.1, 6.2, 6.3 and 6.4 illustrate frequencies in response to four key questions about the way students viewed their relationships with writing. The figures represent the entire student body, both treatment and control groups at both participating schools. Of additional interest is the large percentage recorded as ‘neither agree nor disagree’. Although this can sometimes indicate uncertainty about the question or perhaps a disengaged attitude to the instrument or process, here they can be accepted as valid uncertainty about the topic in question. This acceptance is based on a comparison of averages answering agree/disagree type questions across the survey as a whole. Apart from
this group of four questions, and another few asking for attitudes to working with technology in class, the response of ‘Neither Agree nor disagree’ occurred at an average of 19% across the entire questionnaire. In the following questions relating to writing, this uncertainty was chosen by an average of 32% of students.

**Figure 6.2 Student attitudes to writing**
Survey Statement: I enjoy writing about the world around me.

![Bar chart showing student attitudes to writing](image1)

**Figure 6.3 Student enjoyment of non-fiction writing**
Survey Statement: I enjoy non-fiction writing.

![Bar chart showing student enjoyment of non-fiction writing](image2)
Figure 6.4 Student attitudes to the usefulness and power of writing 1
Survey Statement: Writing can change the world

Figure 6.5 Student attitudes to the usefulness and power of writing 2
Survey Statement: Writing can change things in my life.
The proportion of students claiming to enjoy writing about ‘the world around me’ or non-fiction generally was under a third, with the latter approaching a quarter. By comparison, the proportion of students who agreed (or strongly agreed) with the statement ‘I enjoy creative writing’ was 53%! There was more of an acceptance, on the other hand, of the role of writing, with just over 40% of students agreeing that writing can change either ‘things in my life’ or ‘the world’. These results indicate that while enjoyment, especially of non-fiction writing generally, might be limited, there is some acceptance of the role or usefulness of writing as a social or political activity.

Nevertheless, between half and three quarters of participating students expressed a dislike – or least an ambivalence – towards this kind of writing and its usefulness. This finding resonates with the general unease in the literature around approaches to the teaching of writing that mark the period either side of this new century. The critical pedagogy field has long been interested in the ways students are discouraged from even considering themselves as writers who might engage with the world. Martin (1985) for example summarises the writing career of the typical student as “ten years of expressive writing and two years of literary criticism” (p. 53); an approach that deliberately disempowers by withholding purposeful analytical writing for as long as possible. The constant regulation and testing of literacy, meanwhile, makes “language use and instruction into pillars of the status quo” (Shor, 1999, p. 294). The cumulative effect is students with “socially subordinate identities” who lack the authority and security to join an “unfamiliar critical process” (Shor, 1999, p. 292).

While it is beyond the remit of this discussion to evaluate the types of identities at play when the participating students wrote or thought about writing, there are key responses in the pre-intervention questionnaire that hint at some of the factors contributing to students’ reluctance to view themselves as writers. A lack of choice, a doubt about personal relevance and a difficulty connecting writing to the real world are all themes picked up on by the interview sample reported in the next chapter.
Figure 6.6. How often do you get to choose a topic to work on in class?

![Bar chart showing the frequency of topic selection in class.](image)

Figure 6.7. How often do you create something in class that gets seen outside of school?

![Bar chart showing the frequency of creating something outside of school.](image)
Chapter 6 – Findings 2: Attitudes to Writing

Figure 6.8. How often do you get to choose what to write about in English class?

Figure 6.9. How often do you write something in English that gets seen by a real audience outside of school?
Like all the questionnaire responses, the answers recorded in Figures 6.6 to 6.9 merely give us a snapshot of thinking across the participating student body. It is indicative however that around 50% of students reported choosing topics to work on or write about (in English classes), either ‘never’ of ‘less than once a term’. Only around 15% reported being given some choice ‘often’ or more frequently. The figures are more dramatic when it comes to indicators of real-world authenticity or meaningful purpose. Over 80% of students reported creating (or writing in English) something that was seen outside of school either ‘never’ or ‘less than once a term’.

While caution is important in assessing the causality or significance of these interpretations, it is at least possible to conclude that the schools have not managed to create a culture where writing is perceived by the students to be connected to personal choice and the achievement of authentic out-of-school purposes. In this regard, the figures reported here tally with a persistent sense in the literature that students are still not involved in writing that matters either to them or their communities. In one recent and broad-ranging overview for example (Graham et al., 2014), non-communicative and non-authentic writing were seen to persist as the norm. In this snapshot of American teachers, persuasive essays were given once or twice a year or less, while the most context-specific and authentic of writing types – blogs, letters, emails and autobiographies for example – were hardly ever assigned. Instead, in-class writing was mainly non-compositional, that is “filling in the blanks, short answer responses, and copying… with just 7.7% of class time devoted to writing extended text” (Graham et al., 2014, p. 1017).

6.2.2 Student perceptions of themselves as analytical writers

Interviews with participating students across the two settings revealed a pattern of hesitancy around the purposes and meanings of analytical writing generally, and essays in particular. Students described the freedom, choice and creativity they associated with creative writing and speaking, but then expressed a generalised feeling of constraint when it came to putting opinions into writing.

I sort of just have trouble with putting it on the page. I can speak freely, but then when it comes to writing the sentence, I'll end up rewriting a sentence maybe like four or five times just going, "No. It doesn't sound right," and then by the time you've done that, you lose where you're at with the rest of it (J9)32.

32 In these codes the number represents the year group and the letter is a randomly assigned code to maintain anonymity.
When students were asked to explore this feeling further they narrowed in on a sense that they lacked choice, in both what to think and what to write. According to student C9, “you have to write down what the teacher says and stuff.” As opposed to the perceived freedom of creative writing, with essay writing “you have to do it on that and lots of people do the exact same thing” (H10). Indeed one student described how in the process of writing her essay about the benefits or perils of ambition in Macbeth, she ended up falling into line with the class opinion:

But I was thinking the other way, that it’s a good thing to have which is you can’t overuse it. But then I ended up writing my essay about how it’s bad because the whole class was just saying it was bad, so I just caught up with them that it was bad. And so my whole essay is not what I believe but I just wrote it down because that’s what everyone else had type thing (B10).

A sense of self-doubt about both the worth and the correctness of opinions expressed in this kind of writing pervades the interview sample. “If I do a persuasive thing, I’m really bad at it because I always think, ‘That’s not right. That’s not what they’ve got here, so it’s not right, the way I say it’” (I9). While many students indicated that boredom with topics studied, and a lack of content to write about, added to their sense of unease with this kind of writing, it is important to note here that there was a powerful motif of restriction running though the interviews. “I think I don’t open my mind up enough just to go, ‘Let’s just write and see how it goes.’ I’m like, ‘Oh, writing? I don’t really want to do that.’ And that’s what ends up on the page” (K9).

The comparisons that many students made between speaking, whether formal public speaking or classroom discussions and debates, and argumentative writing deepen this sense that writing is viewed as less “alive” or “vibrant”(J9). Students not only enjoy expressing themselves – “I don’t mind like my opinion being out there” (D9) – but they explicitly stated that they felt that writing inhibits this:

I find I can express emotion in that way [speaking] so I can really feel like I can connect with the audience because it’s a live thing, whereas writing, when that person is reading it, I don’t feel that connection. It’s hard to express (J9).

The strands of thinking amongst a large proportion of the students, regardless of year group, streaming or school were consistent with their sense that the social practice of writing was regarded as unrewarding and constraining. Students
consistently saw essays and argumentative writing as something they did at school because they were required to. There was very little sense that writing could perform a social purpose such as enabling engagement with the public sphere. Students felt that their writing of opinion was constrained by their desire to give the teacher the expected answer rather than facilitated by their keenness to have a say.

There is no evidence from the interviews that the intervention had any impact on these feelings towards writing as a practice. Provoking or measuring such changes was not a goal of this investigation, but it is important that the digital argument mapping intervention did lead students to reflect through the interviews on their relationship with writing. In many ways this is a more important goal for design-based research than a simplistic measurement of gains in engagement, especially after an intervention of this type and length. The post-intervention interviews triggered for many students a more informed exploration of their unease with essays and argumentative writing. Engagement with this form of writing – as it is presently conceived and taught – is low, and as long as students do not see themselves as writers and do not engage in meaningful writing practices this is unlikely to change.

The following sections, exploring current teaching practice in this area as well as the argument intervention, should be seen in the context of the attitudes expressed in this section. Contemporary approaches to teaching analytical and essay-writing have their genesis in a desire to treat student writers like ‘real’ writers, and to involve them in the structures and purposes of writing as cultural communication. That students, on the whole, do not feel like real writers participating in something that matters to them, suggests that this genesis has been forgotten or eroded, and is a warning to educators that writing instruction predicated on doing more of the same may work to exacerbate the problem.

6.3 Student attitudes to classroom writing strategies.

This section begins by exploring the views of students and teachers at the participating schools about what works for them in the classroom when it comes to learning and teaching argumentative writing. Supporting literature and the
interview data are then used to assess actual classroom practice against these student and teacher interpretations.

6.3.1 What works in the opinions of student and teachers?

According to the students in the present investigation, the keys to their success in and engagement with argumentative writing are an interesting topic that involves meaningful discussion with peers, a supportive teacher and the opportunity to work on models which are then used to develop their own versions. The general sense that an interesting topic is the key involves not only a desire not to be “bored” (D9) but a consistent emphasis from students in the interviews that engaging subjects provide them with enough content to write about and enhance their understanding of key terms and issues. Most interestingly, the consistent call for interesting topics goes hand in hand with the perceived importance of being able to talk about these topics in meaningful ways with other students before any writing takes place:

When you have a talk before you can get more ideas ‘cause I just sit there like when we just had to write and like retelling and then write the questions about it when you think what am I gonna do? What answer can I put down or anything? But when you talk about it before you get more ideas on what to write down (H10).

Students’ emphasis on talk, especially before writing, is one of the key themes of this dissertation. It is taken up in both the following section on argument mapping as a pre-planning strategy, and the following chapter on the dialogic learning environment needed to ensure that educational technology is used in ways that benefit student learning.

In order of frequency of interview mentions, quality time with a teacher to discuss and review written work came after interesting topics and time to talk. Here students are referring to a variety of experiences ranging from a non-specific “nice”ness (E9) of the teacher, to a very particular sense that the teacher takes the time – in either online settings such as Edmodo – or during one-to-one conferencing in the classroom to help students review aspects of their writing. While working with peers, outside of opportunities to talk, is not mentioned by the interviewees in this investigation as a primary factor in their engagement with writing, the emphasis on workshopping written work with the teacher gels with the reported significance of the collaborative aspects of the process writing approach (Sutherland & Wilkinson, 2010). The importance of the student-teacher relationship
is a theme picked up on in the following chapter in the light of student and teacher attitudes to the use of digital technologies in the writing classroom.

By ‘models’, the students were referring to both whole text exemplars of an essay, for example, that are discussed in class and used as templates, and paragraph structure scaffolds such as WHY, STEEL and PEEL\textsuperscript{33} that they were explicitly taught in order to support the organization of ideas within a paragraph. Teachers and students alike credited these paragraph structures, in particular, with helping students to develop argumentative writing skills. The interpretations reported here offer only a snapshot of attitudes, and it is beyond the scope and intent of this study to measure the impact of these approaches on either student engagement or writing effectiveness. However, as the emphasis on this type of paragraph structure, as a focal point of a text types approach, is widespread through NSW schools\textsuperscript{34}, it is both a potential confounding variable in this investigation, and a key to exploring attitudes towards the alternative approach trialled during the intervention. As such, student and teacher attitudes to paragraph structures as a classroom approach to learning argumentative writing are explored here with the view to developing a nuanced account of what engages students and teachers in this practice.

The student investment in a paragraph structure approach rests on a sense that it helps them ‘get’ the required set out, and it assists them to remember ideas and information:

Sometimes I don't really get the set out, how we are supposed to write it. I prefer to have it set how I'm supposed to write it so that I know -- because otherwise, it's just me writing, and so it doesn't really make sense, whereas if you have a set thing like a "WHY" paragraph, it makes sense, but if you don't have anything set like that, it doesn't really make sense (L9).

Students consistently mentioned a sense that the paragraph acronyms such as STEEL help them to “know where to put things” and make their writing “sound more like an essay” (K10). According to one student “all of my ideas that I’ve been mentioning in the introduction would be jumbled up all over the place” (J10) without the paragraph scaffold. For another student, the WHY structure “jogs your

\textsuperscript{33} WHY – What, how and why; STEEL – statement, topic, elaboration, example and link; PEEL – point, elaboration, example and link.

\textsuperscript{34} The NSW government recommends TEEL – topic sentence, elaboration, examples, link – on its Learning, High Performance and Accountability Directorate website (NSW DEC, 2015)
memory on what part goes next” and is thus “helpful” (F10) in the requirement to set out ideas effectively.

While teachers also credited factors such as feedback, modelling and practice in their sense of what works for students, they too are invested in the paragraph structure approach, often as part of a whole school initiative:

“We did a lot of teaching around structure first and we tried to do that all throughout the term. So, one of my very first lessons was a lesson on WHY paragraph structure and why we use WHY paragraphs with the scope towards Year 11 and 12, even pushing that aspect of it (SB).

Teachers on the whole expressed an indifference to the particular acronym used, but did suggest the usefulness of the paragraph template approach in helping students both set out their ideas in the required academic format, and “think outside the text and relat[e] it to the world” (SB).35

It is important to note, in terms of the trustworthiness of these findings, that neither students nor teachers mentioned paragraph templates unsolicited when they were asked in interviews to explore what they thought helped them to write, or teach writing. While terms such as scaffolding, practice, and modelling were used unsolicited, the responses discussed here came from an explicit interviewer question about WHY or similar paragraph templates. The approach is generally accepted as a norm within schools, and while its usefulness is mentioned by some students when they were prompted, there seems to be little enthusiasm generated in response to this strategy. Indeed, some students find it “confusing” (H9) and many others hint at a long repetitive process: “It took me a very long time to learn the WHY paragraph structure” (A10).

The end result, a planned paragraph, was not found to be helpful by some, while for others there was an ongoing confusion that hints at some of the acknowledged problems with a focus on structure over or before other aspects of writing:

I haven’t remembered the-- but I do follow the kind of steps and that. So I remember T is… I know it’s the thesis statement and you always… the conceptualized… something thesis statement and we follow those words by remembering what they are, the thesis statement is the question. You’ll do the question asked and you make your statement as to answer that question and there’s a lot of other ones as well. [Laughter] I don’t usually

35 Participating teachers are referred to by their initials to maintain anonymity.
remember them [the other acronym elements]. I just remember to how to
do an essay I mean I only really do it one way (L10).

The struggle to define elements of the approach, within a generalised understanding
of purpose of the template, is generally indicative of many students in the interview
sample. The template has been learnt at some point, utilised as part of classroom
activities and perhaps used to help develop an essay. However there is little sense
that the template has been fully understood, or that it can be used for anything more
than the structuring of an acceptable paragraph.

### 6.3.2 “Pointless” versus “meaningful” writing.

There is a palpable sense that students in this investigation recognise the difference
between “pointless” and “meaningful” (G9) writing. Whether the writing is done on
a laptop or on paper, the students were consistently aware of the purpose, or lack
thereof, of the time spent writing: “Just writing off the board is exactly what we are
doing” (J10). This same student describes the process of working with the
paragraph acronym STEEL in order to develop essay-writing:

> It’s just been her really writing stuff on the board to help us with it and
> then we going-- us going home, the students and like just writing essays
> after essay pretty much just practising what we can do but we all, when
> we did our essays probably at the start of the term for our assignm-
> ent, we all got I think pretty good marks but they weren’t good enough for class
> two standard so she made us do it again. So it’s just a little practice and
> trying to get everything right (J10).

The relative merits and deficiencies of the genre or text types approach to teaching
writing are well-rehearsed. In the student responses presented here, especially the
way the paragraph templates are seen to clarify the task and the required response
to it, we see the benefits of making linguistic structures explicit. On the other hand,
the failure of students and teachers to completely embrace the model, resonates
with concerns stretching across the last twenty years that a crude interpretation of
the genre approach has led to reductive and mechanistic lessons and student output,
with consequent damage to student creativity and engagement (Sutherland &
Wilkinson, 2010). Kamler (1995) criticizes the “narrow focus on language and text
and … lack of attention to the instructional and disciplinary contexts in which texts
are constructed” (p. 9) while, more recently, Moon (2012) has argued that the deep
structures analysed through this approach lie below the surface and can, as such,
work as abstractions only for mature writers to make generalisations on. For novice writers this is problematic when they are asked "to replicate the deep structures of texts without first attending to the surface arrangement and style" (p. 45).

The use of paragraph templates to scaffold students’ argumentative writing in the two participating schools, as apparent from interviews and classroom observations, confirms the growing view that the approach has been watered down to a formulaic set of practices that sideline an emphasis on audience, purpose and the range of possible genres that is a focus of the approach in theory (see for example Sutherland & Wilkinson, 2010). The fact that students (and teachers) find a text type structure approach useful does not necessarily mean that it is beneficial for learning. Criticism of the text types approach has long pointed to the kinds of formulaic learning and writing that emerge from this process (Sutherland & Wilkinson, 2010), no matter how ‘useful’ it might be. The students in this investigation confirm this research direction through their emphasis on feelings of confusion and the absence of creativity compared to imaginative writing. A key finding of this investigation also extends our research understandings by acknowledging the feelings of constraint that students report, especially when they feel they have to fit ideas into a predetermined structure and a predetermined viewpoint.

Considering the sentiments about writing evident in these findings, perhaps it is unsurprising that students and teachers are reaching for a stable and well-delineated strategy that gives them both something firm to grasp. With writing seen as “pointless”, widespread confusion over the purpose of essays and the social role of this kind of writing, and the unease students reported in relation to trying to structure their argumentative writing, the paragraph templates give students and teachers a clear lesson objective that results, at least superficially, in success. Structures such as the paragraph templates used in these schools can also, however, be a crutch that obscures the weakness at the heart of the teaching context. Structure can work well as a bandaid to pointless and repetitive writing, to uninteresting topics, and to essay writing that is devoid of purpose, context and audience. But perhaps only to an extent. This kind of structure does not seem to address the feeling that students have of being constrained both by the form itself and the strategies being used to develop competency in it. Indeed, it is entirely possible that the template approach is actually exacerbating the problem. In order to
explore this possibility we will now turn to the key element of the research intervention: the attitudes of students and teachers to the argument mapping program trialled in the treatment classes.

6.4 Attitudes to Using the Digital Argument Mapping Program in Class.

This section outlines the key themes, derived from student and teacher interviews and observed in their classrooms, in relation to the benefits and weaknesses of digital argument mapping as a scaffolding strategy for the writing of opinion. Some identified benefits chime with the advantages of current approaches, while others distinguish argumentation and argument mapping as a potentially more communicative and hence meaningful approach to writing.

6.4.1 Planning and understanding structure.

Students and teachers credited the diagram of the developing argument (see Section 4.2.4) with helping them to understand both the required structure and the elements of argument that lead to effective writing. According to student B9 “you had it all planned out on the sheet and because we had different diagrams and stuff like a thesis and all our dot points” the sense of what to write, and how, was clarified. “It makes it like so like it makes sense and so that’s how I could kind of section it off and make more understanding of like how to put it together” (E10).

While the students here do not explicitly differentiate these processes of planning and understanding from how they might describe their work with the paragraph templates that are a key feature of a genre approach, the teachers’ comments suggest important differences:

It’s another way to say well particularly in planning because I think sometimes students just want to write and maybe they get everything down but they miss that planning stage. I think that really helped them there just to really think about those ideas and plan them but also to see another model of how things can be put together is really useful (AH).

There is a sense here, and in the teacher’s explanation below, that the planning done on the digital map feeds directly into a more purposeful thinking about what is being written:
I personally like the idea that every different section of it was going to have a different shape. I like it because the kids could then see that in certain aspects in different paragraphs would end up in different paragraphs have the same purpose and the same function. So all the bits in rectangles were reasons why you believe something, all bits that were in - I think it was ovals - were evidence from your text and all bits that were in clouds were links to your thesis. And I think that worked really well to have a visual difference between the parts that the kids could easily identify. So I like that aspect and it was easy to use in terms of actually making a mind map and moving things around and creating something that was a good graphical organizer (JR).

There are three important differences between the argument mapping and the paragraph template approach hinted at here. The first is the visual layout of the former – discussed in the next section – but seen here as crucial for a student understanding of the relationships between the different parts of an argument. Second, while there is a focus on structure, the emphasis is on the purpose of that structure and, once again, the connections and patterns – such as types of evidence or relationships between ideas and the overall thesis – facilitated by the structure. The third difference is the teacher’s sense, in the final quote above, that the structure works to support metacognition, related to conceiving of different kinds of reasons for example, in a way beneficial for her students.

6.4.2  Visual organization.

“It made it a lot neater. It helped me set it out” (E9). The motif of a positive reaction to the way this program helped students to lay out and organize ideas is very strong through the interview sample. “I think it helps just because it puts it there visually and you can see where you have to separate and what part you use for which section, which is good” (K9). The students’ responses here resonate with the general sense in the literature (Harrell & Wetzell, 2013; Nussbaum et al., 2007) that the visual organization of ideas extends the cognitive focus of approaches that set up a theoretical structure, model and analysis of that model, then expect students to construct their own based on the template. The usefulness of this approach is contrasted – by student H9, like many others – to the way the abstract dot points made the WHY paragraph template unhelpful: “it was so confusing and I didn't use the sheet” (H9). According to this student, the visual layout of the argument map,
on the other hand, guides her thinking so that her path through the essay is clear in front of her.

Many students labelled themselves as “visual learners” (L9 for example) and commented on the way the program therefore “made it easier for me to learn” (L9). The following two student quotes suggest the ways in which the mapping allowed for the structuring of a text length argument:

It showed -- it set it out in a way that was easier to read. So basically, you go, I want to see what it meant by Macbeth's power, so you look in the power one. And then it goes down and it gives you the examples of what you put down for it, and then it explains it as well with the way I set it out it did. And then I could go, okay, that's easy (B10).

and

Well when I did the three different arguments you can like separate them off and then you just like, it's easier to like fill them in and like compare them and everything when they’re all just like-- you can put them like next to each other and everything. It’s like easier to see how it’s all working out (F10).

These student responses resonated with the views of the teachers who not only commented on the engagement of students with the visual process – “I think the kids really did like seeing just a model of their ideas being posted in there” (AH) – but the way the visual connected with understanding: “it helped quite a few of the kids that are visual learners or pretty good with visual learning. They could see what fitted where quite well. And they were pretty quick to figure out that these bits went together and [that] those bits went together” (JR).

6.4.3 Elements of argumentation.

The topic of discussion most significant to the developing argument of this dissertation, is when the thoughts of students and teachers moved beyond planning, organization and layout to consider how the argument mapping program enabled them to think about argument itself. Students were not asked explicitly to discuss the way the program facilitated elements such as alternative viewpoints, so it is interesting how many touched on this factor when describing their experiences:

That's been very useful, especially for me learning the set out of an essay like saying this is why and this is why it isn't. At the start of term, I didn't get that at all. I was like, why don't you just choose one side and stick
with it…I think that really helped grasping the concept of that [including opposing points of view]” (I9).

The teachers, on the whole, echoed this perceived benefit. PM noted how both programs introduced her students to “that idea of counter argument”, especially in a context where their work in “exposition” was, she felt, too often one-sided. “Yes, we did discussion but it’s very tokenistic I think and discussion means looking more at both sides.”

That teachers and students alike spoke favourably and unsolicited about the way the program introduced them to, and facilitated their use and understanding of counter-argument, is a significant finding and connects the interview data to the results of the writing pre- and post-tests. The improvements in treatment students’ abilities to include meaningful alternate points-of-view are, as we have seen, statistically significant. Here, it becomes apparent that both students and teachers were engaged by the way the program allowed for the inclusion of opposing viewpoints. In addition they were highly positive about the way the idea of counter-argument as a rhetorical device was facilitated by the classroom use of this strategy.

One teacher in particular notes the way that an orientation towards counter-argument also helped to develop a more personal, responsive and mature position from which to write:

It has also given them more of a voice because not everybody has always agreed with the line that’s been taken. And so in the essays, the final essays, some did two positive paragraphs and one negative or others did two negatives and one positive. But they have choice then rather than just having to say one way or the other. And some wanted to say both, and so that style of approach and seeing and having a lot more to look at certainly gave them more choices and could make them defend their arguments a lot better and have more to argue. So I think that was beneficial and different from other terms (PM).

The impression held by this teacher, particularly that the students had “more to argue” as a result of the training and practice in counter-argument, triangulates with the improvements reported through the writing results and suggests one probable reason: the choice of lines of argument are expanded by the argument scaffold so that students have more authentic opinions that they can develop through a piece of writing. In addition, these significant findings bring into sharp relief one of the key
supposed benefits of the text types approach. The paragraph template is meant to help students elaborate on their ideas and provide evidence for their views. Measuring the effectiveness of the genre approach in achieving this goal is not one of the objectives of this investigation, and the literature on this account is certainly not clear (Graham & Perin, 2007). However, the responses of teachers and students on their use of the argument mapping program, strongly indicated a sense that students were both able to elaborate further on ideas and achieve a higher degree of conceptual understanding based on the scaffolding of argument as opposed to the existing approaches they were used to. The same teacher suggested that the voice found by students arguing both sides meant that:

they had to be more empathetic and holistic in terms of their understanding of the concept and that there was no wrong or right way of looking at it anything. I think it certainly built into that and as I say, the detail in their paragraphs certainly improved to defend that argument or, you know, that point of view (PM).

It is clear therefore, from teachers’ responses, that they recognized in their students’ work that argument mapping not only allowed for the inclusion of more meaningful alternative viewpoints, but it also had a positive bearing on the way they were thinking about and using another key element of argumentation, evidence:

I think they were starting to get the idea that for English and for writing an essay, you had to be able to link evidence to your points and that you had to support your points more than they probably would have otherwise (JR).

For this mixed ability class this was a major development in their orientation towards writing. The teachers of two higher ability classes echo the idea that the mapping program facilitated a kind of brainstorming of “a lot of points, but [especially] what either was the most important or what you could back up the most strongly. So that was good. They got to think about that, what’s the best” (AH). For PM this resulted in a marked improvement in both the quantity and quality of the arguments deployed in their post-intervention writing:

I think looking at all their essays at the end they certainly had a lot more content to support their argument. You know, in terms of arguments they actually had detailed examples to support it rather than just saying they did this. They could give examples and they gave quotes and they could
prove what they were saying. So they had more argument to defend, you know, their point of view. So I think that was very clear (PM).

While the teachers’ perceptions – that the students working with the program improved their use of evidence as part of their argumentative writing – resonates with both the writing data and the students’ own description of the perceived benefits of working with the specific strategies embodied by the program, there is another intriguing possibility derived from the classroom observations. It is possible that it is not only the structuring, layout and “voice” facilitated by the program that leads to benefits, but the dialogic environment created by the specific teacher-student and student-student interactions with the program. All teachers were observed making the rounds of the students working with the programs and entering into constructive interventions around the nature of the task and the nature of arguments and evidence. While a full analysis of these interactions is one of the elements of the next chapter, here it is worth noting that there were substantive discussions between teachers and students beyond either technical support or general class management observed in all participating classes.

Teachers were observed discussing the nature of the required thesis, the links back to a thesis, the use of reasons to support an argument and the deployment of evidence to support reasons. This last component was perhaps most commonly observed, suggesting that the learning environment created around the programs facilitated an in-depth workshopping approach to the development of supporting detail for student arguments. Whether the teachers used the exercise of digital argument mapping to give advice about the nature of argument, or point out connections for the required essay, the digital argument mapping was observed to create opportunities for meaningful teacher-student discussion while other students’ arguments were developing in their own collaborative digital environments.

While the Discussion chapters will further explore this point, it is worth noting here that it is the communicative elements of the learning environment around the writing strategy (or digital technology) that appear to facilitate an approach to a strategy that is found to be beneficial by students and teachers.

6.4.4 Thinking and reflection.

Although it is clear that some aspects of this way of working mesh with, or perhaps merely extend, existing approaches to argumentative writing, it is also apparent that what teachers and students described were ways of interacting and of thinking that
are outside the usual ambit of the text types approach. This is particularly so when teachers attempted to describe the type of thinking encouraged during use of the program:

> And I think what they did is they really thought about that [evidence and reasoning] and we did talk a little bit about prioritizing a little bit on my debating slant of that. Either point comes out first, that kind of thing. And they got to think about that (AH).

This sense that the students were taken to a new point is emphasized during this exchange with the teacher of a mixed ability class:

> And for this bottom end of kids, that’s the first time I actually have seen some lightbulb moments that-- “Oh, okay.” First, I say that and I prove it with that and then people are going to believe me. And my teacher is going to be impressed kind of thing, so it did turn a few lights on at least.  
> [Interviewer: And was that sitting in front of the computer using the Draw.io at that moment?]  
> Yeah, that’s sitting in a computer room and figuring out what to put in that particular bubble (JR).

We have seen for the writing results that conceptual thinking about the topics improved for both treatment and control groups. The kinds of thinking being described here, on the other hand, relate more to a cognitive, or metacognitive framework, where an understanding of the point of argument and of writing analytically is consciously considered as part of the learning process.

Approximately two-thirds of the interviewees mentioned some form of initial or renewed understanding of the rhetorical nature of their writing as a development from the focus on argument. For student D9, the process of working through appropriate arguments pushed him to think about how he could “connect with the audience” in ways that he had only previously considered in relation to verbal debating or speeches. The sense that the purpose of writing involved the attempt to influence an imagined or intended audience towards acceptance of one’s point of view was touched on by many of this sub-sample; the wrestling with content drawn from texts, as well as the structure of the visual representation, were focused on a rhetorical purpose rather than the need to fill out the abstract elements of a paragraph template.

It is particularly heartening that mixed ability classes – perhaps most at risk of disengagement when the purpose of classroom activities is not clear – found the
argument mapping beneficial in opening out the purpose and organisation of their writing.

6.4.5 **Other benefits discussed in interviews.**

Students in particular mentioned two other aspects of working with the mapping program that they saw as beneficial. The first relates to the assistance it had given them in remembering the required content:

> I found it very useful because, like I always do it like with the test today, I always forget everything 'cause I’m nervous. It was good having that there so, like there’s something there and then I can just remember more about it from having it there so that was good (C9).

The student is referring here to her use of a printed copy of her argument map as support for an in-class essay during the intervention. In a traditional open-book writing task students may be permitted to bring in notes or summaries to refer to while writing. Several students commented, in post-intervention interviews, that having the argument outline worked as a powerful quick reference to the structure of their prepared argument as well as an overview of key supporting evidence.

Secondly, approximately one third of students commented unsolicited on the “interactive” (E9) nature of the program. For this student, being able to take it home and repeatedly change the diagram helped him to keep developing ideas. While it would be possible to construct an argument map on paper, the computer was seen to improve the malleability of the diagram: “it’s easy to add annotations and stuff like that” (C10). The ease of changing, updating and adding dovetails into a generalized enjoyment of the on-screen experience in relation to not only its practical nature but the way the interaction with the program developed understanding; according to E10 using the program was “pretty fun ‘cause you get to like color and then you got to get different shapes and they like gave you a better understanding of it ‘cause it’s more like hands-on kind of thing.” This fluidity of the map itself and the potential interactions with it is a common theme:

> It’s actually more fun. It’s more fun you can play around with it and it’s not just write this, write this, write this. You can play around with it, plot like new things up on there. You can change your texts and change like the images. It’s more fun for you (H10).

It is not only the enjoyment of the empowered space that is recognized, but the usefulness of this kind of mapping structure for preparing to write:
it made it quite a bit easier actually cause you just type it in and then you
just change around the words so it sort of positions it for you. You can
type it in, positions it for you, and then you can go off that and that’s like
a draft done (K10)

For the teachers too, there was a recognition that “moving something around and
creating something” was a useful approach to developing argument ideas: “it was
quite simple to use, quick for the kids to pick up and easy to modify if you made a
mistake” (JR).

6.4.6 Perceived weaknesses.

While the overall response to using the argument mapping program to develop
students’ writing was positive, students and teachers did identify areas where either
individual students or types of classes would potentially struggle.

There were students who “just don’t like mapping out” (D10) ideas, and those who
could not see the difference to doing it on paper. There were those students resistant
in general to using digital technologies. Student I9, for example, said, “I'm still one
of those people who loves pen and paper. I just think putting your ideas on a
computer, it's just like – ugh.” On the whole, reservations of this kind – which were
unusual across the whole data set – came from students in the higher ability classes
who were keen not to let the strategy interfere with their thinking and writing
processes, which they saw as already well-developed. For one of the teachers of a
mixed ability class, on the other hand, the weakness of the program lay in the
difficulty some of her students had in “getting their heads around” applying their
“argument skills and … language skills to that set of bubbles you got in front of
you” (JR).

Across the spread of higher ability and mixed ability classes there was a discernible
difference in the types of benefits mentioned by students and a corresponding
theme to the negatives described. Mixed ability students liked the layout and visual
elements of the program, while it was their teachers who most often worried about
the potential for these students to use the program to its full potential, either
because of deficiencies in literacy skills or lack of understanding of argumentation.
On the other hand, students in higher ability classes, while also commenting on the
merits of scaffolded organization, most often prized the way working with the
program facilitated their use of alternate viewpoints and higher order thinking.
However, one of three teachers of higher streamed classes thought that, on the
whole, the program “didn’t give them anything that they couldn’t already do because of the nature of the [highly able] class” (TN). While this teacher was, elsewhere in her interview, supportive of specific features of the program, and her students were largely very positive, her hesitation here speaks to a nervousness that any digital tool of this kind will interfere, in its staged scaffolding of thinking processes, with the cognitive processes of already able students. The literature, as we have seen, does not in general support this view, but it is important for the reliability and validity of this investigation to report on these interpretations by some teachers and students.

6.5 Summary and conclusions

This chapter has looked at how students see the place of writing in their lives, and how both students and teachers feel about the ways argumentative writing is learnt at school.

1. Students do not see themselves as ‘writers’. They do not, on the whole, see non-fiction, argumentative or essay writing as something that is enjoyable or useful. Most students do not imagine they might intervene in the social sphere with writing as their tool.

2. While, as expected, the intervention had no influence on these feelings, the process has revealed important possibilities to explain this situation. Students feel compelled – in these forms of writing – to write what they think is ‘right’. They feel constricted by elements of the form and the subject matter. Compared to the confidence and freedom they feel when asked to argue verbally or write imaginatively, there is a mixture of confusion, doubt and unease when faced with argumentative writing. The questionnaire and interview data revealed that contributing factors in these sentiments are the dearth of opportunities to choose topics and the limited scope for authentic and purposeful writing to actual audiences outside of the classroom.

3. Students in these schools do not participate in a meaningful way and to a meaningful extent in three of the four strategies most commonly cited in the literature: purposeful writing, collaboration during the writing process,
awareness of audience and the explicit teaching of strategies (Graham & Perrin, 2007; Hattie, 2009).

4. The two schools involved in this investigation could be seen to focus only on the explicit teaching of strategies related to text types and paragraph templates (the fourth strategy from the literature cited above). This suggests a narrowness of approach to writing instruction which resonates with students’ feelings of disengagement and constraint. While both the literature and participants in this investigation see benefits in this approach, the student respondents have limited understanding and engagement with activities related to paragraph structure. Firstly, the strategy is used in contexts where most school writing is non-communicative and non-compositional. Students in this study commented on the perceived pointlessness of most writing they are asked to do. It is a tentative interpretation of this investigation therefore that while the paragraph templates are found to be useful, they are limited in their ability to either engage students in the social practice of writing or lead them to an understanding of the potential rhetorical purposes and contexts of argumentative writing. Indeed, while the genre-based text types approach may lead to the construction of paragraphs that mimic the required model, there is little sense in the literature and amongst the students of these schools that “writing and articulation” (Kemp, 1995, p. 180) in the socio-linguistic sense are enabled.

5. Teachers and students appreciated the objective of the digital mapping in developing argument and doing so in a communicative way. The program was found to help students plan their ideas for writing through the visual layout of the argument. This is distinct to the more abstract paragraph template model in that the focus of the map is on the nature of the argument being developed.

6. Students and teachers appreciated, and were observed engaging extensively in, meaningful discussions that were facilitated by the developing argument map.

7. Students and teachers, both without specific direction in this regard, mentioned counter-argument as a revelation from this process. Students independently recognized the value of including alternate points of view as either a rhetorical device or a means to a more balanced discussion, and teachers saw the independence of voice facilitated for students with the use of this aspect of argumentation.
In all there is a distinction which has been drawn in this chapter on the basis of writing data, observations and post-intervention interviews, between a mainstream text types approach and an alternative strategy based on a mode of discourse that is by definition communicative, and develops communicative practices and responses. In contrast to the paragraph template approach, argument mapping:

- Facilitates a visual layout that is focused on an *understanding of the purpose* of the writing.
- Focuses on structure not as an end but as a means to considering patterns and *relationships between ideas*.
- Develops *metacognitive thinking* about argument.
- Facilitates the inclusion of alternative viewpoints in a way that allows students more of a *personal voice*, and hence unlocks for many the feeling of restriction hitherto felt in regards to essay-writing.
- Involves a *dialogic workshopping* approach which is both facilitated by the argument mapping process, and then feeds back in to enhance the effectiveness of the ongoing process.
- Allows students to interact with a changeable object (the map) which then facilitates a *fluidity of thinking* and planning that contrasts to the feelings of constraint described by students when trying to write essays using a text types approach.
- Orients the student as thinker and writer towards an imagined or intended *audience*, thus giving a meaningful context for decisions about which evidence to include or line of argument to develop.

To what extent can these features be described as ‘communicative’? By definition communication can be seen to involve the following features: a willingness or motivation to interact with another; a purpose; the exchange of information or ideas; a means (such as email) and a real or implied audience. Argumentation and argument mapping facilitate such interactions in their classroom processes and written products. Students are guided towards verbal and written dialogue, and in their consideration of argument grammar, retain a focus on the purpose of their writing and the nature of the audience they are writing to. Above and beyond

36 Definition adapted from Merriam-Webster online dictionary: [https://www.merriam-webster.com/dictionary/communication](https://www.merriam-webster.com/dictionary/communication)
structure and drafting, students develop a personal voice that echoes an earlier era of openness and hesitancy in the writing of essays.

Care has been taken in this chapter to make pragmatic and trustworthy claims on the basis of interview and observation data. It is important to recall that these findings are a snapshot of opinion, both within the two schools and across the sample population. While students were purposefully sampled to obtain a wide range of opinions from a variety of student backgrounds, the opinions represented here are only tentatively representative. It is useful to emphasize, in addition, that the interpretations voiced by participants here are most relevant to this investigation in terms of their correlation with other data. Hence positive attitudes to the argument mapping program are related to improvements, especially in key argumentation skills, reported in the previous chapter’s analysis of writing test results. Attitudes expressed in this chapter are connected, in the following chapter, to attitudes to learning with technology in general and with further observations of student and teacher behaviour in the intervention classrooms.
Chapter 7 – Findings 3: Attitudes to Educational Technology

Figure 7.1 The qualitative phase II

 Argument as communicative impetus for sustained writing

- Explore literature approaches to writing in a digital age classroom
- Identify and evaluate changes in argumentation skills evident in essay writing
- Evaluate the impact of streaming, school, year and attitudes on treatment group results
- Analyse attitudes to writing, existing writing pedagogy and DAM
- Analyse attitudes to learning with educational technology
- Evaluate implications for writing pedagogy and educational technology
This chapter identifies and assesses the attitudes of students and teachers to their use of digital technologies for school-based learning and teaching. The research literature suggests much about the purported gains in learning expected from the use of digital technology. In doing so, it draws on teachers’ experiences and the conclusions they enunciate about what works in the classroom. This dissertation has posited that the experiences and interpretations of students have hitherto been both under-examined and under-reported.

In response, this chapter explores students’ attitudes to key aspects of educational technology – content provision and presentation, collaboration and higher order thinking in particular – and compares these attitudes to both the relevant literature and to their own teachers’ views. In this way, a context is built for understanding student and teacher attitudes to digital argument mapping as one specific type of educational technology.

The first Findings chapter, Chapter 5, assessed the impact of the digital argument mapping on argumentative writing, and the second Findings chapter, Chapter 6, explored the attitudes of students and teachers to this approach to writing in the context of students’ attitudes to writing and their experiences of other approaches. This third and final Findings chapter assesses students’ conceptions of the digital age classroom in order to develop an understanding of what students consider to be beneficial learning with technology.

7.1 Introduction

The use of digital argument mapping technology in the classroom rests on a number of assumptions about what writing is, and how it can be learnt. These assumptions, in particular the role of the visual and hierarchical organisation of argument to support the development of effective writing, have been assessed in Chapters 5 and 6. However the learning environment that has been the focus of this investigation is specifically a digital one, and this aspect of students’ interactions with each other, their teachers and their computers has hitherto been in the background. This chapter seeks to foreground issues specific to the use of digital technologies in the classroom by assessing students’ and teachers’ interpretations of their use of
Rationale and Draw.io in the context of their attitudes to learning and teaching with digital technology in the English classroom.

The first Findings chapter (5) of this dissertation reported on quantitative data revealing the qualified success of the digital argument mapping intervention in improving key features of student argumentation evident in their essay writing. The second Findings chapter (6) evaluated students’ and teachers’ attitudes to writing in an effort to provide a context for exploring those improvements. A key finding of that chapter was the way that the particular characteristics of argument mapping appeal to students and teachers, especially when juxtaposed to accepted strategies in use in the contemporary classroom.

This third Findings chapter draws upon qualitative data from the semi-structured interviews to assess the benefits and disadvantages teachers and students describe in relation to their experiences of learning in the digital classroom. The key aim, in line with the third research objective of this investigation, is to distinguish the uses of educational technology, particularly those identified by teachers and technology aficionados as ‘revolutionary’, from the sense that students have of actually learning with digital technologies. From this foundation in the attitudes of teachers and students, the Discussion chapters to follow, Chapters 8 and 9, evaluate whether the argument mapping program, and the learning environment in play around its use, facilitated improvements in writing because they suit the ways students prefer to learn with technology.

This current chapter therefore addresses the third research objective:

*To evaluate the extent to which digital technologies used in the classroom facilitate learning interactions that are valued by students, and may therefore explain their engagement with digital argument mapping.*

Experiences with and attitudes to learning and teaching with digital argument programs will be considered in relation to three aspects of student and teacher attitudes to educational technology. Firstly, whether the general benefits of using educational technology equate to ‘learning’ in the eyes of students. Secondly, whether collaborating on and with technology facilitates ‘learning’. Thirdly, whether the interactions between teachers and students in technology-focused learning environments enhance learning.
This chapter identifies a gap between students’ use of educational technology in classroom settings, and their desire for purposeful learning with technology. A use may be considered important and efficient but this does not make it synonymous with ‘learning’ in the eyes of students. Participating students were cognizant that speed, efficiency and access to information were not adequate replacements for meaningful discussion and the relationship with the teacher.

7.2 Working with Educational Technology as ‘Learning’.

Literature that espouses the advantages of using digital technologies for learning and teaching, makes – as we have seen in Chapter 2 – a series of claims related to what are broadly termed ‘21st century skills’. Digital technology in the classroom is, in the general conception, a liberating force from the container model of information as knowledge; it allows for intense personal and creative self-expression; it promotes higher-order and divergent thinking; and it facilitates collaborative problem-solving. In this way, the technology is seen to promote independent life-long learning, team-work and adaptability (Gee, 2013; Healy, 2007; Kalantzis & Cope, 2008; Kress, 2003; Lankshear & Knobel, 2006). The first section of this chapter explores the attitudes of participant students and teachers to the perceived benefits and constraints of educational technology in the context of these wider claims from the literature.

7.2.1 Ease of use.

The first of the three most often mentioned benefits from the participant interviews relates to the way students perceived educational technology as making life easier for them in regards to classroom work. Their writing was easier to change and organise: “And if I have to edit it, I just go to that and don’t have to rub things out and change all the paragraphs in. It's a lot easier” (J9). Their work was quicker to exchange and present: “Like doing assignments, like if we have to present from the class and just plug in your USB and just show them the words and so they can see what you saying” (A9). Thanks to the use of computers, schoolwork was thought to feel more organized: “It's just more manageable I think. Books get ruined easily and stuff like being in a school bag, and you can just manage it easier. And yeah, just with all the compartmentalisation you can have in computers and stuff” (C10).
Chapter 7 – Findings 3: Attitudes to Educational Technology

Synonyms for ease, speed or malleability were used by almost two thirds of the interview sample and were also most commonly the primary answer before interviewer encouragement to look for other elements.

7.2.2 Typing versus writing.
Equally widely mentioned were the benefits of typing over writing in terms of speed and neatness. Student G9 spoke for many when she said typing was “just neater in general. Not all over the shop. You can underline things or change their colour.” From students who worried about the legibility of their hand-writing, those who found pen and paper simply slow and difficult, to those who were left-handed and enjoyed the freedom from ink-stained hands, typing was a widely touched on perceived benefit. As with the general ease-of-use category, however, the connection between this advantage and learning – as opposed to doing work faster, more neatly or with heightened organization – is not always clear. This is hinted at in the following exchange with student F9 from a mixed ability class:

[Interviewer: Do you feel that computers help you learn?]
Student: I reckon they do.
[Interviewer: Yeah, can you put your finger on any reasons or any of the ways they do?]
Student: It’s just a lot neater than my writing. Easier to read.

The alignment of learning and ‘ease’ was more common at the Year 9 level and amongst students from the mixed ability classes. In the interests of trustworthiness, the interviewer resisted feeding students a particular definition or concept of learning. As can be seen in the interview prompts (see Appendix 6), students were asked how educational technology was affecting them. It was not until later questions, focused on relationships with other students and the teacher, that students on the whole began to shape their own sense of what learning with technology might mean.

7.2.3 Searching for information.
Rounding out the three most common themes mentioned by students was the ability to find information that was needed to complete work. While students most often simply emphasized the ease of access to a range of information, there were some subtle sub-themes, firstly, around understanding – “because like you can search things out and like if you don’t understand something then you can search it” (C9) – and independence – “I think it was good, because you have access to the Internet
and if there’s something you’re not sure about and the teacher’s busy you can find out about it yourself” (G9). In addition there were some, more often in the older year group, who identified a sense of the broader palette of information available as an advantage: “I guess with the internet you can – it’s anything. You can just look at anything. And yeah, sometimes it is broader than what the school offers” (C10) and “[y]ou can get more information on the computer but you can go on books with the writing [but] you get more updated on the computer” (H10).

In these final comments about the ‘broadness’ of internet sourced information there are at last connections, though admittedly from a small group of the interview sample, to the literature based claims for the benefits of technology. These students speak to a sense of personalized and independent learning empowered by access to information. The recognition that the search function allows them to seek beyond the teacher and beyond the classroom walls resonates with claims that technology is changing the traditional power relationships with regards to knowledge that exist in schools.

7.2.4 Creativity.

Many students commented on the advantage of working with programs that allowed them to develop “a more polished product in the end” (L10). There is an overlap here with the perceived benefit of neatness, especially when it comes to typing over hand-writing, but as F10 suggests there is a wider enjoyment of the opportunity to be creative: “the presentation on the computer looks much like neater and more like fancy.” What students mean here by ‘creativity’ is important; work is “polished…it looks nice…fancy…makes more sense” (F10). Synonyms for these terms are plentiful in the qualitative data. The focus on “mak[ing] it look nice” (D9) is clearly significant to students but it does not align easily with the creativity that is often flagged in the literature as an affordance of working with digital technologies. Ljungdahl (2010), for example, claims that working with ICT “can ignite the imagination” (p. 400) or “encourage creative thinking” (p. 414); a typical conception in which creativity seems to be synonymous with knowledge construction (over knowledge retelling) and higher order thinking. The students in this sample did not mention this sense of creativity as part of their interpretations of the benefits of working with technology.
The teachers interviewed in this investigation also nominated creativity as a key advantage, and while their sense of that key word pushed beyond the general student focus on neatness and fanciness, there was still a focus on the power of various tools to enhance presentation, almost as an end in itself. PM’s thoughts here are generally indicative:

You’re giving them opportunities to create far more or so than you’ve ever done before and more interesting and valid ways of creating than just writing a story or drawing a story board or a comic. You can put music to it. You could think colours -- you’re thinking about the way elements to go with it far more or so than I think you ever did on paper or with pieces of butcher’s paper or some textas because not everybody can draw but you can all cut and paste, you can all play around with the Adobe, you know, Photoshop and things like that. I think it’s opened up skills for people that they couldn’t ever have done on paper.

There is a subtle connection to the democratizing power of the presentation affordance here, and other teachers’ comments also broaden the definition to include the way variety allows for “more opportunities for the kids to express themselves a bit more like to reach higher levels than what they could do otherwise” (JR). There is a hint here of the link between creativity and thinking that the literature often reaches for, but it not clear what exactly those “higher levels” mean for JR. Indeed elsewhere in her interview she suggested that the thinking behind digitally enhanced presentation was not distinguishable from pre-digital forms:

I think the quality in the final product is better with technology, and I think that just comes down to it looks more aesthetically pleasing because I can manipulate more things with them. And I don’t have to rely on, for example, their drawing skills. So I think the final presentation is usually much more pretty… and they put a little bit more time into it with technology than what they do if you ask them to create a poster for example. But I think the thinking process is a fairly similar.

For both students and teachers in this sample, it appears that the power and pleasure of that aesthetically pleasing product is what draws them to the technology. It is also significant – returning to PM’s sense above that “not everybody can draw, but you can all cut and paste” – that here technology’s ease-of-use is seen to dampen the effect of individual creativity that is considered more of a factor in pre-digital contexts. Creativity – as facilitated by a digital tool and conceived of by these
participants – is therefore more widely available to students; but does it enhance opportunities for learning?

7.2.5 **Variety and engagement.**

Students and teachers alike used these two terms freely in their responses to describe, for students, a generalized enjoyment of the change to established classroom patterns signalled by technology, and for teachers, the enhanced means at their disposal for presenting content.

Approximately one third of the student sample mentioned the way that technology makes learning “funner” (D9) through the variation to the day it creates. “Yeah, it’s a change, computers. A bit different, so a bit more fun. Just something different” (G9). It is significant that these comments came entirely from the mixed ability cohort, and therefore may signal more about the perceived pressure of classroom content and activities than any specific aspect of the technology: “[b]eing on the computer and using it…it’s better than just sitting and just writing off the board” (E9). In the following exchange, student F9 makes apparent the way the ‘variety’ of technology can be both perceived and used, by students and teachers alike, as a reward for getting the unpleasant business of the classroom done:

> It does make it easier, it does make it fun when you play games, I guess. Just makes it better.  
> [Interviewer: Okay, so if you’re in a class with computers you get to have more fun, is that because you’re playing games? Is that things that the teachers want you to do or just what you want to do?]  
> Student: I do do the work, I usually go and play games afterwards.

Teachers’ notions of the advantages of technology in terms of engagement centred on the choices different programs provided for accessing and presenting content in ways they considered to be more engaging to students. In the following extract, CE touches on the variety of modes she has used to engage her students in the background to the lives of poets Ted Hughes and Sylvia Plath:

> And because there are pictures and things, visuals, photographs, that’s much more engaging than I suppose them just reading a biography about him. It’s just a few minutes, quite fast. They sit and listen. They have an understanding of who he was, the time that he lived, etc, etc, in, you know, a 15-minute slideshow. So that would be an example of where I would incorporate technology…. And the voice-over is as well so with Sylvia Plath there’s heaps of readings of her reciting her own, you know,
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poem *Daddy*. And so they can hear her and there’s stuff on Ted Hughes, they can hear him. That kind of thing.

The variety of access points to content along with the attention of students seems to be the connecting strand between the perceptions of many teachers about the way digital technologies have changed their teaching. For SB, the technology was “just an engagement tool” that allowed her to adapt lessons, during their course, to the questions and problems posed by students. Other teachers emphasized the “variety of different options” (JR) and particularly their sense that since students are overwhelmingly visual learners, the content can be presented in different ways to suit this learning style.

Studies have reported on the sometimes widely divergent perceptions that students and teachers have on what makes presentation using digital technology ‘engaging’ for students. Twiner et al. (2010), for example, overview research which highlights the ways that interactive whiteboards (IWBs) can reinforce a “traditional, teacher-centred pedagogy” (p. 218) with attention fixed at the front of the classroom. According to Reedy (2008), this means that the key teaching activity related to the use of Powerpoint and IWBs is the presentation of information, and the key learning activity remains passive observation. These studies report that students are never as thrilled with this form of classwork, in which the meanings of presentation and learning are once again conflated, as teachers believe they are.

In the interpretations of the participating students reported here, this theme from the literature is echoed and extended. Students appreciated the presentation of content that is enabled for them and their teachers. Their hesitancy, however, was not so much about boredom as a recognition that the ease of accessing, presenting and manipulating information was not always satisfying in terms of their learning needs.

The key theme for students, when they were asked about the perceived disadvantages of technology, was the impact it had on their learning. While students could see the benefits of typing over writing, searching through the internet, interacting with peers and presenting their products in a more professional and interesting way, they were less certain about the effects of screen time on their ability to think, learn and share ideas. Teachers, on the other hand, overwhelmingly believed that digital technology was not only beneficial for their ability to engage
and impart skills and knowledge, but that learning was enhanced by their students’ use of technology.

Before this significant disparity is fully explored it is important to note two shared concerns.

### 7.2.6 Technology infrastructure

Both teachers and students expressed ongoing concerns about the stability and security of school technology infrastructures. While a purely personal discomfort with technology is unusual – no teachers and only one participating student (L10) mentioned confusion over how to use technology and some physical discomfort associated with its use – a generalized wariness with the extent that school-based technology could be relied on was mentioned by every teacher and close to one third of students. Importantly, the consequences of hardware and internet connectivity stability go beyond the effects that disruptions may have on the teacher’s lesson design:

You’ve got to get a class of 30 sometimes kids in to a room where everything works. Otherwise, you’ve got behaviour problems because not everybody’s got a computer to work. So that’s challenging in every school I’ve been in since the start of the whole Digital Revolution\(^\text{37}\) happened. I can’t see that changing too much in the future because Bring Your Own Device\(^\text{38}\) is going to cause all its own sorts of problems (JR).

### 7.2.7 Behaviour and distraction

Problems related to behaviour and distraction were emphasized by teachers and students alike, revealing ongoing struggles over logistics and power relations that have a negative bearing on learning during technology based lessons. SB summed up the teacher perception that it can be challenging to keep students on the intended learning task: “There is always the student or the group of students who are going to do this instead of doing what you wanted them to do.” When asked to compare distraction between lesson types, TN suggested students “would probably be more off task on the computers than they were in the classroom.” The students

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\(^{37}\) The teacher is referring here to the Australian Federal Government policy commonly known as the Digital Education Revolution (DER), the centrepiece of which was the provision – from 2009 to 2013 – of a laptop to every Year 9 student in a public high school.

\(^{38}\) Bring Your Own Device (BYOD) refers to policy – mooted at the time of the investigation but subsequently in place – that students would be responsible for bringing their own digital device to school in order to participate in digital learning activities.
themselves then noted the impact: "Yeah, because there’s the option to play games in there so they [teachers] spend a lot of time telling people not to do that" (G9) and “sometimes they’re more louder and more like aggressive to teachers and stuff especially if like someone is playing on their computer and they take that away from them. They get very aggressive towards the teacher” (H10). As we will see, it may well be the digital era, but since students still highly value their interactions with teachers, the disruptions and struggles for control that often characterize technology-based lessons are keenly felt by many:

When we're in the classroom, I'd get more time with Miss, but then when we're in the computer room, she's constantly yelling at other people especially the boys because they're playing games and they're not doing work, and she doesn't really have time just to come over and talk with us to help (H9).

There is an explicit suggestion here that the learning environment around the technology, specifically the relationships in play and the limited access to the guidance of the teacher, can negatively affect any of the potential benefits of the technology. Students recognized that the very affordances of the technology could restrict key skills:

these days through technology, you can just type in the question and then it comes up with the answer. Like that’s good in a way but like, I don’t know, not really like you’re learning from it. Like obviously if you’ve never learned that before [it is useful] (E10).

It is clear that students not only value meaningful learning – at least in these reflections – but they are also aware of the factors, social as well as pedagogical, that interfere with their opportunities to develop their own thinking in learning environments that are supportive and communicative.

7.2.8 Learning and ideas.
One third of students commented on the way that the gathering and reworking of information via digital technologies impacted negatively on their sense of their own learning and ideas:

I think with computers when people gather information they also like tend to copy and paste things from websites a lot that sort of more of like the quality of work… but I think when you have paper and you have like a group, I think you just concentrate better as well sometimes like it’s just
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easier to concentrate on just like the ideas and I think the work ends up turning up better like the quality not like the physical (F10).

Student K10 suggested there were “more discussions not using technology” and I9 said, “I just don’t think it lets you fully explore your ideas.” While the teachers were also generally concerned with the effects of the “copy and paste” (TN) culture, it is significant that the emphasis on learning, ideas and discussions being stymied in this process, came exclusively from the students.

The questions posed during the interview process attempted to drill down into the interpretations behind this general sense, expressed by over half the interview sample, that there is a significant though nuanced downside to classroom work with technology. Student J9, while again extolling the benefits of the “quicker” computers and the fellow students “talking to each other with ideas”, also referred to the way yet other students were “more enclosed because they have a computer there in that device’s environment rather than the outside and seeing people.” This sense of being enclosed is echoed by student K9:

> When you're using computers, you can do it by yourself. When you're not using computers, you interact with people. In computers, you can get information from the internet. When you're not using computers, you help each other out and you interact more.

The enclosed space of the computer is interpreted here as a physical space, but it is also considered a cerebral or cognitive space in a way that takes us closer to what these students are meaning by both thinking and learning. In this extended discussion with the interviewer, student B10 pinpointed her concerns about the impact of internet searches on discussion:

> Where if people are doing work, I guess it’s still different because it's talking about the work on the computer, not what they're thinking through the book, if that makes sense. It's like…their thinking isn't more of their own. It's more of what the computer is kind of telling them because it's all there. If they're on the internet looking at something or this book says this, does this mean it's this or this type? The discussion is less I guess inventive. It's like not their own.

[Interviewer: So it doesn't sound like a good thing?]

Student: Not really.

[Interviewer: I am wondering if you can think -- this might be hard -- a specific example that you can think of where that has happened?]
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Student: Okay, like if Miss says, ‘Here's this quote from Macbeth. What do you think it means?’ People on the computer would more likely, they'd search it up on the computer and find an example and would be like, okay, it either means this one or this one from those two points on the computer. But if those people from the books that tried to talk it out and explain it and then they had come to a better conclusion, I think because it's their own thought and not someone else’s.

In these attitudes there is an interplay between the perceived enclosed space of the computer, the enclosed nature of ideas and a sense that interactions between students are also enclosed. It is a significant finding of this investigation that students are unconvinced that educational technology, or at least the ways it is being utilised in classrooms, actually enhances the exploration of ideas that students consider to be ‘learning’. The perceived benefits of access to and re-presentation of content are not enough to convince students themselves that aspects of learning that they value, such as *understanding* (see extended quote below) and reflection, are being developed. The interpretations of the students also echo Selwyn’s (2014, Chapter 7, para. 3) notion that digital technologies may “atomise educational processes and practices into a series of discrete tasks...the partial, segmented, task-orientated, fragmented and discontinuous nature of digital education” which then leads to an alienation from more meaningful social interactions.

We have seen that some students consider that the time spent searching on the computer stymies the potential benefits of working with others, particularly the depth and originality of ideas. In addition, the fragmentation suggested here can refer to an entire classroom, not just the collaborative space of the pair or group:

When using technology everyone is quiet, very, very quiet. No one speaks, very quiet. It [technology] is more interesting than what paper is because there’s so many things to do on it now [but in this class] it’s just writing where everyone’s quiet. And also people listening to music all the time in classes so that also keeps them quiet I guess. But yeah, you’ll go into a classroom and there will be like three people not listening to music now. It’s just everyone’s doing it. I think [in non-technology classes], you know, some teachers would be like asking questions and you’d have to raise your hand and be like, “Yeah, I know that.” Yeah, well, when we’re using technology no one does that. It’s just dead silent and she’ll be waiting for someone to answer the thing and then no-one does, so she’ll
just yell out some random’s name and they’ll be like, “What?” [Laughter] 
When we’re using paper, everyone’s just like in for a conversation like they are always like, “Oh, yeah. We’ll have a conversation about this instead of writing and get a better understanding of what, you know, than writing it down on paper.” I think mostly everyone in the school right now wants to have a conversation instead of writing it down (J10).

There is a palpable understanding through these student interpretations that the benefits of technology are limited, especially when the lesson design or the – otherwise beneficial affordance – interferes with the desired learning environment of the students. The extent to which the student-student and student-teacher relationship, or the lesson design instituted by the teacher, is felt to be the cause of this conflict is the focus of the next section of this chapter. It is evident, for the moment at least, that many students have sophisticated metacognitive insights about how the quality of their learning – especially through peer and classroom communication – is affected by the search, typing and presentation affordances of digital technologies. In this sense, they may have a better understanding of this dynamic than their teachers:

So the relationship between [me and] another student I would say…with the technology there, it’s a lot like the computer is getting more attention or things like that. And then without it, like I said before, you’re talking to them or asking them for help or things like that instead of doing the computer. I mean sometimes you can learn really well off another student but then you’ve got your laptop there and you’re searching, I mean some days you can search there for entire period trying to find something and it’s always there but it’s not explained the way you understand it (L10).

7.3 Collaborating on Educational Technologies as ‘Learning’.

One of the key aspects of the digital argument mapping program is its facilitation of a paired or small group problem-solving approach to developing an argument. While it is of course possible to develop a map individually, all but two students in this study were part of a collaborative process whereby the sharing of ideas and the co-authoring of map content was a central element of the approach co-designed by teachers and the researcher. In this section, the findings of interview and observation data are presented in order to evaluate student and teacher attitudes to working collaboratively on digital technology. Interactivity is one of the most
commonly touted educational benefits of digital technologies, even though – as we have seen – this affordance is very difficult to measure. The following sections explore student and teacher views about the benefits and constraints of working with others on educational technology. A foundation is laid for the Discussion chapters’ analysis of how the specific type of collaboration around the digital argument mapping program enhanced learning generally and the writing of opinion more specifically.

7.3.1 **The broadening of ideas and worldviews.**

One of the strongest areas of agreement between students and teachers in this investigation was around the benefits of students working together for the range and quality of ideas in play during an activity. Typical of the overwhelming majority of students who named this advantage was C9: “you might like say something to the other student and then they might say anything and then you have like a good idea like put it together and, yeah.” There was certainly an element of thinking on the students’ parts that valued more prosaic aspects liking “helping each other out” (B9 for example) and sharing the work: “One of us does the research and one of us does the Word thing, and it's really good” (E9) but there was also a strong recognition that the sum of the individual parts lead to something beyond what the individual was capable of. For C10, during collaboration “you gain their insight as well as yours and, yeah, you can just see things that you might not have seen before and apply that to your work.” According to K10 you got “more complex ideas” which improved “writing quality”. It is significant that many students valued this process beyond its usefulness for getting the work done faster. Indeed, at both year groups and streaming levels, there was a recognition that working together could result in significant interactions, for example ones that “bring out something in the other person that you didn’t know they were interested about. It’s good for that side of things” (I9).

Observations of student interaction dynamics in the intervention classrooms support these advantages identified by students in their interviews. In-class observations sought to find examples of student behaviour in three general categories: off task behaviour, and student-teacher interactions facilitated or enhanced by the program in use, student-student interactions focused on any of the following lesson elements:
• The logistics of the digital argument mapping program

• The nature of the assignment/essay task

• Argumentation

As set out in the Methodologies chapter (3) these observations were qualitative in nature and the data does not presume to be a record of all classroom activity. It is partial and tentative, but recorded here with an impulse to describe one researcher’s impressions of generalized classroom behaviour as accurately as possible.

Students in pairs and small groups were widely observed participating in good-natured and constructive debates about the evidence they should use, and the placing of that evidence in their developing argument map. Partners asked each other for advice about the diagram, the nature of evidence and reasoning required by the map, and the examples from their texts (including the novel *The Lord of the Flies* as referred to in the example below) that would be necessary. The following conversation, between five students labelled A to E, is typical of many observed across both streaming levels:

A: Trust me, Sam and Eric [characters] are the only ones who see it.

B: OK

A: They run back down the mountain…

B: But he has already landed.

C: I think no-one understands his intellect

D: Yeah

E: Like when he is sitting on the beach [student then reads section from the novel]. This shows that…

D: Would we use that line though?

C: Yeah we can use that for reason 2 [in the argument map].

E: Or support for reason 2.
C: [inaudible]

D: So what do you want reason 2 to be then?

This type of free-flowing but purposeful discussion exemplified student interactions in this learning environment at their best during the intervention. While there were lesson phases that did not lead to this type of interaction\(^\text{39}\), there were enough to lead both students and teachers, as we have seen in the previous chapter, to credit group time with the digital argument mapping program with leading to those lightbulb moments that they both so highly value.

Teachers – as heard in their interviews – also valued the quality of ideas and interactions that arose during pair and group work, with SB indicative of an emphasis on expanding horizons: “I think it’s a great way to broaden their worlds as well even just creating connections with other classrooms and around the world and around schools and working together, working collaboratively.” Connections as a result of working together were seen to matter both in and out of the classroom alike, but always for the intensifying of key skills and behaviours associated with learning:

> There are plenty of times where what they’re trying to create requires a bit of intellectual conversation between them and a bit of negotiation about what to use and how to use it and where to find it or who’s going to write it, and the language of it. Those tasks work really well with most kids (JR).

This type of interaction, whether it lead to intellectual conversation or broader worldviews was seen to have flow on effects beyond the content of the lesson, with PM highlighting the social effects of pair work allowing possibly less confident individuals a space to explore ideas:

> So it’s the pulling apart and that sharing of knowledge meant everybody got built up rather than there’s always been a core group of kids here that are quicker, and more effective at that, but everybody was supportive so the quality of the whole class went up [emphasis in original].

\(^{39}\) No attempt was made to measure distraction time and or make an assessment about relative levels of distraction while using this particular educational technology in this way. Apart from purposeful discussion, students sometimes worked alone finding evidence and together in more prosaic ways, such as on the ‘look’ of the diagram. Discussion Chapter 9 evaluates the relationship between ‘interactive’ and dialogic activities and the technology as part of the learning environment in play here.
Similarly AH credited the “paired situation with technology” with making students “feel a little more confident” to share ideas where they may have been daunted by the whole class context.

Interestingly, AH was the only teacher who referred specifically, in the initial unprompted discussion, to pair-work as a benefit in connection to technology. For students, the most common comments about the benefits of pair-work, for example, with technology, were made in relation to the sharing of workload and the broadening of worldviews. It could therefore be argued that the benefits described here by both students and teachers relate to well-designed and executed pair-work in general. Indeed it is an important conclusion based on the findings of this investigation that what students are looking for most in technology-centred collaboration is the replication of what they see as the best features of collaboration without technology. The mere fact of connection to another student in another class, or another country for that matter, is not enough if that connection does not develop ideas in a way students recognise as synonymous with learning. When interviewees were pushed to explore student interaction around technology in a more holistic consideration of the learning environment, discussions very often turned to a more nuanced consideration of power, choice and distraction.

7.3.2 The perils of partners.

When speaking about the disadvantages of working with other students on technology, interviewees were most likely to mention issues of control and choice. Partners were seen to “take over” (B9) or complicate matters unnecessarily with their “different ideas” until arguments started and the group was “not being productive” (J9). While students were generally positive, as we have seen, about the blending of different opinions, when it comes to group work on a computer, they were also cognizant that the collaborative structure took away at least some of their control:

I work alone [on computers] because I think I can get like I think I can get it done the way I want it to be done and so, you know, I’d love to get other people’s ideas and things, it’s just I have a specific way on what I want to do (J10).

The frustration expressed with pair or group work extends to both the distraction of multiple group members who are thought to be more likely to get off task, and to the propensity for one member to take charge and thus make it “harder to
contribute” (F10). Student L9 sums up a general interpretation about the difference between paper and digital technology when it comes to sharing ideas:

It's harder on a computer, I find, because it's one person, but when it's paper and a pen, you can move it. You can write your own ideas down. You can write it yourself, but on a computer, you have one main person doing it all.

Of course it is just as easy, in theory, to move a tablet or laptop, or shift places at the keyboard, but the feeling amongst many students is that they are less likely to do this with computers.

Teachers were more likely to emphasize “the slackers” (JR) and the distraction of the social scene: “small groups usually work reasonably well, and two to a computer is probably the ideal because as soon as you get three, somebody is not doing much” (JR). Several of the teachers employed specific tactics to deal with the problem, one best summed up by CE as “one student...doing the bulk of the work and the other two stuffing around”,

I like the idea of students having to go by themselves [on computers] but then sharing those ideas when they come together. I don’t like the idea of one student doing all of the work and a student either being railroaded and not listened to or a student being able to sit back while their partners do all the work. So I like the idea of students having their ideas and their opinion and then perhaps jotting them down and then getting—I’m not saying to do all the work by yourself. But I’m just saying, you put your ideas down and then okay right now we do a bit of discussion or paired work, then to fours and then eights. So you get lots more ideas (TN).

The focus here is on both classroom control and equity, and on ensuring the best possible learning environment is created. While students and teachers each have particular gripes related to the level and fairness of group interaction, it is significant that both also emphasize the impact of group structures, whether utilising digital technology or not, on the quality of learning that takes place:

I’m not really convinced that that [pairs or groups with a computer] make things better: my own son and a couple of kids out there said to me that the most unproductive work they ever did at schools was group work because unless you’re really, really careful with how you structure it, there’s always one or two kids that want to be the slackers.
Interviewer: Does it make any difference [if there is a computer present or not]?
Interviewee: No. Actually I don’t think so. I think it’s just a group mentality (JR).

The pedagogical links between group work and technology, particularly the assumption that collaboration is either a component of a tool or necessarily the best way to use it, are the focus of analysis in the Discussion chapter 9.

### 7.3.3 Connecting and communicating.

Students were aware that working together implied more than just pair or group work where physically present individuals interacted over single or multiple computers. As the findings reported here suggest, students in particular had complex interpretations of the nature of the learning that can take place via digital technology in a classroom. A final area that came up in the student and teacher interviews, one that only adds to the complexity of the relationship between collaboration and learning, was the enhanced communication between partners.

Digital technology was valued by participants because it allowed for a seamless interchange between partners: “It is really good ’cause it’s easy to hand things on to other people through e-mail or talk to them on Facebook or something like that” (L10). The interaction emphasized here extends to teachers:

Yeah, it's good to give stuff straight to the teacher as well as email. It's another alternative to that, and it is good to get feedback on as well. And it is good with the sharing of documents as well with email. It might not always come through but with Edmodo it's really easy to just go and get linked to stuff that she can give us (C10).

The benefit being recognized here is beyond simply a faster or more efficient – because digital – method of exchanging information or files. Students and teachers report on an enhanced depth of interaction between students about the topics being studied:

It enables them to interact with other kids on other computers so if you set up, Edmodo or something like that, you can have your whole class online chatting and blogging and showing each other drafts and things which most of our classes do quite well (JR).
It is crucial to the developing argument of this dissertation that the student definition of ‘communicating’ involves more than merely passing on information or connecting with another. There are strong resonances, in the student voice here, of Kress and van Leeuwen’s (2001) notion of the interpretive community, with its focus on purpose and context, and its valuing of interpretation and not just articulation. These are themes taken up in the following Discussion chapters.

7.4 The Teacher-student Dynamic in Technology-based Classes and its Impact on ‘Learning’.

The following section describes interview data from a set of questions that invited students and teachers to explore their interactions with each other during lessons that involved digital technologies. Once again, the aim is to assess whether the classroom dynamics – in particular communication patterns, teaching styles and lesson designs – in the digital age classroom are, in the eyes of students and teachers, facilitating learning interactions that are valued by students.

7.4.1 The views of teachers.

To this point, we have seen that the participating teachers were overwhelmingly positive about the role of digital technology in their classrooms. The constraints imposed by infrastructure problems, distraction and the inequities of group work were seen as unfortunate obstacles in an otherwise useful and engaging practice. After discussions in the interviews focused on their feelings about technology generally, followed by their interpretations of the pros and cons of pair and group work, teachers were asked to explore their relationships with students, both in terms of general social interactions and through the types of lessons and learning environments they were functioning within.

There was a sense, from some teachers, that in classroom settings involving technology they were better able to guide students to “more interesting ways of finding their information and coming up with product” (JR). This same teacher, however, considered her teaching to be no more student-centred using technology than in previous years where she would need to “cut it out and…stick it on a page where you’d want it.” The distinction, according to JR again, was that teaching with
Chapter 7 – Findings 3: Attitudes to Educational Technology

technology had “definitely opened my eyes to the lots of different options of how you can get the same content across in lots of different ways and what might work better with particular groups or particular ages.”

The self-assessment, common across all teachers, was that teachers were working as guides to valid content, buttressed by the power of technology to connect and engage. For PM, this involved the partial dissolution of the classroom’s physical space:

you’ve got more reason to get out of the classroom, the classroom is no longer just here as a physical space. We’re out and about. You’re using your school grounds. You’re using your community. Your classroom is the world, you know, go via Google to all sorts of places and then all sorts of things and then come back and share. [Y]ou can talk to an author here or there, or have people come in and physicists from Sydney University talking about, you know, Big Bangs and meteorites and things, you know. So the classroom has extended beyond the four walls which I think is really exciting and made it more real. The classroom space is very artificial and so technology makes it more real and long term and holistic in terms of what’s going.

PM related this connection to the real world to the development of higher order thinking skills, and it is clear that many teachers’ frustrations with the copy and paste culture of plagiarism was also related to this intention to use technology to facilitate inquiry and reflection. It is apparent, however, that to a degree, this interest in the world beyond the classroom walls is still connected to the desire to access information and then be creative with it in the presentation stage of the activity. For JR, the technology gave her students “some chance to more than just research, you know to do something creative with it.” She acknowledged though that this led to more conversations “about what looks good” than the issues being focused on.

The tensions between the information accessing and presenting affordances of the technology, and its potential for facilitating something more – higher order thinking, knowledge creation or reflectiveness – were unresolved for most teachers. SB, the youngest of the participating cohort and the one most generally reliant, by her own admission, on educational technology, was clear that “the final product is better with technology… it looks more aesthetically pleasing because I can manipulate more things” with students who may not be so confident with drawing

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or hand-writing. But in terms of the “thinking process” (SB), she acknowledged the equivalence to the way her students would approach a task if it involved butcher’s paper and an encyclopaedia.

The teachers in this investigation have responded to the limitations they perceive by focusing on the purposes behind the use of technology. “You know, what was the technology being used for? And note-taking is not one of the best ways it can be used. You don’t need a laptop for that” (PM). For JR, this has meant starting units of work with “inquiry questions… that they need to explore and come up with a product for.” The end result was “a lot more higher order thinking and lot more conceptual kind of discussion than we would normally get if you just say ‘Invent a newspaper using this template’.” SB saw competitions which set up rivalries in the classroom as one of the keys to a more purposeful use of technology: “much better than if you just said, ‘Here’s a research task. Here’s an iPad. Find me out this, this, and this.’”

While teachers’ uses of and intentions with educational technology covered a wide and sometimes uneven terrain stretching from accessing content to encouraging higher order thinking (a view not strongly shared by students as we have seen), the one aspect which was clear and constant across all teacher interviewees was the perceived impact on their relationships with students. For SB, technology in the classroom allowed her to follow student questions with an immediate connection to information on the internet, not only making the lesson more “student-directed”, but establishing a rapport that came from the teacher taking student interests seriously and being able to respond “instantly” to them. According to AH, a shared interest in the technology itself gave her credibility in the eyes of her students and helped to strengthen teacher-student relationships.

All teachers described the changing power dynamics in the classroom as one of the main benefits of their in-class use of digital technology. The altered dynamics can refer to the ownership of knowledge and skill: “I love those moments when they actually teach me stuff” (JR), as well as a sense of pride and usefulness that students can feel: “You could just see how proud and how happy they were to have a role in the classroom” (AH). The teachers felt very comfortable with the idea that

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40 Although the student discussion often distinguishes between digital technology (in the form of laptops or iPads) in their usual learning space, as opposed to the students being moved to the computer lab or room, this distinction is not a focus of this dissertation. Many treatment classes used both options during the intervention. The distinction between classroom and computer lab ‘spaces’ warrants further research.
they would be helped by their students, according to TN, for example, “I have no problems with someone showing me what I’ve been doing wrong or how about doing it this way.” The contribution of students and ensuing camaraderie “probably makes it a little bit more cooperative, a little bit less teacher versus students” (JR) and results in a situation where “teachers are far more facilitators now than they ever were. You don’t need to have all the answers. You don’t need to even know how to use all the technology” (PM).

7.4.2 The views of students.
A key finding of this investigation is the significant dissonance between the teachers’ conception of a cooperative environment of inquiry and creative presentation and the students’ experiences of their own and teachers’ technology use in their lessons. Student misgivings about the supposed gains of technology on learning were introduced earlier in this chapter. Here, the discussion will be expanded to three key areas that over half the student interview sample made reference to:

- the generic and teacher-centred pedagogy employed in many of their classrooms
- the loss of meaningful one-to-one student-teacher time, and
- the loss of a communal learning space.

7.4.2.1 Generic pedagogy.
Student interviewees were explicitly asked if teachers became more coach or facilitator-like in technology classrooms. The overwhelming majority\(^41\) responded in the negative: “They might write some stuff on the board and teach for like 10 minutes then go on computers. Then they mark the roll, then try and find a website and put it on the board” (F9). According to student I9,

> it’s the other way around when you're on a computer. I think it's more they're up front and then a lot of the times the teachers, especially here, tend to write a website on the board where you go and then they sit down and do their own thing at the computer. If you're going to ask them a question, they're like, “Oh, I don't actually know what you're doing.” Half of the class was on games and I don't know what I'm doing.

\(^{41}\) Two students mentioned positives: “They’re more cruisey” (G9) and “When we are all on computers Miss becomes…really like helpful and goes around to everyone” (F10). Several students could see no difference.
The same student coined the term “generic” to convey his sense that the range of teaching activities related to the use of technology in classrooms was actually very narrow. The common refrain summed up by “she just stands up the front all the time” (H9) does not connect easily with teachers’ ideas of a flexible student-directed pedagogy. It does however resonate with research, outlined in the literature review, on the extent to which IWBs and Powerpoint have become technologies of presentation, while the ‘learning’ that takes place is more akin to observation (for example Reedy, 2008).

7.4.2.2 One-to-one time.
Indeed the teacher at the front of the class running an information-presentation type lesson is also felt to deprive students of what they most value in the classroom: meaningful one-to-one or small group time with their teacher. “I don’t think it’s as intimate. You don’t get that much one-to-one like tuition” (I9). While “learning online is pretty good” according to student J9, “it isn’t the same as a real-life teacher.” He goes on to make a finely nuanced distinction between the types of help available from interaction with the teacher compared to online sources: “I'm a very inquisitive person. A real teacher, I can ask on the spot. I'll get feedback if they don't understand what I'm saying. It's not like a long forum. We can discern [it] out quicker.”

7.4.2.3 A communal learning space.
For student K9, the independent and individuated work common to the class using digital technology means that “the teacher’s not, sort of, with you.” His preference, echoed by a majority of the student interview sample, is for the teacher guiding the class as a unit where:

everyone's at the same path of where they're up to, whereas in a computer lab, some kids can be ten questions ahead of the other person and then the teacher has got to go to that person individually, which can be good, but if not everyone gets a go, then it can be bad as well.

While a class on “the same path” is of course possible whether technology is being used or not, in these students’ interpretations it is more likely, and more meaningful to their learning, without the presence of computers. In what is perhaps the most surprising finding of this investigation, students expressed a clear preference for a teacher “orientated” (K9), as opposed to teacher-centred, style:
I think I prefer it when a teacher is teaching to the class rather than saying, "All right. Now, click on to this. Go into that and then run through this space." I think I work better with someone actually talking to me. That's just me though (K9).

Actually, this sentiment is shared by the majority. An approach made up of guided explanation, discussion, some presentation – perhaps a short Youtube clip – with the teacher “pointing out what is important” (K9) is preferred over the perceived norm of the independent research on digital technology where students are at different points and often cannot get the help they need.

The students’ interpretations of the constraints of learning with digital technology were amplified by the lack of beneficial engagement with their teachers. For student L9, “I just feel in the computer room, I know the teachers might not interact as much as they would in a normal classroom” while student B10 found “[t]he relationship is closer if you use books over if you use your laptop.” The distinction between technology and non-technology relations with the teacher seems to hinge on the attention paid in both directions of the relationship. While teachers are seen to be focused on the technology and often the behaviour problems related to its use, students recognize that their own attention is drawn from activities that matter to them: “[n]ot everyone is focused and the class becomes more disruptive. If you have more computers, the class is a lot more disruptive than it would be if everyone is just working on their own work and on their paper” (D10).

Both students and teachers were, as we have seen, concerned by the effects of this disruption on learning. Here, however, we see that even when the class is settled, the atomization of the students – those much-heralded independent learners of the digital age – militated against the kinds of engagement with learning that the students were seeking. For student G10, “when you’re in a computer room everyone would be facing their computer screens and they probably wouldn’t pay attention as much as them only really being able to face forward towards where the teacher is standing and talking.” In a typically discerning take on the importance of a two-way focus for learning, many students commented on how a teacher to whole class connection improved learning. Student E10 for example found that:

without computers in the class like the teachers like can focus on everyone. She can be like, here’s what we’re going to do. This is like the task that like I’m giving you and she goes around helping people, she still does that in computer lab but it’s just different because like kids get so
distracted by the computer they’re not going be bothered asking what to do until like half way through the lesson.

While the distraction caused by the technology had many impacts, most especially the loss of teacher time for one-to-one attention, here the students were explicitly, and in unsolicited responses, referring to the effects on learning as distinct from the work of the classroom. For student H10:

When you are on the computer like you want to pay more attention to the actual computer than the teacher but-
[Interviewer: Is that a good thing or a bad thing?]
Student: A bad thing.
[Interviewer: Why?]
Student: Because you… got the attention on the computer and not like the actual learning sometimes… Like when you are writing stuff you go and talk to them but when you’re on a computer you want to just hide away a bit more.

This division of attention was described elsewhere as feeling “zoomed in” (L10) and could be misconstrued as the much-vaunted engagement with learning through technology that teachers and educators often identify. Only here the student, typically appreciative of the complexity involved, recognized the drawback: “You might not hear them [the teacher] start talking, oh, she’s saying something and come in half way through the conversation and miss something” (L10).

As a final theme in students’ responses, there was one more equally nuanced notion about the interplay of technology, attention and lesson design. Students recognized that with or without technology, the lesson could be focused on the teacher in more or less meaningful ways. For L10, “if the teacher has the technology, then it’s an aid to them because it’s concentration on them and the technology because they have the control over the technology”. This is a notion that would seem to straddle competing student needs: to have the class as a learning unit on “the same path” (K9), but to avoid the limiting teacher-centred pedagogy described elsewhere as “generic” (I9). Teacher control over the technology is described by students positively if it is used to guide the whole-class learning. Student G9 hinted at such a balance, one that may satisfy several student learning needs, when she described the way a teacher’s use of the whiteboard to guide the class activity by putting up key
words and the addresses of relevant websites allowed the students to “get on that [if needed] and know exactly where they [the teacher] is going.” Here there was a sense that the teacher was maintaining the communal learning environment, allowing for individual access to content as needed, but also utilising the presentation affordance of the technology to assist in the explanation of material. Perhaps not revolutionary, but a careful alignment of technology and purpose that seemed to make the use of educational technology about learning in the interpretations of these students.

7.5 Summary

The aim of this chapter has been to assess the attitudes of students and teachers to the use of educational technology in classrooms. By establishing this context, it is then possible to further assess the successes of the argument mapping program by exploring the extent to which its classroom use fits with student and teacher interpretations of the teaching and learning behaviours that are enhanced in technology-based lessons, as opposed to those which are constrained. In short, this chapter has established that the enhancement of learning through the use of digital educational technologies depends on more than their mere presence in the classroom, and more than mere abstractions about 21st century skills and attitudes:

• Students were thinking beyond the ease-of-use and power of presentation associated with a particular program. Malleability, typing, access to information and the creativity associated with flashy presentation program were all appreciated, but did not simplistically align with the students’ insightful conceptions of ‘learning’.

• Students and teachers alike identified the quality of ideas that arose from the discussions and sharing between students as one of the main benefits of pair and group work. However, students recognised that the distractions and inequity of some technology-centred collaboration detracted from their learning. They valued and desired collaborative environments that led to meaningful discussions and a broadening of worldviews.
Both students and teachers recognized that the heightened level of thinking that they desired in group work was only possible in certain circumstances, and that digital technology only complicated these circumstances. In no sense was the digital viewed by either party as a simple means towards achieving good or better interaction with others.

Teachers valued the closer relationships they saw facilitated by students’ use of technology. Students bemoaned the loss of their relationships with teachers during many kinds of technology-focused lessons. Students suggested that the quality of their interactions with teachers was diminished by technology. They were clear on their preference for a teacher-oriented (as opposed to teacher-centred) learning environment where the class remained “on the same path”. Students rejected approaches that led to the independent learner enclosed at his or her screen and atomised from the learning community.

Students were largely critical of the generic technology teaching style they experienced in many classrooms. This can be summed up as a presentation of content, or a portal to content, followed by independent work.

7.6 From Findings to Discussion

This section concludes the presentation of the findings of this investigation. After suggesting that the use of digital argument mapping had led to improvements in argumentative writing, this dissertation has posited that the gains may be explained by the distinctions between an approach focused on a mode of communication over current useful but constraining practices such as paragraph templates. In this chapter a case has been made, based largely on student voice, for a reconsideration of student use of educational technology for learning. Student interview responses suggested a disturbing disjoint between teacher and theory advocacy of a new frontier in independent learning, and the student desire for meaningful talk, teacher guidance and communal learning around the digital artefact.

The following two chapters take these key findings and discuss their implications for the development of theory and classroom practice in the areas of writing instruction and educational technology use. Both Discussion chapters hinge on the
communicative nature of argumentation, a feature which has been a constant theme in students’ and teachers’ interpretations of their classroom experiences during this intervention. This is explored firstly in relation to the writing classroom, and then with regards to the potential for digital technology to facilitate the kind of learning environment that leads to more effective and engaged writing.
Chapter 8 – Discussion 1: Argument and the Development of Purposeful and Communicative Writing.

Figure 8.1 The discussion stage of this investigation I

- Explore literature approaches to writing in a digital age classroom
- Identify and evaluate changes in argumentation skills evident in essay writing
- Analyse attitudes to learning with educational technology
- Evaluate the impact of streaming, school, year and attitudes on treatment group results
- Analyse attitudes to writing, existing writing pedagogy and DAM
- Evaluate implications for WRITING PEDAGOGY and educational technology

Argument as communicative impetus for sustained writing
This first of two Discussion chapters synthesizes findings related to the learning and teaching of argumentative writing drawn from the quantitative writing and questionnaire data, as well as the qualitative observation and interview data. Based on distinctions drawn in the second Findings chapter, Chapter 6, between contemporary writing practices and argument mapping, this chapter evaluates four aspects of argumentation and argument mapping in order to understand the nature and potential of the reported advances in student writing. One, explicit teaching and cognitive approaches to argument. Two, collaboration, dialogue and the dialectic as part of the process of planning argument. Three, counter-argument and evidence. And four, the social and cognitive potential of argument mapping.

8.1 Introduction: The Decline of the Essay

This dissertation has considered, in both its review of existing literature and its reporting of research findings, the gap between our socio-cultural ideal of what writing can and should be, and the writing practices experienced by high school students. This dissonance represents a complex interplay of policy developments, conceptions of writing pedagogy, and wider social and economic forces related to technology, literacy and learning. And nowhere is this gap wider and more strongly felt by teachers and students alike, than in the form of the essay. If, as Pirie (1997) has suggested, the fit between communication and essay-writing seems like a strange one, then this is a strong warning that our conception of what argument and essay-writing are has become dangerously narrow.

The default contemporary form for the presentation of argumentative writing is the essay. Representative of wider schooling patterns, the participating schools in this investigation used essays to assess students in one or two assignments during a typical year, and in half-yearly or yearly exams. Stage 5, in which phase of schooling all participating Year 9 and 10 students were studying during the intervention, is book-ended by the NAPLAN persuasive writing task near the beginning of Year 9, and then the two years of formal preparation for the largely essay-based42 Higher School Certificate (HSC) concluding in Year 12.

42 In the Humanities subjects. Other subjects, Science for example, include ‘extended responses’ in their exam formats.
State-wide data from the 2014 HSC English Advanced and Standard exams provides a striking stepping off point for considering the health of essay-writing, and in particular, its relationship with meaningful argumentative writing. 59% of Advanced students and approximately 8% of Standard students achieved results in bands 5 and 6, usually characterised as a “well developed ability” to compose a “critical personal response” (New South Wales. Board of Studies, 2014). This appears positive for the Advanced cohort but represents only 30% of the overall total candidature. Over 60%, therefore, of the participating student body is classified as, or below, “sound”, or writing with “confidence and control”. 45% of the total candidature is below “sound”. These raw figures can of course be interpreted in many ways. Assessments of causality are beyond the scope of this discussion. In particular they need to be treated with caution due to two contrasting factors. One, the writing results are based on exam performance under pressure. In addition, while the numbers look good for the top end and worrying for the lower end, it is also worth noting that these official figures are in reality a statistical manipulation known as ‘scaled marks’, and so – particularly for the Advanced cohort – there is a gap between these results and the original (usually lower) raw marks that an individual essay may have been given.

This – albeit partial – analysis chimes with the sense from the literature that although both NAPLAN and PISA results are currently reasonably strong in Australia, there is evidence that standards are gradually falling (Moon, 2012). On a generalised reading of these figures, somewhere near 50% of the exam candidature at the end of formal schooling in NSW is unable to reach a “sound” level of essay writing. Perhaps another 20% can be considered sound. Less than one third of school students finish school with some degree of mastery over this practice, under exam conditions.

Academic attention to this weakness in expressing opinion in a sustained written format has focused on a number of complementary concerns about the way argumentative writing is both conceived and taught in schools. School students are seen to have limited access to the necessary textual “codes which animate the discursive space of a culture” (Bolter, 1991, p. 38), and without which a sense of the writing self with a contribution to make through argumentative writing is not

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43 Total candidature: 58214 students, of whom approximately 45% took the more challenging ‘Advanced’ course. Results are reported in Bands, of which band 6 is the highest, and represents an “insightful” response. In 2014, 15% of Advanced students and 0.3% of ‘Standard’ students achieved a total result in this band.
possible. From a different perspective, Martin (1985) suggests that writing pedagogy has clouded the differences and connections between verbal and written argument in such a way that student writers cannot deal with the requirements of dialogue and discussion as a written form without an interlocutor.

The school framing of argument in its written form has been criticised for its valuing of polarised debate over more personal, informal, thought-becoming-word types of discourses (Morgan & Beaumont, 2003). Pirie (1997) extends this assessment to the ways “feigned authority” (p. 80), thesis hunting and a rigid hierarchical structure have moved writing in English away from broad, critical literacy type outcomes such as widening and deepening understanding, towards a narrow, mechanistic aim: “something like getting better at writing English essays with their precise text-and-evidence protocols” (p. 85). Sanborn (1994), amongst others, has described how the rigidification of the essay, from its Montaigne era conception as an exploration of ideas, to the current workhorse for the Academy, has squeezed out openness, hesitancy and the personal, and replaced them with order and logic in the service of one controlling idea. Debate around the relative merits of formula as opposed to improvisation in this context is apparent in ongoing tussles over the five-paragraph essay. Opponents deride it as the equivalent of a paint-by-numbers kit, while supporters use the analogy of music scales, which must be rote-learned in order to support later improvisation. It is significant that recent attempts to find balance (see for example Haluska, 2012), may start with the proposed benefits of structure, but then stress that students must be guided on to competencies such as awareness of audience, modality and refutation of hostile arguments, in order to avoid the pitfalls of a formulaic approach. This warning is useful, but the extent to which it has been taken up by educators pushed for time and marks is not at all clear.

In their hesitancy over purpose, their struggles with structure and their feelings of constraint around ideas, the students in this investigation confirm many of the literature themes about the nature of argumentative writing as composed in the essay form. In particular, as reported in the summary of students’ interpretations of writing in Chapter 6, the students’ generalised sense of wanting to be ‘right’, has indeed led argumentative writing in these schools to become “an exercise in which one strings together a set of reasonable sounding arguments, being careful not to include anything that anyone might challenge” (Kuhn & Crowell, 2011).
students and teachers reported that a broadly text types or genre approach that has focused on structure at the paragraph or whole essay level may have assisted students in achieving a feeling of ‘rightness’, and a sense of order, these successes have come at a cost.

If it is clear that the experiences of students at the participating schools confirm the concerns evident in the literature, it is also illuminating that the interpretations of the students revealed in these findings also point to a better future alignment of teaching practice with the demands of more effective and engaged writing. In their interviews students emphasized the importance of relevant and stimulating topics to both engaged technology use and engaged writing, as well as to learning more generally. When asked to elaborate on ‘stimulating’, students pinpointed topics that they were – or were open to becoming – passionate about. Moreover, they stressed the opportunities these topics, mostly the kind of issues-based English units that focus on, for example, ambition in *Macbeth*, gave them to interact with peers, think deeply, choose aspects to explore, and connect themes to their own lives. This investigation has so far revealed that, despite the flaws in approaches manifest in the essay, students are keen to communicate in meaningful ways with each other, with their teachers and through the opportunities provided by stimulating topics.

It does appear, however, that if the writing they do at the end of a typical unit of work, or as an assessment of such a unit, has been stripped of purpose, relevance, audience, authenticity, and therefore vitality, no amount of drafting and structural modelling will re-energise it.

8.2 The Potential of Argument

The following section will put forward the contribution my findings on argumentation have made to the research literature and pedagogy in the area of writing instruction. The attitudes and experiences of students and teachers in this investigation are assessed in the light of eclectic approaches focused on argument as a mode of discourse rather than contemporary strategies utilising disembodied elements of structure, or aspects of a truncated process writing framework.
There is clear evidence from the intervention reported here that participants responded well to activities within a learning environment that sought to facilitate the learning of argument. As seen through writing pre- and post-test data, students were better able to develop and maintain a thesis, deploy evidence to support that thesis, and use an engaging personal voice to connect with and position the implied reader. In interviews their teachers reported a significant impact on students’ abilities to elaborate on their premises and defend their arguments with the judicious use of evidence. Students were able to link evidence in a more convincing way to the points they were attempting to argue. They took on, included in their writing and valued in their interviews, the skill of incorporating alternative arguments to lend strength and diversity to their theses.

In the following sub-sections, a series of possible explanations ranging from skills-based to dialogic and collaborative social interactions, through the more cognitive focus of counter-argument and finally the use of argument mapping are explored to shed light on the reasons underlying these observed improvements. Students and teachers were involved in complex behaviours and practices within all of the following aspects of argumentation; the objective from a design-based research perspective is to tease out effects and the nature of the interactions between these elements at play in the learning environment.

8.2.1 The explicit teaching of argumentation skills.

While it is impossible to reduce improvements in argumentative writing observed in this investigation to the students’ exposure to a set of skills, it is important to note the students’ use – in observed classroom interactions and interview data – of the argument grammar that had been explicitly taught and modelled to them. Students, as reported in Chapter 6, continually debated both which evidence to use and the nature and usefulness of evidence as a feature of their developing argument maps. Students discussed the order of ‘reasons’ (Toulmin’s ‘claim’) and the extent to which reasons had fulfilled their purpose by being adequately supported. In their interviews they used the shared language of argument grammar, without researcher prompting, to explain their thoughts on argument mapping: “For me, it kind of feeds out your thought process, as in here’s an argument. Next step is to go to the reason and then why is that reason so, like you know, what's the evidence for that?” (J9).

44 As introduced on p. 9
This investigation therefore aligns with previous research to confirm the place of “metacognitive reflection to scaffold students’ written argument” (Felton & Herko, 2004, p. 672; see also Newell et al., 2011) within a writing workshop approach. Moreover this investigation also ratifies the emphasis placed on the explicit teaching of strategies as the key element of writing instruction for teenagers. Graham and Perin’s (2007) overview found this approach to have the highest effect size of those examined. Importantly, though, in the light of questions over the effectiveness of a text types approach, self-regulated strategy development (SRSD), where the external scaffolding is gradually removed, was found to be particularly effective in Graham and Perin’s meta-analysis. The explicit teaching of an argumentation grammar which is then carried over into digital argument mapping work aligns with a cognitive teaching framework that includes techniques such as mnemonics, brainstorming and collaborative peer revision, but also aligns with broader constructivist notions about when and how to fade strategies depending on student need and development. There is a strong warning here about the rigidification of any strategies into reified templates or structures that then become the focus of learning.

Whether it is labelled a skills-based focus on argumentative grammar, a cognitive orientation towards rhetorical moves (Felton & Herko, 2004), an explicit teaching of rhetoric (Moon, 2012) or a systemic-functional focus on grammatical structures and lexical moves (Llosa et al., 2011), this investigation suggests that these skills were independently transferred to student writing, that students positively related to these cognitive processes during student interactions, and positively evaluated them during student interviews.

Furthermore the findings of this investigation concerning this under-utilised set of skills add weight to Andrew’s (1995) notion that mature argumentation in schools is in part limited by the problematic Piagetian conception that teenagers are not ready to deal cognitively with argument. The actions and interpretations of the participating students suggest that the developmental conception is incorrect and that teaching programs that actively engage younger students’ cognitive attention to argumentation (see for example Schwarz & Asterhan, 2010) are justified as an approach towards more effective and engaged writing. It is a key proposition of this dissertation, and an extension of the focus of existing literature, that students at this age are not only ready and able to take on an explicitly-taught set of argumentation
skills, they are actively seeking this type of thinking and interaction. As we have seen from their attitudes to counter-argument, for example, and their enhanced ability to include it in their essay-writing, students are not only generally cognitively able, they are specifically willing to transfer argumentation skills to their argumentative writing.

There is an important warning in the literature here, however. Schwarz and Asterhan (2010) report that students’ early development of argumentative skills means that any decontextualized teaching of skills at a later stage may be counter-productive. For them “argumentation is a social activity” (p. 137) and skills must be taught in educational settings which foster purposeful argumentation aimed at facilitating what systemic-functionalists, with their interest in the socially derived relationship of writer and audience, would call “interpersonal meaning” (Llosa et al., 2011, p. 257).

The student reactions, reported in Chapter 6, made it clear that the processes of argumentation, and in particular digital argument mapping, had been successful in orienting them towards a consideration of the intended or imagined reader of their writing. This awareness of audience is a significant achievement in a context of disengagement with and confusion over the purposes of argumentative writing. This investigation has suggested that participating students now have an enhanced awareness that the purpose of their writing is dependent on the marshalling of arguments for an audience who must be considered – either to be convinced or to illicit a response. In this way argumentation has indeed contributed towards an “interpretive community” (Kress & van Leeuwen, 2001, p. 9)\(^{45}\), one that depends on meaningful cycles of articulation and response, and within which students are more engaged in writing and more able to produce effective writing.

### 8.2.2 Argument and the revitalisation of the process of writing.

The research literature suggests that collaborative classroom work within a dialogic learning environment which includes meaningful teacher-to-student as well and student-to-student talk, can facilitate the take up and deployment of argumentation skills in students. While this view is supported by the present investigation, the focus is now on the extent to which, and the manner in which, argumentation skills transfer to student writing. Hence this sub-section evaluates the ways in which

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\(^{45}\) See Introduction p. 8 for the initial discussion of this concept.
argumentation, collaboration and dialogue can interact as part of a revitalised process-writing approach, to enhance engagement with and the effectiveness of argumentative writing.

In their overview, Nussbaum, Winsor, Aqui and Poliquin (2007) conclude that collaborative argumentation, students “working together to construct and critique arguments” (p. 480), facilitates learning. Moreover, this kind of discussion followed by diagramming (see section below on argument mapping) was found to help students move beyond the tendency to pick a side in an argument and reject counterevidence. In a similar synthesis of research on the benefits of collaborative argumentation-based learning (CABLE), the authors specify that in this approach, learning partners “collectively contribute reasons and evidence from different viewpoints in order to build up a shared understanding of the issue instead of merely convincing or changing their own and each other’s attitudes” (Noroozi et al., 2012, p. 81).

The participating students in this investigation were very clear about the types of collaboration they found to be useful, whether involving technology or not. While the perils of unmotivated partners and those who took too much control were repeatedly voiced, the students also consistently emphasized the benefits of the multiple worldviews expressed by their partners. Students and their teachers valued the ability to “gain…insight” (C10) from pair and groupwork, not only into the topic being discussed, but into each other’s ways of thinking. As reported in Chapter 7, students were repeatedly observed engaging in meaningful and purposeful collaborative argumentation while constructing argument maps. In addition, students in interviews commented unsolicited on the perceived benefits of the approach and their engagement with the process. While these interpretations and observations cannot pinpoint this collaborative element as a causative variable, the views of students and teachers, together with the significant reported gains in writing effectiveness suggest that this was a key factor in the learning environment, and is perhaps an area for ongoing research.

The observed interactions of students in the classroom, their interpretations of the process during interviews and the gains detected in their writing, all confirm a valuing in the literature of dialogues which blend dialogic and dialectic moves. Using the sense of these terms borrowed from Platonic philosophy, Schwarz and...
Asterhan (2010) for example, define the dialogic as “empathetic reference to the other” and dialectic as a “commitment to critical consideration of alternative views” (p. 138). They describe the gradual devaluing of dialogic elements through the post-Socratic world and the watering down of dialecticism until it had become a training in logic and rhetoric in the service of the State. In their view, the more democratic 20th century has brought with it Buber’s interest in an ethical interpersonal component of the dialectic which focuses on the social over the individual or bureaucratic. Habermas is then seen to value social relationships in which communication leads to the construction of a just society; for both Buber and Habermas “communication is at the basis of changes in thinking” (Schwarz & Asterhan, 2010, p. 140). In educational settings therefore an “[a]dherence to dialogism makes it possible to implement argumentative practices in schools that champion the precedence of communication for mutual and reciprocal understanding over univocal rationalism” (p. 140).

In their overview of studies linking argument, explanation and learning, Schwarz and Asterhan contend that “only engagement in dialectical argumentative discourse was followed by radical conceptual change… whereas consensual processes of explanation construction were not” (p. 148). The authors consider key programs in the field such as Lipman’s Philosophy for Children, Perkin’s Point Zero program, and The Argumentative Group at the Hebrew University. While the influence of dialogism on critical thinking is unclear from the accumulated studies, argumentative practices are seen to “support genuine reasoning development” (p. 157). Significantly, the conditions under which this is seen to take place align with the design and teaching practices implemented during this intervention: students were given explicit training in argumentative skills, used a digital graphical organiser, and were encouraged by explicit pedagogical principles to be autonomous, collaborative, communicative and committed to reasoning (based on Schwarz & De Groot, 2007)

The current investigation, albeit tentatively, suggests that students’ conceptual gains from intra-personal cognitive conflict within a dialogic learning environment can be transferred to their argumentative writing. In line with the nature of this feasibility type study, further research could explore the precise nature of the dialogue and cognitive conflict necessary for this transfer. Student behaviour during this intervention, and student and teacher reflections on that behaviour, suggest that
changes in conceptual thinking – as well as changes in thinking about that conceptual thinking – occurred for a significant proportion of participants. This includes both “lightbulb” moments about the topic (JR) and the nature of evidence, and the “voice” (PM) students were seen to develop by arguing through evidence and counter-argument. While the links to writing are certainly not established in an absolute causative sense by this investigation, PM, for example, could describe the way that her students’ more “empathetic and holistic… understanding of the concept” could be seen in the “detail in their paragraphs” that was then used to “defend that argument” or “point of view.”

The students themselves, as reported in Chapter 6, emphasized both interesting topics and a chance to work together and discuss them as a perceived factor in their success with and interest in argumentative writing. Many students claimed to enjoy the chance to merely hear others’ opinions, while several pointed out the way an opportunity to discuss topics before writing with both peers and the teacher was fundamental to their ability to generate ideas and consider alternative viewpoints.

An important implication here for our time-starved approach to teaching writing is clear: a well-considered process writing approach which develops meaningful cycles of teacher-student and student-student talk as part of planning and drafting deserves to retain its place, alongside cognitive and genre approaches, in our writing instruction repertoire.

The process writing approach was present in both schools in the form of drafting and one-to-one conferencing with the teacher. These are repeatedly voiced by students and teachers alike as critically important to the success of writing, with time spent workshopping with the teacher highlighted by students in both print and digital environments as crucial to both their understanding of content and preparedness to write. According to Sutherland and Wilkinson (2010), however, the process writing approach involves both planning before drafting and publishing after it. Planning was not mentioned by students in their interviews except in relation to the limitations many saw in the usefulness of dot point summaries as a preparation for essay-writing. Publishing, as we have seen in the questionnaire data, was experienced infrequently by the participating cohorts.

While the suggestion that the process writing approach is being enacted in a watered-down state is alarming, the broader literature has been concerned for some
time that process writing, with its focus on the self-expression of the student and its downplaying of formal instruction, is limited in the extent to which it can improve the effectiveness of writing (Moon, 2012). If planning and publishing are limited, and other elements of the approach, such as collaborative writing and teacher intervention in the form of mini-lessons are at best minimal, then a connection to the students’ sense that much of the writing they do is “pointless” (G9, for example) is understandable. In addition, the original purpose of this approach, that of providing writers with the stimulation of writing for real audiences (Sutherland & Wilkinson, 2010), is – as reported from the questionnaire data – absent from the experiences of the overwhelming majority of students in this sample.

It is a key finding of this investigation that important features of the process writing approach are not being utilised in the classroom, and that students in particular are constrained by the remaining cycles of structural work on whole texts and paragraphs. However, the nature of writing strategies employed by teachers is insufficient to fully explain either the hesitancy of students in this sample or the limitations of school and university writing reported in the literature (see for example Shetler et al., 2013). Interview participants emphasized an “interesting topic” (K10 for example) and access to workshopping time with a teacher as keys to their writing success. They also bemoaned the absence of these factors in their classrooms. While this does not necessarily mean that interesting topics and interested teachers were unavailable, it does hint at the impacts of content heavy term-long topics and high stakes testing on the ability of teachers to facilitate the kinds of learning suggested by the literature and demanded by their students. Several teachers credited the repeated cycles of content heavy units of work followed by assessment task preparation with limiting their time and energy for writing workshops or the development of authentic writing contexts.

This investigation extends on previous work which criticizes the current state of process writing to suggest that certain kinds of pre-writing strategies can work to improve student engagement and effectiveness, despite (or perhaps because of) the cost to content-provision time. Effective strategies utilise cognitive skills in a meaningful collaborative context. In other words, these approaches explicitly structure meaningful collaborative work that involves students putting argumentation skills into practice in a social setting. The dialogic learning environment, particularly if it involves dialectical moves, revitalises the planning
stage of the process approach so that it is neither confusing nor pointless. It is also not paid lip service to in the form of a quick mind map; rather it is a lengthy interpersonal process focused on communication, ideas and personal voice.

The teachers in the present investigation suggested that the more dialogic aspects of the argumentation facilitated not only more ideas but conceptually more well-rounded ones: “Yes we did discussion but it’s been very tokenistic [before]. It’s the greater mulling it through and taking the concept and articulating it into concrete, I think is the thing that has been improved” (PM). If, according to Andrews (1994), language forms like the essay are learnt through dialogue, then fixed forms or genres need not be the focus of the curriculum. Interactions using these forms, learning through collaboration, interaction and dialogue rather than the reciting of templates or learning of grammatical skills, is the way forward.

8.2.3 Exposure to counter-argument

The ability to consider alternative viewpoints, either as a rhetorical device to strengthen an initial argument, or to develop a more balanced thesis, was the clearest gain reported by the writing data in this investigation. It is also one of the most pervasive themes explored as a benefit of the process by both students and teachers in their interviews. Typical of teacher interpretations is the following from PM, where she considers not only the effects on essay-writing, but the sociolinguistic benefits for students of finding a more authentic voice to address issues with:

It has also given them more of a voice because not everybody has always agreed with the line that’s been meant to be taken. And so in the essays some did two positive paragraphs and one negative or others did two negatives and one positive. But they have choice then rather than just having to say one way or the other. And some wanted to say both, and so that style of approach and seeing and having a lot more to look at certainly gave them more choices and could make them defend their arguments a lot better and have more to argue. So I think that was beneficial and different from other terms. I think looking at all their essays at the end they certainly had a lot more content to support their argument. You know, in terms of arguments they actually had detailed examples to support it…had more argument to defend, you know, their point of view. So I think that was very clear (PM).
While extensive gains in the ability to consider alternative viewpoints within essays has been a very pleasing result of the intervention, it is the way teachers and students have responded so positively in interviews to this new skill set that is one of the most significant findings of this investigation. There is a palpable mixture of excitement and relief, usually unsolicited, when students consider the way the mapping out of counter-argument has allowed them to understand the purpose of more balanced essays, and encouraged them to construct a meaningful line-of-argument.

This investigation has found that students in a high school setting, working on subject-specific content that has been the focus of ongoing classroom activity, are not only interested in the possibilities opened up for them by the structuring of counter-argument, but willing and able to transfer that understanding and engagement to their written work in the form of essays. It is also apparent, and an extension of existing research in the sphere of secondary education, that an understanding of the purpose of writing argumentatively and the nature and usefulness of considering alternative viewpoints, is facilitated by the argument mapping learning environment.

The participating students emphasized a sense of the intra-personal argument that was encouraged by the process: “Having a discussion with yourself helped me -- so I'd say one thing and then I could go against that and say another thing, so it just helped me set that out” (L9). Others suggested that a combination of the explicit teaching of argumentation and the work with argument mapping had allowed them to grasp the concept of using opposing points-of-view in an essay. Typical of these is I9:

That's been very useful especially for me learning the set out of an essay like saying this is why and this is why it isn't. At the start of term, I didn't get that at all. I was like, why don't you just choose one side and stick with it.

Once again it is not possible to delineate the precise role that a consideration of counter-argument may have had in improvements in student writing through this intervention. It is possible, however, to note that counter-argument implies both cognitive processes in the strategic organisation of ideas, and dialogic elements in
the consideration of others’ or alternative viewpoints. The dialectical elements are perhaps the most important to note. In the argument/counter-argument integration framework reported by Nussbaum et al. (2007), research in this field is clear that without explicit scaffolding of counter-argumentation, students’ argumentative writing remains superficial. Elsewhere Nussbaum and Schraw (2007) have defined counter-argument integration as the ability to evaluate, weigh and combine arguments into an “overall final position” (p. 60). Whether this final position refutes an initial proposition, synthesizes two or more into a compromise thesis, or weighs the evidence or disadvantages to support one side over another, the key elements involve the critical evaluation of alternative views (the dialectic) and intra-personal cognitive conflict. Both this critical evaluation and the cognitive conflict were facilitated by the mapping, and emphasized by participants in this investigation as highlights of the process.

The present investigation has not specified aspects of counter-argument that students were taught or for which their writing was assessed. Whether an individual student deployed a refutation, synthesizing or weighing strategy (Nussbaum & Schraw, 2007), or whether their consideration of alternatives took place across or within paragraphs, was not a focal point of this inquiry. While there is scope in ongoing research to pinpoint specific counter-argument strategies as more or less effective, this investigation took a more generalised approach in line with its feasibility objectives. All intervention students were involved in extended classroom practices that involved the explicit teaching of terminology and concepts – an argumentation grammar – in relation to topics arising from the texts being studied. All intervention students then worked in collaboration with others to produce argument maps that explicitly scaffolded a counter-argument. They were given the freedom to choose counter-argument approaches in line with their developing theses, and many students credited this type of choice as fundamental to their engagement with the process.

Previous studies have found that students are typically challenged by three aspects of counter-argument: the high cognitive load (Coirier, Andriessen, & Chanquoy, 1999), the desire to maintain consistency (Simon & Holyoak, 2002), and their limited understanding of the rhetorical power of considering and rebutting a counter-argument (Nussbaum & Kardash, 2005). These issues were explicitly addressed in this investigation, in particular through the provision of argument
maps to help structure counter-argument and lessen cognitive load. In addition the dialogic environment coupled with explicit instruction in argumentation was intended to highlight the positive persuasive impacts of counter-argument as a rhetorical tactic. Unlike previous studies (see for example Nussbaum & Schraw, 2007), which have focused on undergraduate level, non-digital mapping and have not considered students’ own interpretations of the process, the present investigation has demonstrated that these processes enable high school students to enthusiastically take up counter-argument and transfer the skill willingly to their argumentative writing.

The nature of the connection between the development of counter-argument and writing has challenged both researchers and students. Not only is this a methodological hurdle involving the control of competing variables, but for students and teachers, the connection points to one of the main challenges in the area of argumentation. For Felton and Herko (2004) the key difficulty with written argument is the way students’ interest and energy for verbal argument dissipates when they are asked to write. Typically, essays then become limited to one or two claims in support of a conclusion, with no alternative viewpoints addressed, no counter-arguments offered as rhetorical moves, and an overly high modality obscuring reservations. The problem may lie in students (and perhaps teachers) failing to recognise the differences between spoken and written argument (Bereiter & Scardamalia, 1987). In particular, argument in dialogue typically develops after turns, but in written argument the composer must predict potential counter-arguments in order to use or rebut them. Bereiter and Scardamalia define the ability of a mature writer to engage in inner dialogue in order to develop a two-sided argument as knowledge-transformation. This is distinguished from the knowledge-telling of a novice who writes what they would say.

It is a significant conclusion of this investigation that the processes involved in argument mapping allowed high school age students to transfer into writing complex ideas based around alternative viewpoints that had developed as a result of both intra and inter-personal dialogue. Furthermore the explicit instruction in argumentation, coupled with intensive and prolonged dialogic work on content, and the scaffolding of counter-argument, facilitated a more effective general deployment of argument elements such as supporting evidence and a prolonged thesis. Perhaps most importantly for a field desperate for ways to facilitate student
investment in the writing of opinion, student and teacher interpretations of the process revealed that the personal voice encouraged by considering alternative viewpoints resulted in an enhanced student engagement with both the objectives and the classroom practices of argumentative writing.

8.2.4 Mapping out the argument

The lesson structures co-designed by participating teachers and the researcher focused on the students’ mapping of their developing arguments using a web-based digital mapping program. As distinct from much recent work in this field, such as research focused on undergraduate philosophy courses (see for example Harrell & Wetzell, 2013), the students were not asked to map existing arguments, they were asked to develop their own arguments in response to a teacher-set topic, with the expectation that evidence would come from texts under study in the English classroom. Moreover, apart from the shift of focus to high school students, the present investigation has also sought to expand the research direction from an orientation to the way argument maps expand critical thinking (Buckingham Shum, 2003; Harrell, 2005), to their bearing on argumentative writing.

This section will consider how the findings of this investigation expand on the expectations of the existing research in the field of argument mapping. On this basis an assessment is made about the potential role of argument mapping in facilitating more effective argumentative writing. Moreover, in preparation for the following chapter which looks specifically at the impacts of digital educational technology, this section seeks to place argument mapping as a practice within the context of a cognitive, collaborative and dialogic learning environment in which elements of existing writing pedagogies – process and genre frameworks – are still very much in play.

As reported in Chapter 5, students involved in the intervention were significantly more able to develop and maintain a thesis and support it with a range of evidence, both compared to control groups and their own pre-writing results. In addition, students stressed throughout their interviews that the visual layout of the argument maps allowed them to plan and organise ideas and better understand both the purpose of argument and the nature of the concepts under consideration: “I think it helps just because it puts it there visually and you can see where you have to separate and what part you use for which section, which is good” (K9).
Nussbaum et al.’s (2007) overview of previous research, graphic organizers of this type were expected to act as a prewriting planning device and, as such, successfully address this typical deficiency in the student writing process.

Planning, visualizing and collating activities during a pre-writing stage link strongly with a process writing approach which has been, as suggested in this dissertation, stripped of this aspect of its pedagogical thrust. If process-writing ‘lite’ – basically a draft and redraft strategy – is the current classroom norm, then the engagement of students participating in this investigation with a structured, visual, easily-malleable planning stage may help to explain improvements in the effectiveness of argumentative writing. This investigation confirms the ability of argument visualisation to help students make sense of information. Existing theory and classroom practice are moreover extended by the conclusion that in high school settings students are able to realise new understandings in their writing where the visualisation has been part of a carefully teacher-orchestrated planning stage of a process-writing approach. Further research isolating the argument mapping from a process-writing framework as part of a controlled experiment, would help to confirm this finding.

The research participants were observed to revel in the collaborative and dialogic space opened up in the learning environment of the intervention. While there is no measurement of the relative enjoyment of pairwork on the digital argument maps as opposed to non-computer or non-digital argument mapping based pairwork, it is a tentative interpretation of this dissertation that the kinds of interaction facilitated by the argument mapping closely align with the interpretations of participating students about when pair or group work is enjoyed or successful (see Chapter 7). This can be summarized as collaborative pair work that involves mutual assistance and the sharing of complementary skills and knowledge that leads to new understandings and a broadened worldview. While resistance to group work around themes of fairness, distraction and control cannot be overlooked, the attitudes of students to this process, coupled with the transference of skills to their writing, suggests that this particular social process was effective at enabling problem-solving that then emerged in more effective written argument.

Moreover the attitudes of all participants, as well as the writing results of students specifically, work to confirm two strands in the literature around argument
mapping. Firstly, student negotiation of multiple perspectives works to construct a constructivist space around the argument map where problem-solving from multiple actors with multiple perspectives is facilitated and valued (Kirschner et al., 2003; Nussbaum et al., 2007). Secondly, the surface representation in the form of the map encourages the development of a shared language which facilitates the students’ approach to the task (van Bruggen, Boshuizen and Kirschner, 2003). Both expected processes were observed in the intervention classrooms, and have been commented on positively by students and teachers. Beyond the now-entrenched theme in this dissertation that such socio-linguistic elements of the learning environment are then transferred to student writing, it is a key conclusion of this investigation that the argument map works to scaffold meaningful communication as part of the process of developing writing. Moreover, in a significant extension of previous understandings, students’ written work itself was found to be more communicative in its strategic use of evidence to support more clearly defined personal theses, and its deployment of alternative viewpoints as part of an acceptance and utilisation of multiple perspectives.

Argument mapping therefore bolsters a process writing approach and confirms the importance of constructivist orientation towards problem-solving. Does this counteract a more cognitive focus? According to Buckingham Shum (2003), the initial development of argument visualization saw it as “a cognitive tool for reflection”; one that could “augment our intellectual ability in argument analysis and construction” (p. 5). We have seen that participating students responded well to the explicit-teaching of argument grammar within a cognitive pedagogical frame. It has also been suggested that the argument grammar was utilized by students in their interviews and, according to teachers, can be traced through to improvements in their writing. Teachers, moreover, emphasized the conceptual depth and nuance that developed in students’ writing as a result of the argument mapping process. A cognitive focus, including the use of argument diagrams, has been found to significantly improve critical thinking skills (Harrell & Wetzell, 2013), and – if focused on dialectically moving towards discovery (Buckingham Shum, 2003) – improve problem-solving.

Crucially Buckingham Shum suggests that the successes of Computer-supported Argument Visualisation (CSAV) come from a combination of (cognitive) expertise in mapping and technology, and the nature of the problem and purpose of the
activity; a much more socio-linguistic conception. “A focus on any one factor in isolation has proven to be short-sighted” (Buckingham Shum, 2003, p. 19). Certainly, argument map users react positively in general to various aspects of the process, both social and cognitive. A student of Simon Cullen’s, involved in the Princeton philosophy course which utilizes argument mapping, wrote in an anonymous survey: “I think this class has made me a better person, not because of the articles I have read, but because of the new way I have learned to think. I find myself being much more cautious about what I say, and a bit more humble” (Noden, 2015). This is a feeling shared by participating students, who pointed to a more nuanced understanding of the topics being studied, and by teachers who valued the choices in approach available to the students who had mapped out arguments.

One possible reason for the success of students in this investigation transferring those newly plural choices to their argumentative writing, is in the way the argument mapping is seen to alleviate some of the cognitive load associated with writing (Coirier et al., 1999). Citing the research of Bell and Linn in this area, Nussbaum et al. (2007) suggest that argument maps used after discussion has proceeded, “make thinking visible” (p. 484) by laying out arguments and counter-arguments in an organized way. According to schema theory, within a cognitive framework, the acquisition of new schemas can be facilitated by “reducing the extraneous cognitive load during the learning process” (Harrell & Wetzell, 2013, p. 1). The contention here is that the visibility gives cognitive space to the development of more refined theses, or the more effective deployment of evidence. In their interviews, students continually touched on the ways in which the mapping had allowed them to deal more effectively, in their own interpretations, with the content. “I think for me it was more how the space worked and what order to have things than what to write about” (J10). This distinguishes the argument mapping, again in the students’ own sense, from the assistance provided by the paragraph templates or dot point summaries. The objective is not to be ‘right’ or to fit into a predetermined textual structure. The aim is to find common ground, understand different positions, and analyse assumptions and evidence. In short, to communicate. The writing results suggest that treatment students were better able to do this in their writing. The interview data suggests these same students were aware of the process and appreciated the writing identity it allowed them to take up.
8.3 Conclusion

The benefit of observing a learning environment centred on argumentation in a high school English classroom, one focused on concepts and issues drawn from novels and plays studied in class, and oriented towards producing assessable writing, is that it foregrounds the range of pedagogical processes at work and challenges simplistic promotions of any one factor. This investigation has suggested that improvements in writing effectiveness and student engagement with writing practices is the result of a balance of factors at play, rather than the result of an individual strategy or pedagogical approach, even one that has been strongly advocated in the existing literature.

Based on this central argument, the conclusions of this chapter, including implications for classroom practice are summarized here:

• Both genre and process writing approaches are valued by students and teachers, but in contemporary classroom practice they are shadows of the respective movement’s ideals, and may in fact be inhibiting aspects of writing instruction that students most highly value. This investigation has added the key concept of the constraint students feel in regards to current practices, to our understanding of the reasons for student disengagement from essay writing.

• Students value feeling like their writing is purposeful and relevant, that they have a voice and that they can contribute to public debates. Importantly, the participating students pinpointed interesting, relevant topics involving issues where they can listen to each other’s opinions, and workshopping time with a supportive teacher as the keys to their writing development. This investigation extends recent research valuing the explicit teaching of strategies and goal-setting to remind us of the importance of purposeful discussion with peers and mentors as an important element in effective writing instruction.

• There is a complex interaction between verbal and written argument that needs further research and classroom practice attention. The interaction is both a challenge to argumentative writing and a potential way forward. If argument is viewed as a mode of discourse, a way of communicating, then it becomes
possible to see the multiple purposes and forms of argument. It also becomes possible – and necessary – to see the essay as merely one socially constructed outlet for argument. Further than evidence suggesting the decline in essay-writing as a practice and a disposition, this investigation demonstrates that students can be taught to write more effective essays and can be engaged by that process.

• There is a complex interplay of argumentation elements in a learning environment, with little point in the attempt to identify one as more causal than another. Studies such as Felton and Herko’s (2004) “multistage argumentative writing workshop” (p. 679) suggest, and this investigation confirms, the need for a careful alignment. This includes the explicit teaching of argument grammar in a cognitive framework as well as dialogic and collaborative teacher-student and student-student interactions. The workshop involves a staged development of content knowledge with explicit examination of alternative viewpoints through debate, and a pre-writing stage involving collaborative work with graphic organisers. This investigation extends these understandings by, firstly, demonstrating the productive role of digital argument mapping as part of such a workshop, and secondly, by shifting the focus from debate to dialogue as a way to facilitate student understanding of how to balance points of view in a mature piece of writing.

• Metacognitive reflection on argument, including the explicit teaching of argument grammar, is useful and should be incorporated in teaching practices as long as it does not become a decontextualized competency type approach.

• This investigation warns that the nature of collaboration during the writing process needs careful consideration. A collaborative learning environment, one which includes dialogic teaching as well as the fostering of dialectical argument discourse which leads to intra-personal cognitive conflict, has been shown to benefit learning. This dissertation suggests that the writing results of students, and the evaluations of students and teachers of the process, point to the need to frame argumentation work within such a socio-linguistic frame, and that in turn, structured collaboration is beneficial to the process of transferring ideas to writing.
• Participating students demonstrated clear gains in their ability to include counter-argument, or alternative viewpoints, in their essay writing. They were engaged by practices of counter-argument, mentioned them unsolicited as perceived benefits of the process, and included them in their post-writing essays without specific instruction to do so. There is literature support for the notion that counter-argument leads to more nuanced conceptual thinking and this view is corroborated by this investigation. Moreover, this investigation has uncovered evidence that counter-argument can be explicitly developed in classrooms and consciously transferred to student writing. The findings suggest that an explicit and dialogic focus on alternative viewpoints throughout units of work, in addition to the development of linguistic skills in this area, can improve argumentative writing.

What distinguishes this approach from the mainstream contemporary approaches deployed in classrooms and explored here? In a nutshell, both the process and genre movements have lost their communicative focus. Argumentation and argument mapping focus on communication in both the classroom practices that develop writing, and the written products of students. It has been established that communicativeness depends on key notions such as willingness, purpose, exchange and audience. Through its valuing of dialogue in the process of planning, the arrangement of ideas to convince a reader, its structuring of turn-taking within a piece of writing in the form of counter-argument, and its support for an authentic student voice over content and structure, argument is communicative by nature and communicative in the classroom practices explored in this investigation.

Argument mapping has been shown to be a successful cognitive means of scaffolding students’ arguments. Students found elements including its visual nature, clear and logical organisation and demonstration of relationships to be useful in planning for writing. This dissertation supports the view, derived from the Computer-supported Argument Visualisation (CSAV) literature (Kirschner et al., 2003) that planning on argument maps works best in a dialogic environment focused on authentic problems and utilising pre-prepared content. While the focus on authentic problems was not a controlled variable in this investigation, the interpretations of students and teachers, supported by the writing results, suggest that a purposeful constructivist space is opened up by the argument mapping. Beyond its potential impacts on argumentative writing, the problem-solving
approach whereby a shared language is developed through the mapping representation, emphasizes the socio-linguistic element in balance with previously suggested cognitive elements.

Perhaps most significantly, considering the sometimes heroic claims of digital educational technology, it is a socio-linguistic element focused on communication that seems to match both the learning style preferred by students, and the group interactions they find most rewarding and useful. We now turn, in Chapter 9, to an examination of the extent to which this is facilitated in a digital environment.
Chapter 9 – Discussion 2: Arguing with Technology

Figure 9.1 The discussion stage II.

- Evaluate implications for writing pedagogy and EDUCATIONAL TECHNOLOGY
- Explore literature approaches to writing in a digital age classroom
- Identify and evaluate changes in argumentation skills evident in essay writing
- Evaluate the impact of streaming, school, year and attitudes on treatment group results
- Analyse attitudes to writing, existing writing pedagogy and DAM
- Analyse attitudes to learning with educational technology
- Argument as communicative impetus for sustained writing
**Chapter 9 – ** **Discussion 2: Arguing with Technology**

In this chapter the concept of the learning environment is used as a frame for a discussion of the digital argument mapping program in use in actual classroom settings. The learning environment consists of the interaction between learners, teacher, artefacts including educational technology, and social, political and economic imperatives. By focusing on this type of educational technology-in-use (Edgerton, 2007), the aim of this chapter is to assess the communicative interactions that are created in such a learning environment which actually enhance the process of learning with technology, particularly in the field of writing pedagogy.

To this end, this chapter will put forward and assess three contentions that have been made on the basis of findings reported here. First, that educational technology should be used in a way that aligns with students’ own conceptions of purposeful and valuable learning with technology. Second, that a dialogic and collaborative teaching and learning environment will enhance the process of learning if the key stakeholders are involved in authentically communicative interactions. Third, that there is an ongoing value in technology use which aims to scaffold skills such as argumentation, in contrast to the demands of the new literacies agenda for revolutionary and transformative uses of technology which will take learning and schooling beyond such traditional, heritage capacities.

**9.1 Introduction**

This dissertation has advanced two broad explanations, to this point, for the positive writing results from, and positive student engagement with, the digital argument mapping (DAM) intervention.

Firstly, argument is, by inclination, communicative. It not only facilitates dialogic practices involving collaboration, inter-cognitive and intra-cognitive conflict, it also focuses the thinker-writer’s attention onto purpose, the demands of the intended audience, and the characteristics of the context of communication. It is thus distinct from the main current approaches to the teaching and learning of argumentative writing. Writing results and interview data suggest that the students accepted – and were engaged by – the skills, practices and attitudes involved in argumentation.
Secondly, the learning environment in which the argument mapping program was used was a specifically digital one, both as a cultural space and in terms of the artefacts interacted with. The third Findings chapter, however, reported that students have complex notions of the extent to which the work that habitually takes place in these environments actually counts as learning. The data reported in that chapter suggested that students value the following in terms of learning with technology:

- opportunities for meaningful discussion;
- the class remaining “on the same path”;
- the guidance of their teacher;
- purposeful collaboration that results in expanded worldviews; and
- a variety of lesson designs (including the total absence of technology).

This second Discussion chapter will further evaluate these findings in order to understand the ways in which communicative interactions are created which enhance the process of learning with technology, particularly in the field of writing instruction. The three main sections of this chapter seek to answer the following three questions, each the result of broad themes identified in the existing research literature, but then developed more specifically from student interpretations, in other words inductively, from the interview data:

1. Was the digital argument mapping successful because it aligned with student conceptions of beneficial and purposeful learning with digital technologies?

2. What kinds of interactive or dialogic roles do teachers and students play as part of such a beneficial learning environment?

3. Is the use of educational technology that scaffolds, rather than revolutionizes, learning an enabling or constraining aspect of such an environment?
9.2 Purposeful Learning with Technology

The students in this investigation made a strong distinction between learning and mere class work, whether this involved digital technology or not. In the same way that they identified the difference between pointless writing and meaningful communication through writing, they also differentiated between in-class technology use that merely presents information and perhaps atomises the learning space, and technology use that enables discussion and understanding.

One of the most significant findings from this investigation has been the sense that students recognise various benefits of working with digital technology in the classroom, but do not simplistically align those benefits with learning. The ease of use, therefore, coupled with the advantages of typing over writing, searching for information on the internet, creative presentation, and the fun and variety brought to the classroom by certain programs, are valued but distinguished from meaningful dialogue with others, thinking independently and wrestling with ideas. Equally significant has been the parallel finding that there is a gap in this regard to what teachers see as the connection between educational technology and learning. While participating teachers value the opportunities technology provides for students to express themselves and their ideas, their focus is squarely on the way digital tools enhance presentation. On the whole teachers view themselves as guides to useful content; a role facilitated by appealing technology programs and apps, and the access to a range of rich content online. Teachers see the capacity of students to present the products of their learning in a variety of digital formats and modes as a major advantage of digitally revolutionised learning.

A key finding of this investigation, that there is a significant gap between teachers’ and students’ views of the usefulness of educational technology as a presentation tool, supports one side of an unresolved debate that has marked the research field. The literature on Interactive Whiteboards (IWBs), for example, has explored this discrepancy between teacher assumptions and student interpretations about learning for more than two decades. Some studies report successful and innovative uses of IWBs for learner engagement, critical thinking and content understanding (for example Hennessy & Warwick, 2010), though the key factors are the level of teacher orchestration and the nature of learner interaction. Other studies have
demonstrated that common practices with the IWB may reinforce a teacher-centred pedagogy where the learning may be being confused with the passive reception of content (Hall & Higgins, 2005; Reedy, 2008). Importantly for the present investigation, some research (Cutrim Schmid, 2008; Jewitt, Moss, & Cardini, 2007) has suggested that the prepared screens of Powerpoint or other presentation programs commonly projected onto the IWB may fragment learning in a way that the narrative trail developed by the teacher in a face-to-face pedagogy does not. Indeed “multimodal, interactive and fast-paced pedagogies are not necessarily good in and of themselves” (Jewitt et al., 2007, p. 316) when it comes to the presentation of content on the IWB.

The participating students in this investigation were generally disappointed by a teacher-centred use of technology that left them as passive inhabitants of the classroom, or which atomized them into individual learners who could not connect in meaningful ways to the learning community of the class. The distinction between student conceptions of learning, and what too-often takes place in the technology mediated classroom is even sharper when we consider students’ production of texts. The literature ranges from a triumphal heralding of "the creativity inherent in contemporary sociality and text construction practices" (Edwards-Groves, 2012, p. 102) to a hesitancy over the ways that much-vaunted aspects of New Learning such as learning-by-design (Healy, 2008) actually facilitate a construction of knowledge that is connected to higher order thinking and not just the “whizzbangery” of what Healy (2007, p. 194) calls digital “eye candy”. On the one hand, digital multimodal text production “might challenge the learner to become a knowledge creator” (Wikan et al., 2010, p. 226) and engage in “higher order thinking” (Ljungdahl, 2010, p. 402), but on the other, a perhaps more sober OECD review warns that students “are not always comfortable with innovative educational uses of technology despite the social media and digital practices they otherwise engage in” (Istance & Kools, 2013, p. 44).

The students in this investigation were specifically not comfortable with educational uses of technology that they felt stymied their learning. We have seen, from the findings in Chapter 7, that a generic teacher-centred, as opposed to teacher-oriented approach, the dissolution of the class as a learning community on the same path, the absence of meaningful teacher guidance, a lack of opportunity to
share and collaborate, and above all, an emphasis on information gathering over thinking, were felt by students to be elements of lessons involving teacher or teacher-facilitated use of technology that they did not associate with productive learning.

Literature from outside the multiliteracies framework – and hence not quite so enamoured with the revolutionary potential of the multimodal – confirms this more critical sense, from the students themselves, that learning with educational technology requires a “more holistic focus on learning environments, of which technology is only a part” (Istance & Kools, 2013, p. 43). The students’ interpretations corroborate Hattie’s (2009) overview of meta-analyses in the field, with the key conclusions that such an environment involves student control of learning, pair-work over individual or group work, and ICT as a supplement rather than a replacement for teacher instruction. For educational technology to be effective, opportunities for students to discuss and “articulate, explain, and understand a variety of hypotheses and solutions” (p. 226) need to be maximized, meaningful feedback needs to be structured into the student-teacher relationship, and “structured learning experiences” (p. 224) that align with both teacher-directed and cognitive approaches need to be at the forefront of pedagogy.

The following sub-sections evaluate whether the positive engagement with digital argument mapping, and the demonstrated effects of this uptake on student writing, are due to the apparent fit between this type of technology and the learning environment desired by participating students. The potential contributions to teaching practice and literature in this field, by the delineation of types of technology-focused learning environments that actually enhance engagement and learning, are significant.

9.2.1 A teacher-oriented not a teacher-centred tool.
The literature on argument mapping and digital argument mapping (DAM) has reported its successes, particularly in enhancing students’ critical thinking. This investigation has extended the scope of this field by reporting on the particular aspects of DAM that align with student conceptions of the benefits of educational technology. To begin with, the program utilized was easy to use, fast and stable. Text boxes allowed students to type in their ideas and then manipulate them freely.
The finished product was both useful as a planning device and looked “polished” and “fancy” (student F10).

However, this investigation has also revealed that these surface uses of technology do not, in and of themselves, satisfy students’ learning needs. Further characteristics of the program contributed to an engaging learning environment. The DAM was used as a scaffold for developing argumentation skills (see final section of this chapter for discussion about scaffolding as an approach). As such it can be described as a supplement under the guidance of teacher, rather than a replacement which claims to ‘teach’ argument or essay-writing. In the treatment classes the teacher acted as guide by facilitating the cognitive-focused argumentation grammar, modelling examples of maps, and guiding the use of evidence and reasoning. While students retained control of individual computers, arguments and maps, the class worked as a unit on one issue or question and students retained the ability to engage with others who were working at a similar pace on nearby computers. As such the DAM learning environment can be described as maintaining the “same path” so valued by many students, and resisting the atomisation into silent screen-focused individuals criticised – by students – as the default state of so much in-class technology use. In addition, the types of purposeful interaction between student and teacher that are valued by students were maintained in this environment.

The experience of the digital mapping work for most students was a very positive one, even though it was not focused on presentation, research or online communication, and perhaps because of this. Beyond the fact that the program involved typing over writing and involved a visual organisation of information and ideas, it is the interpretation of this dissertation that this engagement with the process – including but not limited to the actual program – arose because of the alignment of key features of the DAM learning environment with students’ conceptions of valuable learning, not simply the advantageous use of educational technology. In particular, this entailed a teacher-oriented environment that did not involve a generic content-presentation activity or independent information-search. The DAM environment confirms one research narrative, as reported by Hattie (2009), that structured learning experiences involving strategy development and the use of technology to supplement a teacher-orientated lesson are effective in both engaging students and having a positive influence on their learning.
9.2.2 A collaborative tool.

Even though students had strong reservations about the usefulness of group or pair work in general, usually related to issues of equity and control, the findings based on both observations and interviews suggest that the collaborative experience of the DAM was a very positive one. It is beyond the scope of this investigation to establish a causal link between positive attitudes to groupwork and positive attitudes to digital argument mapping, in either direction. Although this is a potentially fertile avenue for future research, it suffices here to report that a strong link between these two elements of the learning environment was observed.

While the program can be used by either individuals or groups, the structured pair arrangements utilised in treatment classrooms engaged the students and were a factor in the dialogic environment. Interactivity as a function or property of a digital tool is the focus of much research attention. This investigation suggests that the energised collaborations evident during the mapping process occurred because of the nature of argumentation and the success of this program in scaffolding argumentative thinking. The collaborative argumentation work led to productive intra and inter-cognitive conflict that was appreciated by students, who credited it with facilitating their improved writing.

The fact that students, generally wary of working together, were engaged by this specific activity, both confirms and inverts Hattie’s (2009) notion that “computers can assist in engagement and positive attitudes to learning and school” (p. 221). Here, engagement with the process of argumentation, in particular its communicative and problem-solving characteristics, may well have alleviated some of the common challenges of groupwork and opened up opportunities for students to work meaningfully with each other.

9.2.3 A tool for discussion and ideas.

We have seen that students in this investigation were not only interested in school units of work that facilitated conceptual thinking, but valued collaboration that opened them up to new ideas and alternative worldviews. Coupled with their disdain, evident from interview data, for what they saw as ‘generic’ instructional strategies in technology-based lessons that involved information transfer, it is reasonable to conclude that a key feature in student engagement with the digital
argument mapping was the enhanced discussion of ideas in play in the learning environment.

In their interviews many students noted the ways in which technology use in school can inhibit thinking and discussion. This ranged from the isolation of individuals at their screens to the over-reliance on the search functions of the internet to provide readymade answers. The teacher’s attempt to guide the class in a traditional dialogic way was seen to be stymied by the diffusion of attention, while the ability and proclivity of learners to look to the net for solutions was felt by many students to militate against the flow of discussion and openness to collectively problem-solve. According to student L10 “sometimes you can learn really well off another student but then you’ve got your laptop there and you’re searching”, in ways that change the focus of the lesson from learning to information retrieval.

This investigation suggests that the DAM program, and by extension other programs that are structured and utilized in class in similar ways, aligns with students’ desires for a broadly inquiry-based space in which discussion is valued. While it would be unreasonable to suppose that any particular program can alleviate wider student concerns to do with equity and control, as well as disruptive student behavior that colonizes teacher attention, there is enough evidence from this intervention to make a conclusion about the ways certain types of technology use can facilitate discussion that is found meaningful by students. Firstly, the map as a problem to be worked on calls for meaningful engagement and interaction. Secondly, while evidence can be sought from class texts under study or the internet, it must still be negotiated into the map. As reported in Chapter 6, students were observed in animated dialogue over the strategic use of evidence to support contentions or counter alternative viewpoints. There may be ready-made quotes and textual details available online, but there is no prepared argument map that can be copied and pasted. Students were forced to consult and co-create and they reported both their preference for and enjoyment of this kind of process.

9.2.4 Purposeful learning.
Livingstone’s (2012) critical review of the literature around the purported benefits of learning with educational technology makes clear the disjunction between the two competing paradigms of ‘learning’. One sees technology as enhancing what might be called traditional skills in literacy or numeracy in ways that can be tested.
The other, predicated on the soft skills of collaboration, independence, creativity and design, put forward by the proponents of the participatory culture and new digital literacies, frames learning in ways that are more difficult to measure. While each is open to support and criticism, the gains reported by either paradigm – as we have seen – are equivocal at best.

It is a key contention of this dissertation, based on the attitudes of students in this investigation to learning with technology, and confirmed by their experiences with the DAM program, that the debate has not taken sufficient stock of what students themselves mean by learning. While digital technology’s role in gathering information and presenting it creatively is acknowledged in this context, students differentiate between these activities and learning in ways that distinguish their needs from those of their teachers. The students’ preferences are for the class to remain as a community of learners under the guidance of the teacher; they need meaningful collaboration with their peers; they value discussions that draw on their own ideas rather than those pasted in from secondary sources. When these three conditions are met, students consider themselves to be ‘learning’. While it may not be a surprise that using computer technology to copy in information from a website while the teacher either sits at a computer or manages disruptions, is not considered learning, it bears careful consideration that self-paced individualised learning, the watching of YouTube talks from community ‘experts’, and the creation of creative digital products do not – in and of themselves – fit the bill either.

Finally it can only be a contention of this dissertation that a fit between students’ general conceptions of purposeful learning with technology, and their experiences with the digital argument mapping, can explain more effective argumentative writing. The research literature has long been equivocal about the impacts of ICT on writing (Cramer & Smith, 2002; Andrews et al., 2007), with a key issue being the methodology for judging effectiveness. Here we rely on quantitative improvements in writing scores explained by the students themselves in terms of their preferences for learning with digital technology. That the DAM aligns with students’ needs to be working collaboratively and dialogically with concepts over information, a whole class community over atomised individuals, and a teacher involved in discussions rather than presenting information from the front, at the very least suggests a rationale for the effective take up of skills developed during this process.
In this context, the links between the present investigation and Livingstone’s (2012) important overview are highly generative. Firstly, this study confirms the limitations of viewing learning as merely a statistically significant change measured by test scores or de-contextualised IT skills, both research directions bemoaned by Livingstone and others. Purposeful learning involved not only dialogue and collaboration but the application of IT skills to writing and problem-solving. Secondly, these findings support other studies reporting large effect sizes for blended learning, an occasional strategic use of computers (as opposed to never or often), and the use of technology to “trigger” learning (Livingstone, 2012, p. xvi). Most significantly, while Livingstone reports positive results for strategies that combine elements – such as collaboration – in the treatment situation, her study finds that such benefits are only found in undergraduate and higher contexts. This investigation demonstrates that learning advantages can be extended to high school classrooms when the technology is one strategic element of the learning environment, and is used as a scaffold for meaningful discussion and planning.

9.3 A Dialogic Learning Environment

In the previous section, a major finding was advanced that the digital argument mapping (DAM) program facilitated a type of interaction – collaborative and open to meaningful discussion – that is preferred by students, and seen by them as critical to their learning. In this section, the discussion will be expanded to consider these types of interactions as key features of a dialogic learning environment, one in which the program is but one component.

Sociocultural theorists have wrestled with ways to define and measure interaction, collaboration and dialogue within a digital learning environment. Explaining the relationship between these elements and learning has been a particular challenge. As a design-based research feasibility study, this investigation can make no claims to pinning down either the positive engagement with the tool, or its impacts on writing, to specific classroom interactions. However, a plausible contribution to the developing sociocultural theory base around student-teacher-technology interaction can be made by examining student and teacher attitudes to the digital argument mapping. In particular, this section will seek to overhaul simplistic notions around
the ways that technology and dialogue enhance one another during classroom learning activities. This section will examine the causes of authentic dialogue and collaboration in a technology-centred learning environment, and how these interactions can contribute to a more purposeful use of that technology for learning.

9.3.1 Interactivity.

A sociocultural perspective on learning activity sees the classroom as “an ecology of resources” (Beauchamp & Kennewell, 2010, p. 760) of which interactivity is one element. In “a set of inter-related resource elements” (Luckin, 2008, p. 451) the interactions between people and artefacts create a context for learning. Dialogue and collaboration are viewed as types of interactivity, so that for example, group work on a computer can involve different types of interactivity between group members, and then between group members and the digital resource (Wegerif, 2004).

The intervention classroom involved several types of interaction crucial to this investigation: authoritative and dialogic teacher-whole class interactions, dialogic teacher-student interactions, dialogic and dialectic collaborations between students, interactions between individuals and groups and their computers, both as an item of technology that demands certain physical, emotional and cognitive stances, and as an argument mapping program that facilitated certain types of thinking and writing. These interactions are framed, certainly in the critical theory paradigm by complex notions of subjectionhood as well as wider social, political, cultural and economic constraints.

We have seen that interactions between students and the technology in the intervention classes led to meaningful discussions, engaged contributions to the on-screen work and the development of conceptual understanding that was then able to be transferred to argumentative writing. Aspects of classroom interactions that suggest a functioning ecology of learning included:

1. inter-student negotiated additions and changes to the developing map;

2. the adjustment of the map to suit various personal theses, for example one opposed to the general class direction on the topic;

3. collaboration with the teacher facilitated by the map about the nature of evidence, argument or the thesis being developed;
4. the use of argument maps as part of non-digital activities and as prompts for later writing.

This type of interactivity is not a given in the technology classroom and yet, according to the findings of this investigation, it is strongly desired by students. By giving voice to the experiences of students, this investigation corroborates literature which is critical of the way learners can be “performed as trivial machines…given a specific input, execute a certain function, which results in a specific output” (Sørensen, 2009, p. 81) while using drill and practice programs or searching out information on the internet. In Sørensen’s conception of socio-materiality, or frameworks such as Actor Network Theory (see for example Bigum, 2012a), learner’s self-conceptions are seen to emerge in the interaction with each other and technology in ways which disrupt any “understanding of technology as a system whose singular function is to solve problems or fulfil goals” (Sørensen, 2009, p. 87). In a corrective to abstract notions of technological effectiveness, especially those which ignore student voices, as well as overly idealistic teacher narratives, this investigation suggests that a blindness to the learning ecology is a key factor in reports of disengaged students and stymied learning. In a significant extension of previous work, this investigation has uncovered such disengagement not only in relation to the development of capacities such as analytical thinking and writing, but more generalised student interaction with technology.

The DAM environment, by scaffolding a capacity valued by the subject, one that is by nature communicative, allowed “the activities to turn in all sorts of directions” (Sørensen, 2009, p. 163); this is a technological space in which the technology itself and the learning taking place are both altered by the practices of the learner. There is neither an overly idealistic sense that learners are totally free to design their own learning, nor a “domestication” (Bigum, 2012b, p. 22) of the technology so that it performs a pre-given teacher or institutional role.

An eye to the complexity, fluidity and interactivity of the learning ecology also alerts us to alternative learning trajectories. This investigation adds to existing research – the Computer Supported Collaborative Learning (CSCL) community for example (see Overdijk et al., 2012) – by noting how previously uncertain student voices were given a safe and engaging outlet for their ideas (according to teacher PM for example). In a major extension of this focus, however, it has been found
that students from previously marginalised groupings, as represented in the mixed ability classrooms, found a space here to interact productively with each other and the technology. Students from the mixed ability classes in this intervention had both a more positive response to the program and a more significant rise in writing effectiveness after using it. This suggests that a wide range of students, from those struggling with literacy to those whose voices had previously been silenced, were able to participate in the learning environment.

Ethnic minorities and indigenous students, as well as low SES students or those with learning difficulties, tend to be excluded from learning paradigms that are predicated on middle class values such as collaboration and communicative participation (Sørensen, 2009). While a sociocultural frame is important in order to focus considerations of technology use on the developing interactions of the classroom, there is also an opportunity here – heralded by programs such as DAM – to reconsider which bodies and which ways of thinking are actively encouraged to participate in technology lessons. This investigation therefore problematizes sociocultural frameworks, including Lave and Wenger’s (1991) Communities of Practice for example, that characterise learning as having a clear trajectory or being goal-driven. It also points to the success of this type of digital technology interaction in scaffolding skills in a way that has eluded the process writing approach, for example, with its humanist notions of writing subjecthood. By extension, these findings also call into question simplistic conceptions of learning with technology that are based on humanist notions of subjecthood, agency and creativity that may well be marginalising new generations of learners by sidelining collaborative, cognitive and teacher-oriented learning.

9.3.2 Collaboration.

Wikan et al. (2010) summarise the key literature concerns about the supposed synergies between collaboration and technology in contemporary digital classrooms. In a context of project work, cooperation based on a division of labour is the norm, while “the quality of interaction is often poor” with students spending “most of their time fact finding” (p. 225) after tasks have been divided. Most work is carried out alone and without clear focus. This overview of the way collaboration manifests as a kind of strategic cooperation is confirmed by the distinction participating students made between classroom work and learning. From the findings of this investigation, collaboration of this kind does not count as learning.
for students. In addition, it is plausible to conclude that student reservations about working together – especially the struggle for control and the equity of contributions – are at least partly as a result of this kind of lacklustre collaboration. It is especially concerning if the classroom strategy of collaboration is merely another way to have students collect information. As we have seen, students acknowledged technology’s role in speeding up this process, but did not necessarily count it as ‘learning’. The students’ placing of a very high value on learning is a profound feature of this investigation.

A constructive interplay between the digital argument mapping learning environment and collaboration is suggested by the collaborations observed in intervention classrooms and discussed by students in their interviews. In contrast to the research reported above, students did not divide labour. They did search for information in the form of evidence but then spent the majority of their time discussing how to use this content drawn from the novels or plays being studied. As has been suggested in the Findings chapters much of this discussion can be described as higher order thinking, and it was appreciated as such by both students and their teachers.

The success of this form of collaboration in this environment confirms strands in the research literature that drill down into the components of collaboration, particularly in response to idealistic claims that digital technology is somehow inherently collaborative. Judd, Kennedy and Cropper (2010) for example, acknowledge that wikis, similarly to digital argument maps, “possess a number of features that can facilitate collaboration, [but] it does not necessarily follow that they dictate or impose any meaningful level of collaboration” (p. 342). Their overview of research suggests that factors outside of the nature of the program are critical. These include the socialisation of participants into collaboration skills, the type of group arrangements, the communal nature of the teacher-set topic and task, and the need for incentives such as authentic out-of-school audience or an assessment task.

The variables either controlled for or discussed through this intervention do not include participant socialisation or the nature of the groupings who worked together. It should be noted that the cohorts studied were stable class units with cohesive relationships in the second half of the school year. Teachers also chose to
allow students to work in friendship groupings for these activities. It can be surmised, however, that a common task, the active support of the teacher, and an end-of-unit incentive in the form of an essay to be written for both school assessment and research purposes, had a positive effect on the nature of the collaboration during the intervention. While these are in many ways principles that experienced teachers would apply to any groupwork situation, this investigation confirms their usefulness in technology-centred learning environments, and in school contexts where the students report their absence from normal use of educational technology.

Students have made clear their preference to remain “on the same path” as a whole class under the guidance of their teacher, with meaningful one-to-one time with that teacher as they work collaboratively on technology. Wikan et al. (2010) reports on various studies suggesting that meaningful collaboration between students is enhanced by teachers playing “a more direct role in supporting and scaffolding the learners through the process” (p. 225). This was certainly the case during this intervention, and it is the contention of this dissertation that the digital argument mapping learning environment encourages this type of teaching behaviour. Again assessing causation is not the objective; it is sufficient to suggest a correlation between an active teacher role in setting the general topic and participating in problem-solving, and the DAM environment that enables such interactions.

Importantly for a discussion of the sociocultural frame around technology use, Vygotsky suggested that ideas arrived at by inference and ideas derived from another (a teacher for example) are modes that facilitate each other (Britton, 1994). It is therefore crucial that the teacher creates a rich interactive learning environment based on the nature of the tool, the wider topic and strategies to encourage meaningful collaboration. This investigation affirms the notion that collaboration is not something that can ‘just happen’ either between students or facilitated by digital technology. The concept of an active learner in a Vygotskian perspective does not imply either teacher passivity or an overemphasis on discovery learning (Dixon-Krauss, 1996). Indeed the meaningful collaborative group involves “students with varying abilities working together to solve a problem or complete a project” (Dixon-Krauss, 1996, p. 79). The participating teachers were observed playing an integral role in facilitating both aspects here to ensure that students worked within their zones of proximal development (ZPD) in relation with – as opposed to in
competition against – others, and that the focus of group work was on higher order thinking and not information gathering. This was appreciated by students both in class and in their interviews, and was plausibly a key factor in the take up of argumentation skills reported by this dissertation.

9.3.3 Dialogue.

Davies (2007, p. 52), sees the key characteristics of dialogue as “the capacity to express yourself, to listen to others, and to play your part in the social construction of meaning by weighing your own words and thoughts against those of others.” According to the findings of this investigation, the digital argument mapping (DAM) promoted meaningful self-expression and encouraged students (and teachers) to enter into productive negotiations about meanings, arguments and ideas. It is also the contention of this dissertation that the construction of a dialogic learning environment correspondingly led to a greater engagement with both argumentation and the technology facilitating it. In this final sub-section, the nature of student and teacher talk will be explored to evaluate how aspects of a dialogic environment may support, and in turn may be supported by, certain types of digital activity.

One branch of sociocultural work on literacy has explored classroom communication along two dimensions: a dialogic-authoritative one, and an interactive-non-interactive one (see Twiner et al., 2010 for one overview). Authoritative refers to the display of a single viewpoint (usually the teacher’s) while dialogic involves the inclusion of multiple viewpoints, from students and other sources. Teaching can then be interactive without being dialogic; students’ ideas are called for but not taken up by the teacher. Teaching may also be dialogic without being interactive; the teacher provides alternative viewpoints for students to consider. The four possibilities can be represented as follows:

Figure 9.1. The four types of communicative approach (Mortimer & Scott, 2003).

<table>
<thead>
<tr>
<th>Authoritative, non-interactive</th>
<th>Dialogic, non-interactive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authoritative, interactive</td>
<td>Dialogic, interactive</td>
</tr>
</tbody>
</table>

Interestingly, this is also a key feature of argument mapping. As discussed in the literature review, this kind of argumentation takes the battle out of discussion and replaces it with something more akin to Andrews’ (1995) alternative metaphors of dance and construction, in other words what a student does in the actual ‘zone’ of the ZPD.
For theorists in this field it is not a question of privileging one quadrant over another. Mortimer and Scott (2003) emphasize the value of each and the benefits of various combinations “in allowing students to explore ideas and integrate new understandings” (p. 217).

The particular interactions in the intervention classrooms led to engaged learning, on the students’ own terms and, by extension, more effective argumentative writing as measured by post-intervention essays. Teachers were authoritative and non-interactive when assigning tasks and demonstrating maps and program functions. Students, as we have seen, expressed a desire for this type of clarity and communal guidance from the teacher. Students and teachers spent long periods in interactive-dialogic mode, sharing multiple perspectives in ways clearly valued by students as one of the key benefits of group work. Teachers were also observed sharing multiple viewpoints, taken from students and outside sources, with the class in order to reinforce and model ways of thinking.

Not all classroom talk is productive or dialogic. The mapping of interactive against dialogic focuses educators not only on types of communication in the classroom, but on the nature of learning with technology. Dialogue leads to learning when one’s understandings “can be stimulated, reshaped and sometimes negated by another’s” (Davies, 2007, p. 53). Morgan and Beaumont (2003) credit rough-draft talk facilitated by teachers, while Ferguson, Whitelock and Littleton (2010) categorise talk that acts as a thinking tool as disputational, cumulative or exploratory. It is only in exploratory talk that ideas are both pooled and critically reflected on in order to reach shared conclusions.

In understanding the particular interplay between dialogue, argumentation and technology in the intervention classrooms, it is vital to appreciate both the type of dialogue learners are wanting in order to learn, and the types of dialogue (both spoken and written) that digital argumentation facilitates. Exploratory talk with authentic interchanges of opinion were not only characteristic of student interactions, but were seen to influence student learning behaviour in positive ways. This investigation therefore distinguishes digital argument mapping as a type of technology that facilitates meaningful dialogue.

Meanwhile the synergies between an exploratory, dialogic learning environment and a less rigid and structure-bound argumentative writing model are also difficult
to ignore. The success of students in incorporating alternative viewpoints in their essay-writing, and the engagement with that skill that they voiced in interviews, both point to a type of classroom interaction that facilitated and valued dialogue. It also suggests a technology type that came into its own as a learning platform on the condition that students discussed and collaborated meaningfully. There is a two-way street revealed here that is too-often ignored in the research literature.

9.4 Scaffolding and Multiliteracies: Mutually Exclusive Paradigms?

This chapter has developed a picture of the learning environment around the digital argument mapping in an attempt to explain the positive engagement with argumentation and positive connections to students’ post-intervention writing. The keys to this environment have been identified broadly as a basis in students’ own conception of learning, for example their preference for teacher-oriented over independent learning, and an environment which is interactive, focusing especially on meaningful collaboration and dialogue.

One difficulty with this picture is that in several critical ways it does not fit into the broad multiliteracies paradigm with its objective of shifting the focus of educational technology from one of replicating traditional practices to one of transforming them (Beauchamp, Kennewell, Tanner, & Jones, 2010, for example). The ethos of the new literacies – more participatory, collaborative, distributed and less published, author-centric and individualistic than conventional literacies – converges in certain ways with the learning environment discussed in this chapter. In other ways it is starkly divergent. In particular the scaffolding of argumentation with a conventional literacy process such as mapping, aimed partly at supporting student writing, appears to be a Mindset 1 practice. This has been characterised variously as digitally immigrant (as opposed to native) or as the attempt to pour new wine into old bottles where “long-standing school literacy routines have a new technology tacked on” (Lankshear & Knobel, 2006, p. 55).

In the final section of this chapter, key characteristics of the digital argument mapping experience for students and teachers will be evaluated against the claims of the new literacies/new learning paradigm. Recommendations for the use of both
digital argument mapping and educational technology more generally are made on the basis of these evaluations.

9.4.1 Learning-by-design.

At its apotheosis, the critique of a Mindset 1 conception of educational technology use focuses on the perceived limitations on both teacher and student agency within the traditional classroom. By comparison, in the New Mindset “teachers are designers of student learning environments [and] learners are designers of their own knowledge” (Kalantzis & Cope, 2008, p. v). Digital argument mapping, by contrast, offers students and teachers a rather more prosaic hope. As a type of scaffolding technology, it aims to support developing learners by limiting complexities in the learning environment until skills and confidence have developed sufficiently to do without the assistance (Sharma & Hannafin, 2007). As such it is aligned to the Self-regulated Strategy Development (SRSD) field which aims to “incorporate guidance of the learning process that is faded as internal guidance is developed” (Harris et al., 2008, p. 395).

The provenances here are cognitive and constructivist and we have seen the implications of both for student learning in this investigation. The metacognitive focus on the argumentation grammar that was learnt and practised by all students prior to and during the mapping process, coupled with the cognitive scaffold of the developing argument map, both suggest a skill development paradigm, and one in which the strategic role of the teacher is explicit. The scaffold also acts as support for a student’s ZPD and there are indeed features of the program that allow for the scaffold to be intensified or faded depending on learning needs.

The rhetoric of the multiliteracies agenda can be quite pejorative when it comes to this kind of work. Traditional skills and methods merely augmented by new literacies and technologies creates a “cyber-tooth curriculum” (Rowan, 2012, p. 6), while elsewhere there is an implicit sense that English teachers who do not facilitate the production of digital texts are somehow failing their students (Harris, 2011). The teachers in this investigation did not let their students down by focusing on less revolutionary uses of technology. Moreover, the augmentation of skills valued for many years by subject English as well as the wider community – such as critical thinking – cannot be validly dismissed because the style of technology use
does not conform to a revolutionary vision of technology as unfettered creative design for which there is, at best, hypothetical research support.

In the less fervent digital literacies literature, particularly that devoted to actual classrooms and cognizant of student voice, there is an understanding that the design metaphor needs some pedagogical detail, especially with regards to the role of the teacher. It is here that we might begin to find some useful middle ground on which to assess practices such as argument mapping in a digital context. The New London Group (2000), for example, include overt teacher instruction alongside situated practice and critical framing as part of a pedagogy of multiliteracies. Based on both student and teacher interpretations, as well as classroom observations, it is clear that the teacher role as explicit instructor of argumentation grammar and tactics, as well as coordinator of the class’ communal path towards a set of responses to the topic, was crucial to the perceived engagement with and effectiveness of the intervention.

In a context where there is increasing attention to the limitations of minimal guidance approaches such as teachable moments (Harris, 2011) and discovery learning (Kirschner, Sweller, & Clark, 2006) in supporting students, the onus must be on the learning-by-design framework to explain how a range of learners will acquire writing and thinking skills. The process of working with the argument mapping program did not end in the production of digital texts or transformed learning practices, but it did engage students in knowledge construction and, by their own admission, did support them – these digital insiders – to achieve something they valued. It is critical that those working within or inspired by a multiliteracies paradigm do not confuse the ability to produce a digital text with the ability to produce an effective text – of any kind – that is literate in its awareness of audience, purpose and context.

The learning-by-design notion of learners and teachers as agents of a new frontier of independent and creative learning, facilitated by internetworked digital technologies, is a marvellous vision. This investigation reveals that students need something rather more humble: teacher orientation, guidance and explicit instruction; the cognitive scaffolding of skills and a meaningfully interactive learning environment. Mindset 1 and Mindset 2 need to be seen not as dichotomous but as interdependent modes, ones in which the carefully calibrated classroom development of fundamental skills and attitudes can serve to make the learning-by-design vision a reality.
9.4.2 Authentic products of learning.

Two of the key weaknesses of the multiliteracies approach have been its slight detail on the classroom processes that might lead to objectives such as critical thinking and participation, and a failure to theorise what processes such as knowledge creation look like as the products of student writing. The OECD (Istance & Kools, 2013) recommends avoiding “approaches that place excessive faith in learners to create their own learning environments” as this can be “highly individualistic, idealistic, unsociological and de-politicised” (p. 48). As such an over-emphasis on individuated learning can reinforce corporate over communal goals (Selwyn, 2014) and elide a consideration of the students for whom such creative learning environments are actually available. Similarly problematic is the reliance on “motivated individuals exploiting the possibilities opened up by ICT to ‘do their own thing’ or come together spontaneously in learner networks” (Istance & Kools, 2013, p. 48).

Classroom examples in the research literature can be classified into two broad groups. Those, firstly, that leave the products of knowledge creation work as vaguely defined and rather loosely connected to authenticity, independence and participation. These have been criticised elsewhere as leading to “digital busy work” (Bigum, 2002, p. 135). The other group typically describe a process with a conceptual starting point, a collaborative element both within and outside of the classroom, and a multimodal text design component that fulfils an “agenda bound to processes of civic and private activity” (Healy, 2008, p. 13). This can involve a presentation to the community or a contribution to a blog or wiki. The key to engagement and learning here is authenticity and the connection to the learner’s real world that this implies. However, the authenticity does not reside in the digital; it is an outgrowth of the learning process constructed by the teacher, with particular care taken to align the technological component to the needs of the students.

In many ways the process resembles Andrews’ (1994) suggestion that one of the key implications of a focus on argumentation in the classroom is a recalibration of the purposes of writing towards authenticity and real audiences. His example of a book report given to the school library in order to influence the allocation of funds, follows the same principles described above: conceptual, collaborative, purposeful. Only the digital is missing. Perhaps today the report would have been emailed to the librarian or posted on a section of the school wiki. Either way it serves to
instruct us that if multimodal work focuses on the affordances of the technology and the ideals of participation and democratisation rather than purpose it runs the risk of repeating the errors of the process writing movement in ignoring the marginalised, undervaluing skills development and valorising humanistic notions of subjecthood in the shape of self-expression. Whether the product is an ineffective letter to a librarian or an ineffective (but beautifully multimodal) website post is irrelevant in this context.

The digital argument mapping as it was utilised in the intervention classrooms was not part of a unit of work that aimed to produce texts that would involve students in real-world communication with their communities. The end-product was an assessed essay, a form that has been criticised as context-free and rigid; a mere feint at authentic communication. That participating students and teachers enjoyed the process and felt that it benefitted their writing and thinking (a perception supported by post-test writing data) leaves us with a number of significant issues. Firstly, the finding that a domesticated technology was engaging and effective can be seen to support criticism of a Mindset 1 scenario in which old wine in new bottles serves merely to entrench traditional print literacy ways of thinking. On the other hand, expressing opinion in writing (whether on paper or on the screen) is likely to remain a key schooling competency. Should technology that facilitates skills in this area be ignored because it does not conform to ideals about the way new technology should be utilised to facilitate new literacies?

As a scaffolding-type educational technology, digital argument mapping enables students to create more effective written, and potentially digital, products. By focusing attention on and then building skills in argumentation, we have seen that it focuses students – during the process of planning to write – on their purposes, and on their careful deployment of rhetoric based on an understanding of audience and context. In this way it would be a perfect element in a unit of work that had as its objective a multimodal digital text that aimed to express ideas effectively and communicate authentically with the student’s community. There is a potentially fruitful avenue for further research here to explore the extent to which technology such as DAM can work as a corrective to digital busy work in this kind of context.

In the present investigation, however, the effectiveness of DAM should work as an antidote to overblown claims about the inherent connections between multimodal
products and higher order thinking, and about the inappropriacy of working in Mindset 1 ways. The suggestion of this dissertation is that Mindset 1 approaches are not antiquated practices that need to be jettisoned in favour of “The New.” As encouraging as he is about the new digital frontier and its intrepid explorers, even a commentator like Prensky (2008) acknowledges the deficiencies in skills such as information processing, reflection and the integration of new and old ideas that characterise young learners. The DAM experience highlights the importance of learning environments that address these skills and find ways to use technology as an integral part of a process that scaffolds them.

### 9.4.3 Netizens and social mindtools.

The use of digital argument mapping program in a collaborative, dialogic and purposeful learning environment also allows a more critical focus on the learner identity in a digital context than is typical of the multiliteracies paradigm. The participating students flagged three key concerns about their learning with educational technology. First, the tensions between their desires for independence and their preference for a whole-class approach. Second, their anxiety at the loss of valued learning relationships with their teachers. And thirdly, their sense that conceptual work without adequate support is challenging while digital work without a conceptual focus is disappointing.

Kalantzis and Cope (2011), for example, see the focus on multiliteracies as a way to acknowledge and facilitate learner differences in contrast to the one-size-fits-all pre-digital model. The students in this investigation, however, were quite clear that while independent work on a computer was preferred for researching and text manipulation capabilities, the atomisation of the class into independent learners each at their own screen is neither engaging nor useful for the development of ideas that they see as a necessary part of learning. While the idea of the teacher as guide-on-the-side as opposed to sage-on-the-stage has become a catchcry, this investigation reveals that this is either not the reality of most students’ experiences, or one that they find frustrating when students are at different phases and unable to get the teacher help they need. Finally, while the idea of the “learner as co-constructor of concepts” (Kalantzis & Cope, 2011, p. 79) sounds good and certainly aligns in theory to constructivist conceptions, this investigation has revealed that students in real classrooms need very particular relationships with each other, with
their teachers and with the capacity being developed over a series of lessons, before they can take up the constructivist space signalled by such phrases.

The digital argument mapping intervention suggests that students can take the role of co-construct of text, knowledge or concepts, under certain conditions. As we have seen, this includes the class being on “the same path”, a collaborative, dialogic but also instructor-like teacher, meaningful interactions with co-learners and the purpose and scaffold supplied by the cognitive framework. The now demonstrated effectiveness of the DAM process confirms the literature on the benefits of social mindtools as a way of conceiving of learner identities in the digital age and ways of working with technology that are purposeful and conceptual. Far from the stereotypes of digital natives and netizens, the students in intervention classes were cognitively active learners in the process of learning through “interpersonal collaboration and group-based knowledge construction and creation” (Nuutinen, Sutinen, Botha, & Kommers, 2010, p. 754) Social mindtools are digital tools that facilitate collaboration and purposeful communication amongst users in a learning community. However, the facilitation involves the explicit activation of cognitive processes so that the organisation of thought is developed, and that what students already know is the foundation for new ideas and activities.

Digital argument mapping can be described as a digital social mindtool that is a “knowledge construction device or technique that helps learners to focus their analytical processes” (Nuutinen et al., 2010, p. 758). The program was successful in terms of a number of key literature elements: it improved the thinking capacity of the group and the class towards a common objective, and it mediated the process of dialogue and collaboration so that a shared body of knowledge could develop. As is typical of the social mindtool conception, the digital argument map forced users to explain and justify data and opinions and to reflect on their contributions. According to Nuutinen at al. (2010) the key processes at work here are graphical representation; the facilitation of debate; the use of previous arguments as the basis for ensuing arguments; and motivations drawn from feelings of community, peer and teacher support and external assessment requirements. This investigation adds to the literature on the effectiveness of such digital practices, and it adds to our theory of classroom practice by demonstrating the conditions under which students will be able to transfer ideas and understandings from such processes into their own analytical writing.
Once again these types of learning activities do not sit easily within a multiliteracies’ Mindset 2 conception. In particular there is no multimodal product that is a necessary element of the process. This dissertation recommends that even when a multimodal product is the intended output of a series of learning activities, programs such as digital argument maps that align with the conception of learning suggested by social mindtools, should be part of the process. While the process enabled by the digital mind map does not conform to the simplistic model where students and teachers in a Mindset 1 mould are focused on use and reception and those in the Mindset 2 setting are involved in participation, interactivity and agency, the intervention suggests two significant points. Firstly, the strategic use of social mindtool type programs disrupts the Mindset 1 and 2 dichotomy. It is possible to work on print literacy skills in a digital context where the learner is an active agent of knowledge construction. Rather than debate the merits of Heritage knowledge versus Democratised knowledge, the focus should be on lesson designs that balance the advantages of both a Mindset 1 and a Mindset 2 approach.

Secondly, viewing digital argument mapping as a social mindtool, allows us to consider the ways in which learner identity depends to some extent on the explicit building of skills that is facilitated by tools such as digital argument mapping. It is sobering that the OECD (2012) considers a second digital divide, between those “who have the necessary competencies and skills to benefit from computer use and those who do not” (p. 59) to be emerging. According to this OECD overview, computer use can only make a difference to student learning if appropriate skills, competencies and attitudes are facilitated by schools and teachers. The manipulation of digital technologies to create a multimodal product does not necessarily demonstrate the possession of skills in the critical and creative use of technology. While it may be prosaically (and perhaps defiantly) Mindset 1, a well-constructed digital mindmap is difficult to pull off without an engagement with the capacity of argumentation and the processes involved in interacting purposefully with others in a digital environment.
9.5 **Summary.**

The consideration of digital argument mapping (DAM) as one type of educational technology use within a complex school learning environment, has led to the following conclusions in response to the three focus areas set out in the introduction to this chapter:

1. **Student conceptions of purposeful learning:**
   - ICT is best seen as a supplement to, not a replacement for, teacher instruction. DAM is a teacher-oriented not teacher-centred tool, and it was explicitly valued as such by students. Learners saw the benefits of the teacher facilitation of cognitive aspects, the guidance of the lesson flow, the setting of lesson objectives and the active participation of the teacher in class and pair discussions.
   - DAM contrasted markedly to the type of educational technology use identified by students as stymying independent thought by relying on information too easily found on internet searches. The focus on what to do with information – as reasons, data, evidence – rather than merely finding it, aligns with students’ own conception of learning.
   - DAM facilitates a learning environment in which a variety of talk, dialogic-authoritative and interactive-non interactive, as well as rough draft and disputational talk, can all stimulate learning through the reshaping of ideas from one participant to another. This aligns with student conceptions of learning as meaningful collaborative problem-solving activity.

2. **Interactive and dialogic roles**
   - The focus of lesson design incorporating educational technology needs to be on enabling meaningful interaction between students, between students and teacher and between students and ideas developed through work with the technology. Uses of technology focused on content and presentation do not facilitate this last type of interaction and it is here that meaningful learner self-conception and reflection can develop.
• DAM maintained the desired class unit and did not atomise the learning in ways resisted by students.

• Interactions in the DAM learning environment, especially those focused on problem-solving, allowed for mixed ability students to be engaged and develop more effective argumentative writing.

• The problem-solving, conceptual and rhetorical features of the DAM alleviated common student concerns about collaboration. This investigation demonstrates that technology use, structured carefully as part of a dialogic and purposeful lesson design, can enable meaningful collaboration. This investigation confirms other research which sees collective class tasks and focus, active teacher support and end-of-unit incentives as critical to successful collaboration.

• The strategic role of the teacher here is explicit. The teacher is the co-ordinator of lesson activities and not a guide-on-the-side dabbling in teachable moments.

3. Scaffolding-type educational technology

• DAM is a scaffolding technology that works on the premise that the technology should limit the complexities, including the cognitive load, of argumentation – until skills develop to such an extent that the support can be gradually eased.

• Students were engaged with technology facilitated education in complex ways. They recognised the benefits of malleability, searching and presenting but there were limits to their engagement with this kind of work. It is one key finding of this investigation that where limits exist to students’ interaction with educational technology, one main reason is that the technology itself, or the way it is being utilised, does not conform to student notions of learning. Those notions of learning do not fit simplistically into either a traditionalist or New Learning conceptions and provide a challenge to the validity of both. DAM has elements of both a Mindset 1 and Mindset 2 conception of technology use. The objective needs to be a more sober analysis of the supposed dichotomy.

• The usual rhetoric from within the New Learning paradigm is that if conceptions and uses of technology do not rise to the Mindset 2 level then it is the fault of educators in not ‘meeting’ the students’ needs, society’s
expectations or seeing the potential inherent in the technology beyond the replication of old ways. The Findings demonstrate that none of these explanations holds water. Idealistic rhetoric about digital natives and digital revolution is not helping teachers to look in clear-eyed ways at either technology or the pedagogy needed to ensure it is facilitating learning.

- DAM, therefore, could be seen as one example of how to ensure that transferable skills and higher order thinking are the focus of activities ending in multimodal text production.

- Students as the co-constructors of text is an idea that requires careful analysis and further research. One way forward is to consider DAM as a social mindtool and see learner identity in terms of individual cognitive work that is then facilitated by the program to contribute to communal thinking capacity. The digital argument map, as a social mindtool, successfully mediated dialogue so that a shared body of knowledge could develop. The multiliteracies’ demand for knowledge construction in New Learning, multimodal contexts can sometimes seem idealistic and difficult to ground in actual classroom practice. Digital argument mapping showcases the kinds of learning environment that can facilitate the move beyond transmission and knowledge retelling, in both the processes and products of writing and learning with educational technology.

The following chapter, the final Conclusions and Recommendations chapter, evaluates how this investigation has contributed, and can potentially contribute, to theory and practice in this area of interest and concern to educators and students like.
Chapter 10 – Conclusion and Recommendations

This dissertation has advanced the proposition that both school-based writing instruction and school-based learning with technology have deficiencies when it comes to the consideration of the processes of learning. A simplistic focus on the products of learning, at the cost of a fine-grained consideration of students’ needs during the ‘messy’ activities, collaborations and negotiations of the process of developing writing skills, is perhaps unsurprising in a wider context of policy focus on outcomes. In an era of standardisation, validation and high-stakes testing, with a full-to-the-brim curriculum, teachers are challenged to find space for the carefully staged development of capacities, such as argumentation, that are valued by the subject because of what they bring to students’ sense of themselves and how they might act on their worlds.

This is the first of several dissonances identified by this investigation: the vision outlined in the Australian National Curriculum - students as “confident communicators, imaginative thinkers and informed citizens” (ACARA, 2014, Rationale Section) – is difficult to see enacted in real classrooms where the focus is often on content and the highly-structured assessment of that content. Teachers identified this limitation and students felt the constraints in terms of their relationships with the social practice of writing and their use of educational technology for learning.

The power of the student voice is perhaps the most significant element in this dissertation. Previous studies have considered teachers’ interpretations, as well as quantitative data which measures student achievement. Here, students were involved in a ten week intervention where complex classroom interactions were investigated in a mixed methods approach in order to develop a context of student (and teacher) interpretation around the observable gains in student argumentative writing.

The key recurring theme in students’ interpretations has been their desire for more communicative practices during the process of learning. Students noted the
usefulness of talk before writing, of exploratory and collaborative dialogue while writing, and the chance to conference meaningfully with a teacher during the editing process. Students bemoaned the absence of these activities and the failure of current practices and conceptions of writing to focus on making meaning for clear purposes and audiences in authentic contexts where an interpretive community existed to give significance to their efforts.

In a parallel that should give the proponents of revolutionary educational technology pause, the students in this investigation were no less critical of the ways in which digital technology is being used as a potential facilitator of learning. While initial criticism focused on the generic teaching techniques they associated with educational technology in the hands of their teachers, this well-worn theme in the literature is extended in this dissertation through the nuanced student interpretations of the ways in which their learning needs are not met by individuated, product-driven or information-centred practices that separate them from fellow learners and teachers in ways that bleed out the communicative potential in learning environments that involve technology use.

This concluding chapter has been organised in three sections. The first of these assesses the extent to which the research objectives have been achieved. As part of this assessment the contribution of this research to a consideration of the digital argument mapping (DAM) approach for practice and theory in the area of writing instruction and teaching and learning with digital technologies is explored. The second section evaluates practical recommendations for teaching practice based on the preceding section and the principles of design-based research around which the investigation has been organised. Finally, in the third section of this chapter, the implications and limitations of the methodology, as well as the potential for future research involving argumentation and educational technology, are considered.

10.1 Research Objectives.

The aim of this investigation was to investigate the potential for digital technologies designed to scaffold students’ skills in argumentation, to foster engaged learning practices and the effective writing of opinion. By intervening in functioning
classrooms in order to assess digital argument mapping in actual learning contexts, it was hoped that argumentation could be assessed as a potentially communicative practice that could address deficiencies in the areas of writing pedagogy and the use of educational technology in the writing classroom.

10.1.1 The effectiveness of student argumentative writing and the engagement of students in the digital argument mapping practice.

The first research objective set out to identify and evaluate changes in students’ argumentation skills evident in essay-writing. The second objective sought to explain these changes by evaluating students’ attitudes to working with argument and argument mapping as distinct approaches from those currently practised in the writing classroom.

This dissertation can report that a learning environment centred around argumentation and digital argument mapping can improve the effectiveness of student writing of opinion. It was found that students were able to transfer attitudes to argumentation, as well as new skills in counter-argument, evidence deployment and thesis development to their essay writing at the end of the unit of work.

Furthermore, the high level of student (and teacher) engagement with the practices associated with DAM highlights the student energy for and willingness to be involved in communicative strategies as part of the process of writing. Significantly, this engagement also reflects the dangers of strategies that either skip process or replace it with a template approach aimed at the production of standardised texts and patterns of writing.

The following sections evaluate the elements of the digital argument mapping learning environment that can reasonably be seen to have contributed to improvements in the effectiveness of student writing, as well as student engagement with classroom practices.

10.1.1.1 The visual organisation of ideas

The visual display of abstract information and relationships facilitated by the argument map design, particularly the branching of sub-sections, was found to be extremely helpful by the participating students. In contrast to their interpretations of generalised dot points and paragraph templates, students credited the visual organisation with helping them understand content, where to place that content, and
the role of evidence in supporting their own developing theses in the preparation of whole texts such as essays.

In this investigation we see specific examples of classroom interactions that involved problem-solving facilitated by the visual representation that led to both new conceptual understandings related to the text and concept being studied, and also “lightbulb” (JR) moments where students demonstrated a new appreciation of the role and form of argument, evidence and essay-writing. The evidence of visual support aiding both conceptual development of high school students, as well as their metacognitive understanding of aspects of the learning process, is a key contribution of this investigation to our conception of how effective argumentative writing may be facilitated.

10.1.1.2 Multimodality

The literature would suggest that the visual ‘hook’ of the digital argument map developed by students would have led to increased engagement. As Lenhart et al. (2008) conclude, however, this hook is rarely enough to spark long-term motivation for teen writers. This investigation has revealed that it was the malleability of the multimodal text on the screen, the ability to arrange and re-arrange to suit student purpose, that has engaged students. The constant of the guiding visual structure of the map, combined with an ability to construct and reconstruct on the basis of meaningful ongoing dialogue, may well have encouraged the risk-taking, sharing and experimental thinking seen by Ferguson, Whitelock and Littleton (2010, p. 103) in their work with students collaborating around “improvable objects” on the screen. Here we have explicit student and teacher support for the notion that problem-solving onto a malleable digital representation combining text and visual modes was both useful for conceptual development which could then be transferred to student writing, and engaging as a classroom activity under teacher guidance.

10.1.1.3 The process in student hands

This investigation confirms the possibility of DAM ameliorating one of the key problems of the process writing model, namely, the way that the stages of the process can be taught as content (Andrews, 2011), making it as lock-step and mechanical as the genre approach has become in contemporary contexts. The digital argument mapping process, of which the technology is one aspect, places control of the process in student hands. In their interviews students remarked on the
clarity and fluidity of thinking (as opposed to the constraints of a text-type approach) as they worked through this process, and the way this process enabled them to consider patterns and relationships between ideas that evolved towards a stronger understanding of the purpose of their writing.

10.1.1.4 Collaboration and dialogue

Students value the role of meaningful talk before writing in helping them be more engaged in the writing process. It is one of the strongest themes in the student voice in this investigation that the DAM environment involved meaningful collaboration and dialogue between students and between students and teachers. While both collaboration and dialogic teaching are the focuses of widespread literature attention, this investigation has revealed that student engagement increases when collaborative and dialogic activities are strategically utilised in digital learning environments where a written product is the object of student work. Participating students were very clear on this note: time to interact – facilitated by the digital diagram – allowed them to consider their arguments in ways that they could transfer to their writing tasks. The writing post-test data confirms this student interpretation.

10.1.1.5 Explicit teaching and cognitive strategies

The defining factor in whether technology facilitates student writing is the “strategic instruction” (Andrews et al., 2004, p. 13) provided by teachers. In this investigation, students were explicitly taught an argument grammar; they had argument mapping modelled to them by the teacher, and were continually guided by teacher and partners to consider cognitive elements of argumentation. That these elements were utilised in their writing and discussed in their interviews – both unsolicited – suggests the success of this approach in enabling argumentative writing. In particular, this investigation adds to our understanding of the role of this kind of instruction by emphasizing the way it was desired by students and credited with helping them succeed in this specific digital learning environment.

Beyond student engagement with cognitive processes and their demonstrated ability to transfer gains in this area to their argumentative writing, this investigation has advanced two propositions important to our conceptions of writing pedagogy. One, when the process of writing is viewed as a problem-solving activity, student engagement is high and the product is effective. Two, students are capable and
interested in advanced cognitive pursuits such as argumentation at an earlier than expected age, but these strategies must be framed in a sociolinguistic understanding of the interactions of the learning environment. Argumentation must not be reduced to disembodied competencies.

### 10.1.1.6 Argumentation

The specific grammar and strategies of argumentation proved both engaging to students and effective in helping to develop essay-writing. Apart from the general sense that students reacted well to the explicit instruction in metacognition, there is significant evidence here that the amount and type of evidence use improved and that students improved in their ability to deploy and develop a thesis through a sustained text. Counter-argument, with its rhetorical inclusion of alternative viewpoints, had the most dramatic improvement for the treatment groups. Students emphasized the clarity it gave them about the purpose and organisation of essays, while teachers suggested that this element of argumentation allowed their students to develop a clearer and more personal voice with which to express their opinions.

The communicativeness of counter-argument depends on its facilitation of intrapersonal cognitive conflict (Schwarz, Neuman, Gil & Ilya, 2003) – the student is forced to consider alternative possibilities and their own point of view regarding each. In addition, the organisation of an argument considering these viewpoints depends on the writer’s purpose and understanding of the potential audience in ways that distinguish this approach from the manner in which the process and genre approaches are currently being utilised. In essence, argument orients the writer towards an awareness of audience, and hence brings purpose, context and rhetoric back into a mix that had become reduced to structure and content.

Participating students reacted well to the process of argumentation and credited it with improved writing and understanding of the purpose and style of school-based essays. In an important addition to our developing understanding of argumentation, this investigation gives some backing to Kuhn, Hemberger and Khait’s (2016) contention that adversarial argumentation may prepare students for consensus-seeking. The authors suggest that further research attention is needed to explore the possibility that adversarial argument – “by sharpening relations between claims” (p. 115) – may help students make a transition from critical thinking to critical writing. The student appetite for counter-argument, added to their improvement in ability to
incorporate alternatives in writing to create a consensus they were satisfied with, provides evidence for this transition and marks counter-argument as a key factor in improved student engagement and writing.

10.1.2 Digital technologies in the classroom and ‘learning’.
The third research objective sought to evaluate the extent to which digital technologies used in the classroom facilitate learning interactions that are valued by students. It was hoped that an understanding of student conceptions of the connections between technology and learning would help to explain their engagement with digital argument mapping.

One of the most significant contexts of this investigation is the ongoing struggle to measure the impact of technology on student learning. While researchers have noted the potential for positive outcomes, the consensus remains that the use of computers does not ipso facto “ensure that teaching is easier and more effective or that adolescents will be automatically well prepared to read, write and live in the 21st century” (Bruce, 2005, p.17). In an effort to counterbalance the triumphalism and instrumentalism of an earlier period, a key strand in the last decade’s worth of critical work on educational technology has been the effort to assess the conditions under which “teachers’ instructional practices can be augmented when technology use aligns with their pedagogical beliefs” (Flanagan & Schoffner, 2013, p. 243). In this section of the concluding chapter, digital argument mapping (DAM) will be considered as both a specific instance of technology use that aligned, extended and often contradicted teachers’ pedagogical beliefs, and a type of technology use that reveals much about the current landscape of learning with digital tools.

Above all, this investigation has emphasized the importance of student activities and student interpretations to the judgments of effectiveness and engagement. According to Passey (2014), one key measure of effectiveness is the extent to which skills and knowledge are held in mind by specific groups of learners who are then able to integrate new skills with existing knowledge. In this investigation mixed ability students problem-solved, utilising the moveable text boxes of the DAM tree diagram, and achieved statistically significant improvements in their integration of argument skills into their argumentative writing.

Similarly, students’ perceptions of the experience demonstrated their investment in scaffolding-type technologies, and their desire for purposeful learning in digital
environments. If a student voice that distinguishes between more or less meaningful classroom uses of technology is an important contribution to the field, the dissonance between student and teacher voices is an equally important extension of this understanding. The literature has picked up on distinctions between teacher and student views of Powerpoint use in classrooms, for example, but this dissertation reveals that an overly idealistic conception of the attractiveness of teacher uses of technology pervades the field. Teachers’ interpretations of the student-teacher dynamic, the creativity inherent in student constructed digital presentations, and the hook provided by the digital portal to boundless and varied knowledge, simply does not match the student criticism of the lost relationships, the atomised learning direction, and the superficial thinking and interaction that they experience during much classroom technology use. This dissonance exists whether the technology use is teacher presentation involving YouTube, independent student work on mobile devices, in the usual classroom or in the computer lab, working individually or collaboratively.

The fact that students felt that much computer use in schools constrained their learning by focusing on information rather than ideas, warns us that not enough notice has been taken of student desires when it comes to educational technology, and that student learning goals are more important to them than the theoretical affordances of search and presentation software. Students’ desires to remain on “the same path” (K9) as their classmates, interact meaningfully with their teachers and avoid the “enclosed” (J9) space of the computer when it came to learning, as opposed to gathering or displaying information, suggests a fatigue with generic uses of technology that cannot simply be explained away as a failure of educators to move into a Mindset 2 (Lankshear & Knobel, 2006) realm of multimodal creativity and design.

Based on student interpretations, this investigation concludes that neither a multimodal scaffolding of argument towards essay-writing, nor innovative uses of new media excite students or lead to effective thinking and writing if they do not involve meaningful student-centred learning goals and learning interactions. A simplistic identification of multiliteracies with educational technology, as well as the widespread corporate-driven provision of individualised computer technology, has clouded the multiliteracies’ ideal of deploying technology for the improvement of education and wider society (Pullen and Cole, 2010). This investigation has
proposed that such too-general multiliteracies’ ideals, coupled with an over-investment in the digital products of New Learning, need to be more grounded in the student voice on learning in digital environments.

That student voice reveals one more corrective to the contemporary narrative: the teacher as guide-on-the-side is not appreciated as an asset to learning by many students. Not only does this confirm Hattie’s (2009) preference for an activator rather than guide role, but subverts the participating teachers’ sense of themselves as supporters of independent computer-based learning. This investigation extends Fullan’s (2014) insights around teacher-student partnerships in digital contexts, and highlights not only the effectiveness of the direct instruction of cognitive strategies and the planned creation of a dialogic learning environment, but students’ desire for this kind of teacher-oriented learning while working with educational technology in the classroom.

Furthermore, the idea that technology is threatening teacher authority and challenging teacher identities (Curwood, 2014) is not supported by the teacher voices in this research. Both early and later career teachers are accepting the shift in power dynamics that comes with student skills with technology, and indeed actively seeking it in order to develop relationships with students. Curiously though, it is conceivable that this shift in teacher self-assessment and practice is compounding the problem of a missing teacher role that was voiced by students in this investigation. Dispersed authority may be a feature of online communities, but students seem to be desiring a more active instructor role, one that combines a direct interventionist persona with a situated practice model of constructivist activator.

This investigation has revealed that the explicit teaching of – or at least facilitation of both interests and skills in – collaboration and discussion prior to work with educational technology, will result in enhanced student engagement in the process, and the improved effectiveness of student composition.

In addition, students who the literature would characterise as having moved beyond such Mindset 1 uses of technology as scaffolding an argument, were not at all averse to working in such prosaic online environments. Their peers who self-assessed in this investigation as disliking the influence of educational technology on learning, also enjoyed and benefitted from the DAM processes.
The fact that students who self-assessed as disliking non-fiction writing were also not disadvantaged by, or disengaged from this program, suggests that this way of working with ideas in a digital learning environment appealed to a variety of subgroups: those who had previously not seen themselves as writers, or had perhaps lowered their expectations because of limited writing success; those riding the wave of digital educational progress; and those standing on the shore with their arms folded.

Given this wider context, this dissertation concludes that the following key features of the digital argument mapping environment were responsible for student engagement with the process, as well as enhanced student effectiveness in argumentative writing after the process. From these judgments it is also possible to make recommendations beyond the DAM to general classroom uses of technology for learning.

10.1.2.1 DAM and the student vision of learning.

DAM is a type of technology-in-use that promotes student engagement and effectiveness because it matches their conception of beneficial learning with technology. The learning experience was structured in a way that the class as a unit remained under the guidance of the teacher, even while working on independent arguments on self-controlled machines. The manipulation of content onto the screen involved problem-solving and negotiations that were appreciated by students as ‘purposeful learning’. The interactions that were facilitated by the nature of the program involved students in dialogue and collaborations that both students and teachers felt advanced student understandings and encouraged meaningful contributions.

This sense of a student vision of learning with technology should be at the forefront of decision-making about technology use in classrooms. Whatever the narrative developed by technology corporations, app developers, policy-makers and even well-meaning teachers, if the way a program is utilised in actual learning environments does not satisfy student needs for purposeful learning, then there should be a reconsideration of time and money invested. Moreover, the potential for purposeful learning is not a component of an artefact or program. Digital argument mapping can be used in shallow ways that stymy critical thinking. The key factors are the student receptiveness to a way of working and the nature of the learning
environment to support uses of the technology that are interpreted as meaningful by learners.

10.1.2.2 DAM and interactivity.
Interactivity is a laden term in relation to the educational uses of technology. Apps, programs, learning management systems, and devices that promote some form of interactivity are highly prized. The assumption, however, is that a component of the technology, rather than a complex interplay within a learning environment, leads to meaningful interactions between learners, between learners and the technology, or between learners and teachers.

This investigation has built on previous research that has cast doubt on hyperbolic claims about interactivity and learning in digital contexts. More precisely, the student interpretations of their experiences with DAM encourage a careful reconsideration of what counts as meaningful interaction in the eyes of learners, and what kinds of learning environment actively facilitate this meaningful learning.

In their uses of technology, students are seeking an environment that allows them to collaborate meaningfully with peers. They are not seeking and are not experiencing new or revolutionised collaboration. They want what they see as useful and productive in collaboration without technology: equity and control; the gaining of insight from a whole that is more than the sum of its parts, and a sense that something is being solved, built, or reconsidered. Merely being able to connect, whether this involves sharing a document or finding and manipulating content, does not count for students as purposeful collaboration in a learning environment.

The DAM learning environment facilitated meaningful collaboration because students engaged with the nature and process of argumentation and argument mapping. Students were engaged by the purposeful deployment of evidence and concepts for a clear purpose, the problem-solving nature of the scaffold, and the higher order thinking required by the manipulation of features such as the counter-argument element. It is therefore a major contention of this dissertation that it is not a feature of the digital program that is critical here, but an element of the conceptual work that is being undertaken. If the program is then seen by students to facilitate the conceptual work, an environment of meaningful collaboration also develops and in turn feeds back into that purposeful learning.
Finally, it can be seen that specific types of dialogic-interactive communication were facilitated by the interplay of learners and technology in the learning environments under investigation. In this sense it is the specific nature of the digital argument mapping environment that facilitates a dialogic inclusion of multiple viewpoints, and allows for interactions where the teacher-student discussions satisfy student needs for guidance and extension. Most particularly, three aspects of the program encourage this type of interaction.

1. The inclusion of counter-argument necessitates rough-draft, disputational and exploratory dialogue in order to construct meaningful lines of argument and balances between competing premises.

2. The negotiations about evidence, types as well as specific examples, necessitate dialogue that promotes both intra and inter-cognitive conflict.

3. The developing and problematized map facilitates extended student-teacher interactions in the dialogic-interactive mode, an environment where knowledge is being created through the sharing of multiple viewpoints and the cyclical (re)consideration of elements of the argument and of the argument map.

**10.1.2.3 DAM and knowledge creation.**

Co-created knowledge is a key feature of the DAM learning environment. This investigation has confirmed research which suggests that students enjoy and desire a move beyond knowledge retelling, to a shared space where knowledge-creation, co-constructed or co-created knowledge is the goal of learning. However there are caveats, or extensions, to this understanding that have developed through this investigation. First, knowledge-construction in the literature is often presented as tied to digital multimodal products that have been designed by students. The digital argument mapping environment is focused on process over product. The knowledge-creation is in evidence in the interactions between participants as they work with the technology. Indeed, it is only in evidence if they interact purposefully during the process of developing the argument map.

Second, creative knowledge construction in the form of digital multimodal products is far removed from the conditions of learning in upper secondary schools where a context of standardised testing and content heavy curriculum has restricted the possibilities for this kind of work. This investigation has demonstrated that it is
possible to co-create knowledge in Mindset 1 contexts where the learning is focused on scaffolding print culture capacities such as argumentation. Students did recognise the benefits offered by multimodal work and did enjoy the finesse facilitated through presentation programs. Critically, however, students did not conceive of these activities as productive learning unless the process involved dialogue, collaboration and a deepening of ideas.

Poor learning behaviours that educators have identified in a print culture dominated classroom have not magically vanished in a digital learning environment. Dependent learners, disengagement from teaching and learning practices, and ineffective skills are evident in both the writing classroom and in student uses of technology for learning. The findings of this investigation demonstrate that research involving technology should not be driven by the imperative of technology as disembodied artefact, but rather should focus on specific learning and teaching practices, ideally ones that begin with a capacity – such as argumentation – that is valued across subject areas and can be enacted on a variety of platforms, both print and digital. This orientation towards practices and capacities acts as a powerful corrective to any educational technology rhetoric which skips too lightly over a consideration of when and how technology should be best used during the processes of learning.

10.2 Recommendations for Pedagogy and Teaching Practice

This section sets out areas where practical recommendations for teaching practice can be made on the basis of the conclusions of this investigation. Suggestions for further research in these areas are made where relevant.

10.2.1 DAM and current approaches to writing pedagogy.

Student engagement with current classroom practices related to developing writing skills has been a key focus of this dissertation. This investigation has found statistical and attitudinal support for the widespread literature concern with student engagement in writing as a social practice, and with the process and genre approaches most commonly being used to develop skills in this area. Students were hesitant about the purpose of argumentative writing and the essay; they expressed
self-doubt about their opinions and the structures for conveying them, and they commented on the “pointless” (student G9) writing they were often involved in. In a major extension to our understandings of this topic, the students expressed the constraint they felt around ideas and structures, both in terms of having to fit in with teacher-supplied content, and fall into line with an agreed communal thesis.

While students noted the support they felt paragraph templates provided them, there was a distinct lack of enthusiasm for this approach. A key conclusion of this dissertation is that while a limited text types approach, involving paragraph templates, provides students with support for organising points into a paragraph, the lack of focus on purpose, audience, context and style means that while certain students may become better at writing English style essays (as well as extended responses in other subject areas) that receive stronger examination marks, they are neither engaged by this process nor able to envision the application of decontextualized skills to authentic writing with which they might intervene in the world.

The implication of these student interpretations is that learning activities focused on students ‘getting a structure right’ have limited effectiveness and are felt to be constraining and confusing by students. The provenance of the approach – in both the genre movement and more recently in competency approaches enacted for example in decontextualized NAPLAN skills – is understandable in the desire to give students control of socially important forms and practices. In contrast to the ‘expressiveness’ of the process writing focus on the lifeworld of the writer, the learning and practice of paragraph structures gives both teacher and students something concrete to develop. There is no suggestion that these approaches need to be shelved; the recommendation of this dissertation is for a revitalization of them both through a refocus on purpose and audience in the genre field, and the use of strategies such as argument mapping as part of a re-energizing of the pre-writing planning stage in the process approach. The exploration of a mode of communication such as argumentation provides us with a productive middle ground in which the limitations of current writing pedagogy are revealed, and the usefulness of the re-imagining of process is confirmed.

In students’ engagement with the digital argument mapping, we see the potential of approaches centred on discourse and communication; approaches that may
reinvigorate the text by reconsidering the context, and the process of writing by emphasizing authentic opportunities to discuss and collaborate during a meaningful planning stage. This dissertation suggests that the argument mapping was successful because the map was used to pose and explore problems rather than force students into a template. The scaffold, therefore, works to create a shared structure within which meaningful choices are delineated for the learner in ways which depend on and develop dialogue and dialectical thinking. The student and teacher emphasis on the ‘voice’ inhabited by students in their argumentative writing confirms this point.

Further research isolating the argument mapping from other aspects of a process-writing framework as part of a controlled experiment, would help to confirm the findings reported here. More research is also needed on the point in the process at which scaffolding should be faded for specific types of learners. In the present investigation the argument map was used by students at three points in the process: at an early stage to help facilitate critical reasoning, during the planning of writing to support the development and organisation of ideas, and at a later stage during the writing of an assessment essay to help remind the student of ideas and structure. The relative strengths and weaknesses of using the map at these three stages, as well as an understanding of which types of learners benefit most from having this guidance faded at specific points of the process would aid teachers in making pedagogical decisions about deploying this strategy.

A key conclusion of this investigation has been the distinction drawn between argument mapping and the current incarnations of the genre and process writing approaches. By focusing on the relationships between ideas, patterns (of evidence for example) and the relationship between writer and audience, argument mapping fulfils three critical conditions for meaningful writing and writing instruction. One, it focuses on communication before structure. Two, it focuses on the process of developing ideas and texts. Three, in its movement away from decontextualised structures and skills, it does not go to the opposite extreme of valorising a simplistic expressive writing self for students. Argument mapping therefore inhabits a productive middle ground between competing paradigms: a back-to-basics, standardised, skills-based set of approaches on the one hand, and an overly reactive set of practices that work to marginalise those who do not have the existing skills to express or create with freedom and agency on the other. Argument mapping
involves the direct instruction of a cognitive framework, the teacher-orientation of a whole-class learning environment, and the careful calibration of dialogic and collaborative elements that support the development of authentic student voices in their writing.

While recent studies have lauded the potential of argumentation to improve critical thinking and argument mapping to enhance the effectiveness of reasoning, this investigation has shown that in high school contexts, focused on concepts important to the subject of English, students are willing and able to transfer argumentation skills and attitudes to their argumentative writing in the form of the essay.

10.2.2 Authenticity
This dissertation has aligned itself with the widespread literature concern that much student writing in schools, especially the writing of opinion, is disconnected from authentic purposes and real world contexts. The focus throughout, however, has been on process, and the products – for example an essay about ambition in *Macbeth* – were not written for an audience outside of the classroom or to engage in authentic problem-solving in the real world.

Nevertheless, can a process be authentic? Literature, particularly in the field of multiliteracies, often focuses on the production of new knowledge framed as a multimodal product that is engaged in a real world dynamic, such as a videocast uploaded to a Council website. Writing to an actual audience is authentic in this sense, but how can educators prepare students well for this kind of writing? It is not enough to be merely ‘real’. It is important and has been shown to increase student engagement (Behizadeh, 2015), but without the right kinds of preparation it has also been shown to produce lower-order thinking work focused on the presentation affordances of the digital program (for example, Cumming, Kimber & Wyatt-Smith, 2012).

Digital argument mapping fulfils an important role in the process towards the student production of writing that matters to them, and can therefore be used for authentic purposes. It is “real world audiences and *real communicative acts*, both as a motivator and as a context” that facilitate “genuine authenticity” in student writing (Andrews, 2004, p. xx, emphasis added). The enabling of skills and attitudes towards authentic writing as a communicative act is under-theorised and
researched\textsuperscript{47}. The focus has shifted to authentic multimodal products but the writing processes involved have been neglected, with one result being the mechanistic state of much process and genre work. The DAM work, within a dialogic learning environment, encouraged real communicative acts that led to more effective writing. It is therefore a more authentic process and could be used to bolster higher order and critical thinking in the writing of opinion – for authentic audiences and purposes – in any mode.

10.2.3 Literacy disengagement

The research design has allowed for an exploration of sub-samples within the treatment group, so that more accurate evaluations could be made about the nature and extent of improvements to argumentative writing. Students in mixed ability classes, for example, showed a more significant improvement than those in higher streamed classes. Their interview interpretations focused on an appreciation of the visual structuring of argument, the organisation of evidence to produce content they could use, and the enhancement of their understanding of the point of argument and essay-writing. Their teachers echoed these reactions by noting that a problem-solving approach to argumentation allowed students – many of whom had struggled previously to understand and engage - to appreciate the point of sustained writing of opinion, and feel more confident in having their say within this paradigm.

The encouragement of low literacy, low engagement learners in the writing of opinion is a particular challenge in the English classroom; the take up of argumentation skills by this sub-sample is encouraging in what it suggests about the impact of communicative practices in a wider educational context that often seeks to apply decontextualized skills in an attempt to ameliorate literacy deficiencies. Here the response was due to a finely tuned learning environment focused on meaningful collaboration on a developing map that scaffolded for students their personal responses to each other and the ideas in play in the classroom.

10.2.4 Technology and ideology

It is crucial to recognise that the same technologies that encourage and facilitate the flow of ideas and products out of the classroom, also allow the flow of ideologies into the classroom. Paradoxically, however, the prevailing rhetoric of new technologies is one of democracy, participation, independence and knowledge-

\textsuperscript{47} Perhaps the understandings of Ashton (2010) and Splitter (2009), who see authenticity as more of a perception rather than a characteristic of a task, provide a way forward here.
creation. Because students are underprepared for the dispositions and skills required to wrangle the best from these ideals, they are subject to powerful forces of capital interested less in participation than commodification and surveillance (Selwyn, 2014).

DAM and its use described in this dissertation represents a technology-in-use that is arguably less in thrall to such consumer ideologies. In its focus on problem-solving, critical thinking and authentic interactions it is also capable of being used to help negotiate students’ entries into a digitally rendered global world, to “give students the textual control that they need to engage in all the material, social and personal aspects of their lives” (Misson, 2012, pp. 27-28). Indeed, Misson contends that this negotiated engagement is the key objective for subject English into the 21st century. This dissertation proposes that DAM is a powerful tool with realisable and “humble” aspirations (Rowan, 2012, p. 9) which has been used effectively by students in ways that prepare them for the role of writing in the public space of democracy. Moreover it does so without eliding its ideological provenances.

This dissertation recommends that teachers in high-school settings use DAM and other similar programs in ways that facilitate student control, authenticity in process and product, and critical thinking above internet research and content presentation. Morgan has encouraged us to explore, “What does this technology ask you to become to use it fully?” (1997, p. 192). DAM ‘asks’ us to invest in a dialectic; key to a critical approach necessary to ask difficult questions in a corporate context. DAM ‘asks’ the student to be authentically dialogic in a consumerist context where communication is ubiquitous, and yet often co-opted for marketing or surveillance ends. DAM ‘asks’ for an expressive self but encourages students to see how that thinking and writing position is structured within relationships with others and within sociolinguistic structures such as argument and functional linguistics. DAM ‘asks’ the student to value the process of developing writing, but does not leave the student in an unsupported individualistic space during that process.

10.2.5 Lesson design involving educational technology
This dissertation recommends that, in order to incorporate any technology intended to encourage discussion, higher order thinking and effective argumentative writing, teachers should focus on the role of technology in the processes of learning. As a general rule, argumentation keeps the processes of both writing and learning.
focused on communication. Digital argument mapping facilitates this process by scaffolding thinking in a context of teacher-directed cognitive development, dialogue and collaboration.

In order to maintain such a focus educators could think about the pedagogical choices available for a typical lesson in terms of a number of inter-related (and sometimes overlapping) continuums. These are:

1. Individual – Collaborative
2. Digital technology facilitated – Technology not used (by teacher or students)
3. Teacher oriented – Independent student based
4. Content focus – Analysis focus
5. Reflection (individual) – Communication (social)

Every unit of work, class or activity can be plotted across a combination of these continuums. Hence a reading task could be completed by individuals, with a content focus under the explicit instruction of the teacher. An argument map can, at specific times in the process, be collaborative, digitally facilitated, teacher oriented, with a focus on analysis and communication. At other times in the process and for different purposes, the work on the map might be switched to individual. It might take place on a piece of paper.

Appendix 8 describes the use of such continuums for the design of lessons involving educational technology in the classroom. The key understanding is that these continuums act as a tool for facilitating the analysis of how authentic communication might be encouraged in classes that involve technology use. Either as a planning tool or an exercise in post-lesson analysis, the combination of continuums allows educators to plan for and examine the interplay of these five elements of pedagogy. Moreover, the interaction of the different continuums draws our attention to the ways in which a choice within one continuum can be seen to play out on the available choices in other continuums.

Considering classroom technology use in this way suggests that one weakness of current educational technology narratives is that they take up the first two of the continuums and neglect the final three. The suggestion that educators keep all five
continuums in mind, actively intertwine them and see them as clines instead of dichotomies is made in order to combat the tendency of research and commentary to examine pedagogy in the area of technology in terms of one dimension only, thus diminishing the usefulness of the analysis. So, the question of whether technology was used or not to teach argumentative writing, for example, is only useful if one factors in at least some of the other continuums. As well as making the resulting answers more useful to practising teachers, the ‘questions’ implied by the continuums encourage the focus of lesson planning and analysis to remain on the purposes of technology use and on the ideal point in the process of learning for technology to be used – if at all.

The student interpretations reported in this dissertation suggest that teachers may not be aligning educational objectives with the affordances of technology at their disposal. In particular, teachers appear to be in thrall to the presentational and research capabilities of digital technology in ways that students appreciate – when useful – but also criticise when they interfere with the purposeful classroom communication that they see as vital for learning. The success of the DAM intervention encourages us to think carefully, in all uses of educational technology, about the place and function of the collaborative, the digital, the teacher-oriented, the content-focused and the communicative aspects of the learning environment.

10.3 Issues in Research and Methodology.

10.3.1 Limitations of this investigation.
This investigation has been framed by the theory-driven nature of design-based research (DBR), and grounded by its focus on praxis. According to Wang and Hannufin, “[t]he resulting principles are perceived as having greater external validity than those developed in the laboratory and as better informing long-term and systemic issues in education” (2005, p. 9). Generalisability has also been strengthened by the combination of research methods, particularly the triangulation of qualitative data with data drawn from the writing pre- and post-tests, and the highlighting of student voice in a research context that has tended to prioritise teacher judgment of effectiveness and engagement.
The key limitations of this investigation can be summarised as:

- the absence of a longitudinal focus on the effect of argumentation on student writing. DBR leans towards this type of repeated measurement, but the PhD timeframe has restricted this investigation to a feasibility component. The evidence presented has confirmed the feasibility of DAM in high school settings and suggests that repeated cycles of research, finetuning the focus on variables, would be beneficial for students and teachers.

- The quasi-experimental design has been necessary and in many ways beneficial in the school settings, but it has also weakened the reliability of findings. There are many potential variables at play, and while an attempt has been made to describe and account for possible causation, some variables, such as the teaching history of paragraph templates as well as school academic culture, are impossible to control for. Further research could hone in, with or without a randomised control design, on the ways in which functional linguistics could be applied to argumentation elements, or how particular authoritative-interactive types of dialogue and collaboration could be used to facilitate argumentation skills. As a scaffold DAM has the potential to be faded for various types of students and at different stages of the process; such gradual reduction of support is a key feature of the situated learning-constructivist paradigm and research could explore this aspect of the digital program in an applied setting, with a focus on qualitative methodologies to uncover student and teacher experiences of the process. Similarly, the intervention structure of multiple treatment classes has been both an advantage and disadvantage to this investigation. Gains in sample size and complexity, as well as the potential for comparison between years, schools and streaming level, are offset to some extent by some variability in teacher approach. While all teachers followed the unit of work structure which embedded argument and digital argument mapping in a thematic approach that then relied on collaborative and dialogic work around a shared argument language, potential differences in emphasis, style and classroom culture make comparisons complex. To some extent this is expected within the DBR approach, but in hindsight, a chapter structured as a fine-grained analysis of one classroom, noting differences to other class
groupings in the intervention, would have been useful. At the time of
writing this is planned as a joint-authored journal article,

- The assessment of student scripts depended ultimately on marker judgment. While every effort was made to increase the validity of this process, via sample size, statistical testing, moderation, training and marker isolation, the writing pre- and post-test data is the result of a subjective judgment of students’ scripts according to the prepared rubric.

- Care should be taken with regards to the generalisability of these results. Because of the size and nature of the sample, particularly the writing instrument, the results can be considered reliable for mixed ability or comprehensive schools in comparable settings. Further research is needed in schools with either a selective academic culture or specific literacy issues such as high levels of English as a Second Language or Indigenous students.

For one of the key original practitioners of the design-based research field, the trustworthiness of “complex intervention studies” (Brown, 1992, p. 152) has always depended on a balance between experimental control and the richness of the field. It is hoped that in following her preference for combining larger scale quantitative data with in-depth analysis of the interpretations of representative participants, meaningful evidence of effectiveness has been developed and can be usefully shared with practising educators.

10.3.2 Researcher reflection.
I came to this research from a teaching background of twenty years in the English as a Second Language and High School English and Social Sciences fields. With my original Honours degree in English literature and a subsequent Masters in Cultural Studies, a consideration of learning through and writing extended texts has been a constant in my academic and work background.

For the last six years I have been a marker of the essay-based English matriculation (Year 12) exam as part of the NSW Higher School Certificate. In that time period, preparation of students for the persuasive writing component of the standardised NAPLAN tests across all jurisdictions in Australia has become the norm for Years 3, 5, 7 and 9. How to teach the effective writing of opinion, as well as an appreciation of students’ attitudes to essay-writing, has been a constant feature of
my thinking, professional development and classroom planning for an extended period of my professional life.

The impetus for this research came from a genuine concern that my ability to teach writing skills, and interest students in writing their opinions, was limited. Moreover, my mature professional life has corresponded with the advent and “domestication” (Bigum, 2012b, p. 22) of educational technology. I started with no axe to grind, and no preconceptions about contemporary practice with regards to either writing pedagogy or technology. I started with an aim to improve my own practice and contribute to the practices of my community of teachers. I aimed to find ways to better incorporate into my teaching the proposed benefits of working in digital environments. Since completing the data collection stage of this investigation, I have taken on the role of relieving Head Teacher of English in my local State high school; in this position I have been able to introduce aspects of argumentation and argument mapping into the faculty programming, and been fortunate enough to be able to see their integration into real classroom contexts.

After a three year period of full-time study I returned to the secondary school context keen to see my ideas and findings grounded in the experiences of teachers and students. The main result of the process of literature review and school-based research was to excite me about the possibilities inherent in argumentation. The impact of returning to the faculty and classroom has been to remind me of the complications and tensions at the heart of school literacy practices. I see these occurring all too often between the energy students have for expressing themselves, and imperatives of education policy-makers to have those expressions tested in measurable, standardised and comparable ways.

10.3.3 Overview: The contribution of this investigation.

The process of writing a sustained text is a slow one that sits uneasily with the speed and fluidity of the digital. The gradual development of ideas where planning, drafting and revising are important can, however, be facilitated under certain conditions. Capacities, such as argumentation, work to maintain the focus on communication, in both print and digital contexts, and digital argument mapping can scaffold that argument in ways that are engaging to learners and successful at helping them produce effective writing.
The key contribution of this doctoral thesis to the field is in its demonstration that high-school age students are willing and able to transfer digitally workshopped skills and practices to their writing of opinion. They are not only open to a focus on process, but have actively demanded it in a context of educational technology use which – in the eyes of students – is overly focused on product and undervalues classroom relationships and communication.

This investigation has confirmed the importance of conceptualising the technology-writing research nexus in terms beyond either simply resourcing multimodality or providing the means to word-process faster or present more colourfully. Research is needed on other ways that technology can enable dialogic settings where the processes and forms of writing are developed in ways that militate against “pointless” writing or mechanistic forms. Writing and technology have a “reciprocal relationship” (Andrews, 2004, p. 3) where each changes the other. It is important that ongoing research recognises the developing nature of both in order to enable students to work productively in either realm. The present investigation and such further research may contribute to bringing argument into the policy and pedagogy fold in Australia. While the Common Core State Standards Initiative (2011) in the United States has embedded argumentative writing as a key element of State curriculums, in Australia meanwhile, argumentation has made little headway. The absence of argument, with its focus on communication over product and reasoning over knowing, is perhaps not surprising in a context of standardization and high-stakes testing. Continuing research into the benefits of this approach in high school settings may convince policy-makers and educators to maintain an emphasis on the processes involved in thinking and writing critically that lead to the production of effective writing.

Such a focus on process is just as important for teaching practice. A significant contribution of this investigation has been to bring to the fore a consideration of the most appropriate point in the lesson structure for educational technology to be deployed. This orientation demands not only a nuanced understanding of the type of technology, but a teacher awareness of lesson objectives. DAM is a ‘type’ of educational technology that involves the scaffolding of cognitive strategies, with

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48 The glossary of the new Australian Curriculum: English (ACARA, 2016) does not, for example, list argument or argumentation. In a local (NSW) elaboration of the Australian Curriculum, argument is mentioned in the Learning Across the Curriculum section as an aspect of Critical and Creative Thinking, (Board of Studies NSW, 2012b), and the Stage Statement for Stage 4 (ages 13-14) but not, inexplicably, for Stage 5 (ages 15-16) (Board of Studies NSW, 2012c).
concepts and content developed in class and problem-solved by students and teachers. It is a multimodal environment that aims to develop critical thinking that can be transferred to print literacy forms. It is therefore a strange beast that sits uneasily on the borders of classical delineations between educational technology types. It is not a learning management systems (LMS) or social media portal; it is not word processing or presentation software, and it does not drill and practice, simulate or gamify. DAM uses the power of a malleable visual diagram to create a social mindtool that facilitates critical thinking and writing. As such it straddles the complex boundaries between old world, Mindset 1 uses of technology intended to extend existing skills, and new, Mindset 2, conceptions of technology use that are expected to transform teaching and learning practices.

Ultimately this dissertation has demonstrated that there is a place for this type of technology in the writing classroom, and that’s its use in communicative ways can be beneficial – beyond just the production of more effective student writing – to our conception of the ways in which learning generally can be facilitated by educational technology.

The student voice reported here makes it clear that claims for educational technology revolutionising learning are overblown. While the causes of the gap between teacher, policy and cultural visions of classroom technology use and the actual experiences of students are complex, this dissertation makes clear that it is not simply a case of Luddite teachers refusing to transform practice. Indeed, school-wide and classroom efforts to mirror wider social conceptions of technology use predicated on independence, individuality, multimodal presentation and social communication are being resisted by students who do not automatically associate these values and practices with learning.

What is demanded by students is authentic communication in both the writing classroom, where communication has become abstract, and the technology classroom, where communication is largely superficial. Argumentation, both as a communicative capacity, and as a communicative practice facilitated in a digital environment, can act as an impetus for more effective writing and more engaged writing practices.
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DC: National Governors Association Center for Best Practices and the Council of Chief State School Officers.


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Appendices
Appendix 1  Introduction to students (version used for SERAP application)

Dear students of XX High School,

My name is Tom Gyenes. I am a PhD student in the School of Education at Southern Cross University in Coffs Harbour. As part of my studies I would like to conduct research at your school that I hope will be useful and interesting to you and others. In this letter I would like to explain my project and seek your agreement to be part of my research.

As well as being a student I am also an English teacher. I have always been interested in how teachers can help students be more interested in writing their opinions and so be better writers, especially of essays, that are so important for exams and assessments. I have wondered, like many teachers and researchers around the world, whether learning to argue using computers could make learning more interesting, and also improve a student’s writing skills. Therefore, my research project is titled:

‘Producing Knowledge’ that Counts: Teaching and Learning Argumentative Writing in the Digital Era English Classroom

What does this research involve?
During term 3 of 2014 several English teachers at your school will be working with me to try out techniques aimed at both engaging students more in writing their opinions, and improving their skills in this area. My research will investigate how successful this process is. I will be working with the teachers, interviewing them and observing the classrooms while they teach. I would like to interview some students about your experiences in the classroom during this period. I would also like to see if the teaching techniques have been successful by looking at students’ written work before and after the process. The research will also involve a questionnaire completed at the start of term to explore students’ thoughts and experiences of computers in schools, and your experiences of learning writing in your English classes.

In this way I hope to gain a good understanding of the school community and the class community, so that I can make some useful judgments about whether students enjoy the learning process that you will be a part of, and whether your skills actually improve over this period.

My responsibilities to the students who participate in my study:
Apart from the inconvenience of filling out the short questionnaire and being interviewed (if selected), there is no other risk of harm or discomfort to the participating students. The following procedures are in place to ensure the privacy and comfort of students:

- All responses are confidential and will be de-identified (no names, personal information or opinions are ever used)
- The topics of interest are not controversial, personal or intrusive
- Observations will only be in public situations and involving non-sensitive issues
- All research will take place at the school and during class times so there is no extra travel, time or cost.
- The research will help participating students – I am interested in seeing if the technology used during this term actually improves your writing skills. And I am interested in finding out about your reactions to learning in this way so that your teachers, and teachers generally, can continue to gain skills in this area. Too often teachers get advice on what will work with or interest students that does not come from actual students! I would like this research to be different in this way.

Note change of title since this letter was produced.
Appendices

- The research will benefit the teachers and the school community by helping us understand how computers can be better used; how argument and argumentative writing can be better taught and learnt; and how essay-writing skills can be improved.

The participants’ responsibilities for this research.

For the most part, participation in this research will involve just being a part of the normal classroom activities. All participating students will complete a short questionnaire at the beginning of the term and a random few students will be asked to participate in an interview near the end of the term. The key responsibility for students is just being yourself in the class, letting me observe how the activities go and then speaking to me about your experiences at the end of the process.

How will the results of the research be reported or published?

The results of this study may be published in journals and presented at conferences, but only general information about the group will be used. The names of the town, the school and the individual students will never be used. Please note that all questionnaires, interview transcripts and audio-visual material are kept securely at the University for a period of seven years after completion of the project.

Participant’s Consent

To agree to be a part of this research please return the attached consent form to your English teacher. Please note from the consent form that a student can end their participation at any time. Please also note that it is possible to be a part of the teaching and learning activities of this project, but to opt out of being observed or participating in the interview. Please make a note of any specific requests of this type in the space at the bottom of the consent form.

Inquiries

Further inquiries about the research can be made to:

Tom Gyenes, Researcher
and
Dr Judith Wilks, Research Supervisor

at the School of Education, Southern Cross University, Coffs Harbour on 66593295

Feedback

All participants are entitled to feedback from this study. If you would like to receive a summary of the results please complete the section on the Consent Form.

Research Approval

This research has been approved by the Human Research Ethics Committee at Southern Cross University.
The approval number is ECN-14-020

Complaints about the research/researchers

If at any time you have concerns about the ethical conduct of this research or the researchers, please contact

The Ethics Complaints Officer
Southern Cross University
PO Box 157
Lismore NSW 2480
Email: ethics.lismore@scu.edu.au

All information is confidential and will be handled as soon as possible.
Appendices

Student Consent Form

CONSENT FORM

This Consent Form is given to the student’s teacher and retained by the Southern Cross University researcher for their records. The Information Sheet is kept by the participant. You may request a copy of your consent form.

Title of research project: Producing ‘Knowledge’ that Counts: Teaching and Writing Argumentative Writing in the Digital Era English Classroom

Name of researcher: Tom Gynes

Tick the box that applies, sign and date and give to the researcher

I agree to take part in the Southern Cross University research project specified above. Yes [ ] No [ ]

I understand the information about my participation in the research project, which has been provided to me by the researchers. Yes [ ] No [ ]

I agree to be interviewed by the researcher if requested. Yes [ ] No [ ]

I agree to allow the interview to be audio-taped for transcription purposes only. Yes [ ] No [ ]

I agree to my writing being checked to see if the teaching technique has been effective. Yes [ ] No [ ]

I agree to complete a questionnaire asking me about ICT and writing. Yes [ ] No [ ]

I understand that my participation is voluntary and I understand that I can cease my participation at any time. Yes [ ] No [ ]

I understand that my participation in this research will be treated with confidentiality. Yes [ ] No [ ]

I understand that any information that may identify me will be de-identified at the time of analysis of any data. Yes [ ] No [ ]

I understand that no identifying information will be disclosed or published. Yes [ ] No [ ]

I understand that all information gathered in this research will be kept confidential for 7 years at the University. Yes [ ] No [ ]

I am aware that I can contact the researchers at any time with any queries. Their contact details are provided to me. Yes [ ] No [ ]

I understand that this research project has been approved by the SCU Human Research Ethics Committee. Yes [ ] No [ ]

Participant’s name: __________________________

Your signature: ____________________________________________

Date: __________________________

[ ] Please tick this box and provide your email or mail address below if you wish to receive feedback about the research.

Email: ____________________________________________
Appendices

Appendix 2  Introduction for participating teachers\textsuperscript{50}

How can teachers foster the writing of opinion that is both effective and engaged?

Title of my thesis:
‘Producing Knowledge’ that Counts: Teaching and Learning Argumentative Writing in the Digital-era Secondary English Classroom.

Background
- Digital era literacy
- Essay-writing
- Argument as communication

\textsuperscript{50} Minor aspects of the investigation, including the title and the program used, changed after this introduction.
What do I want to do?

- Try out a digital graphic organiser called ‘Digalo’ over one school term.
- See how teachers and students feel about working with it.
- Examine whether it improves students’ writing.
- Explore whether it improves students’ engagement with writing.

Logistics

The good news

- Digalo is easy to use for you and your students
- It fits in with whatever unit of work you are doing
- Very little disruption or extra work
- Professional development
- Opportunities for academic involvement, journals and conferences
- No intrusive, sensitive or personal questions

The bad news

- I will need to observe you and your class using Digalo
- I would like to interview you about your experiences
Appendices

Appendix 3  Cycles of discussion, adjustment and re-design

Notes from Team Meeting 14.08.14\textsuperscript{51}

Focuses:
- Creating a shared ‘grammar’ or language of argument: for example premise, evidence, elaboration, contention, alternative viewpoints and counter-argument
- Getting the best out of the program
- Using argument as part of the process of learning during the unit, and not just in the preparation of the essay assessment task

1. The language of argument

What matters is not the precise words you chose to use with your class (eg ‘main idea’ or ‘thesis’), or whether you introduce and focus on all the elements of argument or just one/a couple. What matters (based on past research and trials in this area) seems to be:
- That there is preparation (before the ICT work) with the whole class to establish an agreed language. So if you want to focus on elaboration, you would introduce the term ‘contention’ to represent an unsupported idea.
- That this language is woven into the whole of / most of the course so that it becomes part of the process.
- Consistency. Choose an ‘angle’ and stick to it. Will you focus on different types of evidence? Following an argument through? Incorporating different perspectives into a discussion?
- Introduce concepts related to argument carefully and in a well-structured, student-centred way, for example the envelope problem-solving type activity. Start with mini-topics to demonstrate: “Hardline approaches to youth violence, such as the Prince in Romeo & Juliet, are doomed to failure.”
- Model the building of arguments together, as opposed to argument-as-combat. Collaborative work from the start, even before you hit the ICT.
- Start working on argument maps on paper, prior to ICT.

2. The argument-mapping program

Students need time to experiment, they need to use the program as many times as possible ie to get it normalised. Two key points:
- The class should have an agreed group of symbols or representations to use and must keep to it so that students can read each other’s maps. These symbols may include different coloured arrows for ‘support’ or ‘oppose’ or icons for different types of evidence such as ‘quote’ or ‘textual detail’.
- The ideas of different levels (between main idea and ‘reasons’ and then evidence) and different colours, shapes and connectives needs to be set up.

3. Some ideas based on the unit shared by JR (I’ll keep adding to this)

\textsuperscript{51} Circulated via email to all participating teachers after the team meeting.
I think it is clear that the texts and the theme of conflict will be our main focus. I’m hoping that the argumentation work, woven in at a couple of junctures, can help you with those focuses, as well as the assignment at the end.

A) “Create a graphic chart/poster of the different examples of conflict.” (first ‘adjustment’ paragraph in the Introducing Ideas about Conflict in texts section in the Teaching, Learning and Assessment Column)

- Use this as an opportunity to introduce the argument map as a type of graphic chart. The activity would need a provocative statement to base a main idea on. For example “The most interesting types of conflict in the texts stem from intergenerational conflict” or similar depending on your particular focus and class.
- Doing this sort of thing would a) begin to set up that shared language, b) begin to prepare the students for the ICT work, and c) allow us to see if engaging in argument can really help students to learn, understand, think conceptually etc etc

B) “Collaborative exposition” (in the next section on different types of conflict). This is a great opportunity to keep building the shared language and mapping. Perhaps this is a possibility for the first try at the program?

C) Introducing Romeo & Juliet: use argument to introduce key ideas, like approaches to public youth violence as suggested in my introduction. Other opportunities for using a mapped argument at key points in the play are:

- Love, love at first sight, romantic love etc. Dangerous? Realistic?
- Responsibility for the tragedy: the priest, parents, the Prince?
- Parents and children (especially daughters): Juliet’s relationship with her parents. Year 9’s usually like expressing strong opinions here!!!

Mapped arguments (paper or online) can be used here either to introduce the issue before the relevant scenes are read in order to pique interest and understanding, or after the reading to organise evidence in order to support the argument.
Appendices

**Appendix 4 Argumentative writing grading rubric**

<table>
<thead>
<tr>
<th>Component</th>
<th>0 = Not Evident</th>
<th>1 = Limited</th>
<th>2 = Competent</th>
<th>3 = Effective</th>
<th>4 = Skilful</th>
</tr>
</thead>
<tbody>
<tr>
<td>a Development of thesis</td>
<td>0</td>
<td>1 = Some evidence of a thesis. Limited connections made.</td>
<td>2 = Thesis established and maintained with some consistency</td>
<td>3 = Thesis established and carried through composition</td>
<td>4 = Insightful thesis developed and sustained effectively through composition</td>
</tr>
<tr>
<td>b Structure</td>
<td>0</td>
<td>1 = Paragraphs may be used but limited or ineffective structure</td>
<td>2 = Paragraphs that demonstrate basic structure used</td>
<td>3 = Consistent use of well organised paragraphs</td>
<td>4 = Skilful use of paragraphing for flow of ideas</td>
</tr>
<tr>
<td>c Use of evidence to support ideas</td>
<td>0</td>
<td>1 = Some use of evidence</td>
<td>2 = Evidence used to support ideas</td>
<td>3 = Appropriate evidence used to develop ideas</td>
<td>4 = Thorough and sustained marshalling of evidence</td>
</tr>
<tr>
<td>d Incorporation of alternative viewpoints</td>
<td>0</td>
<td>1 = May mention divergent views from one’s own</td>
<td>2 = One or more divergent views used as part of argument</td>
<td>3 = Divergent views used to advance argument</td>
<td>4 = Skilful inclusion of divergent viewpoints to advance argument</td>
</tr>
<tr>
<td>e Weighing and evaluation of evidence; nuance and modality</td>
<td>0</td>
<td>1 = Some attempt to consider or frame evidence</td>
<td>2 = Evidence is sometimes considered and nuanced</td>
<td>3 = Evidence is used in a considered and thoughtful way</td>
<td>4 = Sophisticated approach to evidence: appropriate qualifications and nuance</td>
</tr>
<tr>
<td>f Persuasive techniques</td>
<td>0</td>
<td>1 = Some attempt to use: may be limited or ineffective</td>
<td>2 = Appropriate persuasion sometimes used</td>
<td>3 = Some persuasive techniques used to advance positioning</td>
<td>4 = Skilful deployment of a range of persuasive techniques to position audience</td>
</tr>
<tr>
<td>g Personal voice/ audience awareness</td>
<td>0</td>
<td>1 = May attempt to develop a personal voice</td>
<td>2 = Some audience awareness and use of personal voice</td>
<td>3 = Effective audience awareness and deployment of voice</td>
<td>4 = Skilful development of personal voice and thorough awareness of audience</td>
</tr>
<tr>
<td>h Conceptual quality</td>
<td>0</td>
<td>1 = Composition may touch on conceptual issues</td>
<td>2 = Composition is generally conceptual in focus</td>
<td>3 = Conceptual focus maintained through composition</td>
<td>4 = Insightful ideas with a sustained conceptual approach</td>
</tr>
</tbody>
</table>

---

52 Adapted for this project from Morgan and Beaumont (2003), Schwarz and de Groot (2007), and Kelly and Takao (2002). See discussion in Section 3.5.2.1.
Appendices

Appendix 5  Student questionnaire

Dear student,

This is a questionnaire designed to give the researcher some background about your experiences of school and feelings about learning.

Thank you once again for your time and help.

Instructions:
Please circle the appropriate number for each statement.

Q.1. Personal Information

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Gender</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>b</td>
<td>What year are you in?</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>c</td>
<td>How long have you been at your current school?</td>
<td>0-1 year</td>
<td>1</td>
</tr>
<tr>
<td>d</td>
<td>How often do you bring your school laptop into school?</td>
<td>Everyday</td>
<td>1</td>
</tr>
<tr>
<td>e</td>
<td>Do you use a computer at home to do school work?</td>
<td>Yes</td>
<td>1</td>
</tr>
</tbody>
</table>

Q.2. General experiences of school

How often would you do the following in your classes?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Never</th>
<th>Not very often</th>
<th>Once a term</th>
<th>Often (every week)</th>
<th>Every lesson</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Have one-to-one time with a teacher helping you</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b</td>
<td>Read for pleasure (not because you have to)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c</td>
<td>Work on a problem or issue that you have chosen.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>d</td>
<td>Create something that gets seen by people outside the school</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>e</td>
<td>Take part in whole class discussions</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>f</td>
<td>Take part in group discussions</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>g</td>
<td>Work or discuss something with a partner</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
## Q.3. General Reactions
How do you feel about the following statements?

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I spend most of my time in class working on the activity the teacher has set up.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>b</td>
<td>The other students in my class are usually working on the activity the teacher has set up.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>c</td>
<td>I usually follow class rules</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>d</td>
<td>Most students in my class usually follow class rules</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>e</td>
<td>I enjoy working with other students in my classes</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>f</td>
<td>I get on well with my teachers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

## Q.4. Technology used by your teachers.
How often would your teachers use these programs, technologies or devices in your classes?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Not very often</th>
<th>Once a term</th>
<th>Often (every week)</th>
<th>Every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>An electronic whiteboard</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>b</td>
<td>YouTube</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>c</td>
<td>Microsoft Powerpoint</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>d</td>
<td>A program or device (incl. a DVD player) to show a film</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>e</td>
<td>An electronic discussion board or chat room</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>f</td>
<td>Testing software or websites</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>g</td>
<td>Moodle or Edmodo</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>h</td>
<td>Digital accessories like a camera</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
### Q.5. Experiences with Technology

How do you feel about the following statements?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. I am a confident user of computer technology</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b. My teachers are confident users of educational technology</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c. I’m usually doing what I’m supposed to be doing when I’m using a computer in class</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>d. My keyboarding (typing) skills are good</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>e. Using computers improves the quality of my work</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>f. Using computers makes schoolwork more enjoyable</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>g. I find it easier to learn using computers</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>h. Technical problems often get in the way of computer use at school</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>i. I don’t get enough help with computer use at school</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>j. Using computers improves the presentation of my work</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>k. I prefer to work alone when using a computer</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>l. My internet searches usually get me what I am looking for</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
### Q.6. School computers or laptops during school time
During school I usually use a PC in a computer lab or a laptop (please circle the one you are most likely to use)

<table>
<thead>
<tr>
<th></th>
<th>PC in computer lab</th>
<th>Laptop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

How often would you do the following on a PC or laptop during class time for any reason?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Not very often</th>
<th>Once a term</th>
<th>Often (every week)</th>
<th>Every day</th>
<th>I don’t know what this is</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Use Microsoft Word</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>b</td>
<td>Use Moodle, Edmodo or similar</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>c</td>
<td>Use an electronic whiteboard</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>d</td>
<td>Search the internet</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>e</td>
<td>Use a presentation program like PowerPoint</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>f</td>
<td>Use testing software or sites</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>g</td>
<td>Send an email or other e-communication</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>h</td>
<td>Use a chat room or similar</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>i</td>
<td>Use a concept-mapping tool</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>j</td>
<td>Use Draw/paint/graphics</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>k</td>
<td>Use digital accessories like a camera</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>l</td>
<td>Use Microsoft OneNote</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>m</td>
<td>Use practice or drill sites</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>n</td>
<td>Play online games (organised by teacher)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>o</td>
<td>Play online games chosen by you</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>p</td>
<td>Watch a Movie or TV show</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>q</td>
<td>Listen to music</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>r</td>
<td>Watch something on Youtube</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>s</td>
<td>Record voice or music or video</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>t</td>
<td>Make a post on a blogsite</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>u</td>
<td>Share images or text with another user</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>v</td>
<td>Build content on a website</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

Could you write down some of YOUR favourite sites or online tools:

___________________________________________________________________________
___________________________________________________________________________
___________________________________________________________________________
### Q.7. Technology outside of School
How often would you do the following outside of school on any device?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Not very often</th>
<th>Once a term</th>
<th>Often (every week)</th>
<th>Every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Use Microsoft word</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>b</td>
<td>Use Microsoft OneNote</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>c</td>
<td>Listen to music</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>d</td>
<td>Email</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>e</td>
<td>Use a discussion board or chat room</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>f</td>
<td>Watch a movie or TV show</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>g</td>
<td>Watch something on Youtube</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>h</td>
<td>Use a data base or spreadsheet</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>i</td>
<td>Search for information on the internet</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>j</td>
<td>Use Microsoft PowerPoint</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>k</td>
<td>Use Adobe Elements or Photoshop</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>l</td>
<td>Record voice or music or video</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>m</td>
<td>Make a post onto a blogsite</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>n</td>
<td>Share photos with another user</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>o</td>
<td>Use Facebook</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>p</td>
<td>Use Twitter or Instagram</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>q</td>
<td>Download music or video</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>r</td>
<td>Build content on the web – like a website</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

### Q.8. Literacy and Writing
How often would you do the following in your ENGLISH class?

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>Not very often</th>
<th>Once a term</th>
<th>Often (every week)</th>
<th>Every day</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Choose what I want to write about</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>b</td>
<td>Write an essay</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>c</td>
<td>Grammar exercises/ worksheets</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>d</td>
<td>Write different kinds of texts like news reports or journals</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>e</td>
<td>Learn how to write an essay</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>f</td>
<td>Write short answers to questions</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>g</td>
<td>Write paragraphs</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>h</td>
<td>Learn about persuasive writing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>i</td>
<td>Participate in debates</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>j</td>
<td>Write down my opinions about something</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>
### Q.9. Writing and you
How do you feel about the following statements?
‘Writing’ here means either in or out of school, either on paper or digital.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Neither agree nor disagree</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>I enjoy writing about myself</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>b</td>
<td>I enjoy writing about the world around me</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>c</td>
<td>I enjoy creative writing</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>d</td>
<td>I enjoy non-fiction writing (about history, politics, films, issues, current affairs etc)</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>e</td>
<td>Writing can change the world</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>f</td>
<td>Writing can change things in my life</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>g</td>
<td>Expressing myself well in writing is important to me</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

### Q.10. Students working together
How important do you think each of the following are to you as a student being able to work well together with other students during group activities?

<table>
<thead>
<tr>
<th></th>
<th>Vital</th>
<th>Important</th>
<th>Neither important or unimportant</th>
<th>Not important</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Getting on well together</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>b</td>
<td>Giving each other information</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>c</td>
<td>Being able to say what you think</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>d</td>
<td>Debating skills</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>e</td>
<td>Being open to debating ideas</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>f</td>
<td>Challenging another’s ideas (politely!)</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>g</td>
<td>Sharing work equally</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>h</td>
<td>Having a leader</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>i</td>
<td>Being able to choose own job</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>j</td>
<td>Having clear rules</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>k</td>
<td>Choosing what you wants to do as a group</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>l</td>
<td>Being able to MAKE something together</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>m</td>
<td>Members feeling like they WANT to participate</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>n</td>
<td>Each having a specific job</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>o</td>
<td>Having another student help you do your job</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>p</td>
<td>The teacher as facilitator</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>q</td>
<td>Being able to change groups</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>r</td>
<td>Being able to choose which group to be in</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>s</td>
<td>Having a challenging task</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>t</td>
<td>Everyone contributing equally</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>u</td>
<td>Everyone contributing to the final product or presentation</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

That’s the end of the questionnaire. Thank you for your time.
Appendices

Appendix 6  Interview questions and prompts

Teachers

1. Can you describe your experiences using or teaching with the digital argument mapping program ‘Rationale’ (or ‘Draw-io’)?
   - Challenges?
   - Usefulness?
   - Applicability?

2. What is your opinion of the writing produced by students using Rationale/ Draw-io?

3. a) Do you think essay-writing has improved because of the students’ use of Rationale/ Draw-io?
   - Argumentative-writing
   - Main reasons for thinking yes/no
   b) How can you tell?

4. Can you describe your impressions of the ways students were interacting with each other while using the digital argument mapping program?
   - Interacting with you?
   - How different to non-digital?
   - How different to other digital?
   - Challenges to and benefits for teaching in this way?
   - Thoughts about ‘collaboration’? What does this word mean to you?

5. In what ways has teaching with educational technology this term impacted on your perception of your own teaching?
   - Effects on the learning space?

6. Do you think student engagement with writing changed through the term?
   - In what ways?
   - Main factors influencing the change (or lack of change)?

7. What are your thoughts about the sort of thinking that the techniques used this term engendered?

8. Did the quality of the final written texts produced by students improve?
   - In what ways?
   - ‘Intellectual quality’? What does this mean to you?
   - Major contributing factors?
   - Did the technical quality improve? (language skills, creativity through technology etc)
Students

1. Can you describe your experiences using the digital argument mapping program?
   
   Challenges?
   Usefulness?
   Enjoyment?

2. What is your opinion of the writing you produced while on the program?

3. Do you think your essay-writing has improved because of the use of the argument mapping program?
   
   Argumentative-writing?
   Main reasons for thinking yes/no?

4. What techniques have you/ your teachers used in the past to help you with writing your opinion/ essay-writing?
   
   What has worked best for you? Why?
   How do you feel about writing/ essay-writing?

5. What do you think of the ways in which the students were working with each other while using Rationale/ Draw-io?
   
   Interacting with the teacher?
   How different to non-digital? 
   How different to other digital?
   Pros and cons of learning in this way?

6. Do you think using educational technology in class affects you as a student? In what ways?
   
   Effects on the learning space?
   Effects on your relationships with other students and teachers?

7. Do you think the way you think about writing changed through the term?
   
   In what ways? Main reasons?

8. Did you enjoy the sort of thinking and discussions that you were asked to do and be a part of this term?
   
   Why?
   What does ‘good thinking’ mean to you?

9. What are your thoughts about the kinds of collaboration that developed through this term?
   
   Working together? Cooperating? Team-work?
10. a) What does ‘argument’ mean to you?

   b) Has using Rationale/ Draw-io this term changed the way you think about argument? About writing argument?

11. Has the topic of this term and the types of activities you participated in changed the way you feel about current affairs or politics? Reading about or watching news and current affairs?
Appendices

Appendix 7 Observation record

Observation Report

<table>
<thead>
<tr>
<th>Observation Details</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date: 24/08/2014</td>
<td>Computer lab #2</td>
</tr>
<tr>
<td>School/Year/Class:</td>
<td>Students in pairs at PCs, teacher at front</td>
</tr>
<tr>
<td>PTHS/Yr9/mixed</td>
<td>using IWB.</td>
</tr>
<tr>
<td>ability</td>
<td>Student desks arranged side-on to front</td>
</tr>
<tr>
<td>Time/ Period:</td>
<td></td>
</tr>
<tr>
<td>9.50am/ period 2</td>
<td></td>
</tr>
<tr>
<td>No. of students:</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Teacher: SB</td>
<td></td>
</tr>
</tbody>
</table>

Focus of observations:
- Student interaction with technology
- Teacher lesson design and pedagogy
- Student and teacher interactions
- Student-student interactions

Expanded field notes:

<table>
<thead>
<tr>
<th>Time</th>
<th>Description</th>
<th>Reflection</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.55</td>
<td>Teacher has class attention to IWB at front of room. Shows developing argument map from previous lesson, elicits student ideas for elaborating one branch of map. Explicit use of terminology: reason, contention, evidence, branch of argument map</td>
<td>Behaviour: 2 students keen to work on own (teacher re-directs). Some keen to get started. Tough to keep attention to teacher at front.</td>
</tr>
</tbody>
</table>
| 10.10| Students work in pairs  
1. 2 students discuss which section of text (Lord of the Flies) to use as evidence.  
2. Another pair seeks teacher help with use of the digital map. “Can I put another supporting box in here?” | Substantive communication focused here on evidence from text. Teacher focus on what kind of support is needed at this point. |
| 10.16| Technology issues:  
PC freezes, students forced to reboot (twice). Work lost. | |
| 10.18| Teacher stops class – asks for focus up front  
2 points made via instruction to whole class, example argument map on screen at front:  
1. Demonstrates same type of evidence (a quote from text) being used at same stage of two different paragraphs  
2. Asks open-ended question about other types of evidence that could be used to strengthen thesis within the same paragraph. | Explicit, teacher-oriented instruction  
Class engaged and responsive; several students volunteer ideas, ask clarifying questions. Some |

53 Word-processed transcript of original hand-written notes

Arguing with Technology 302
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
</table>
| 10.32 | Continuing pair-work with DAM Teacher makes rounds; ongoing discussions with pairs about developing maps  
Teacher answers student question about the necessity of including counter-argument. Open-ended discussion between Teacher and 3 nearby students about the nature of essays and the rationale for including a viewpoint divergent from your own i.e as rhetorical device and/or way to show balance  
Teacher asked by one pair to help adjudicate over the usefulness/appropriacy of textual evidence to support the key idea being worked on in the DAM branch. Discussion includes whether or not a quote is necessary, whether textual detail is enough. Teacher encourages students to consider how the concept can be made more sophisticated with the inclusion of different kinds of evidence.  
Some off-task behaviour while T circulates. One student checking email, two pairs engage in social chat over top of PCs.  
Discussion related to both argumentative writing and the essay form, including general discussion about the purpose of this kind of writing. |
| 10.40 | Lesson ends.                                                                                                                                                                                             |
Appendix 8  Using the 5 clines to plan technology lessons

One approach to the use of the 5 ‘clines’ for planning purposes is set out here:

1. Start with the first two clines – Individual vs Collaborative and Technology facilitated vs No Technology used – and construct a matrix of quadrants:

<table>
<thead>
<tr>
<th></th>
<th>Technology facilitated lesson</th>
<th>No technology used</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual work</td>
<td>Example pros and cons.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pros: independent, self-paced</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cons: atomised class, no collaboration</td>
<td></td>
</tr>
<tr>
<td>Collaborative Work</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Draw up the characteristics (pros, cons, features) of each quadrant. For the objectives of a particular lesson, which quadrant provides the most appropriate approach?

3. Most importantly, factor in the other 3 under-utilised clines. What happens, for example, if a collaborative technology-facilitated activity is teacher-oriented rather than independent and student-driven? At what point in the lesson might an explicit instruction approach from the teacher with step-by-step guidance or a scaffold be more appropriate than a problem-solving, student-centred approach? If the activity is teacher-oriented, to what extent is it possible for that activity to encourage reflection and authentic communication (verbal, written or multimodal), or is the lesson pulled into a content focus because of the instructivist drive? Does it make a difference if the activity does not involve digital educational technology at this point?

4. Take into account other practical questions that evolve out of considering activities and lessons through the lens of this matrix. For example: what app or program might encourage reflective thinking if students are working independently on digital technology? Is that really possible? What difference
Appendices

does it make if the independent activity is done on paper? Another example: if higher ability students are missing the whole-class, direct-instruction approach during technology-facilitated lessons, how do teachers factor that back in? What lesson design and technology choices are likely to bring that end of the cline back into focus?

Extract from a worked example.

Whole lesson objective: Students will develop a counter-argument to their developing thesis about conflict in Shakespeare’s *Romeo and Juliet*.

<table>
<thead>
<tr>
<th>Activity objectives and teaching strategies</th>
<th>Planning and analysis using 5 clines</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engagement/orientation stage/lesson ‘hook’: Teacher shows YouTube clip of news report of street protests and ensuing police action. Whole class discussion of news report voiceover concerning responsibility for conflict</td>
<td>Collaborative (whole-class) Technology-facilitated for content Teacher-oriented (to guide discussion) Analysis-focused (HOT; evaluation) Mixture of reflection and communication</td>
</tr>
<tr>
<td>Development of ideas towards counter argument</td>
<td>Collaborative (established pairs) Paper and pen brainstorm Independent, student-centred Analysis focus Mixture of reflection and communication</td>
</tr>
<tr>
<td>Gather evidence to use in argument map</td>
<td>Individual Use text under study and notebooks, Independent Content and analysis focus Reflection</td>
</tr>
<tr>
<td>Map new branch of argument using DAM</td>
<td>Collaborative (established pairs) Technology-facilitated Independent Analysis-focused Reflection and communication</td>
</tr>
<tr>
<td>Language work utilising functional grammar to explore ways of structuring alternative viewpoints</td>
<td>Teacher to individual students Technology-facilitated (projection of teacher material at front of class) Teacher-oriented (explicit instruction) Analysis focus Reflection and communication</td>
</tr>
</tbody>
</table>

Notes on the worked sample above:

What are the impacts of changing this kind of language work to student-centred individual, self-paced work on a digital language program? What are the impacts of structuring such activities as pair or small group collaborative?
### Appendix 9  Descriptive statistics for treatment groups’ personal preferences

<table>
<thead>
<tr>
<th>Enjoy collabor. (n=41)</th>
<th>Overall writing mean</th>
<th>Inclusion of Alternative Viewpoints</th>
<th>Use of evidence to support thesis</th>
<th>Inclusion of persuasive techniques</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Enjoy collab. (n=41)</td>
<td>3.15 (1.46)</td>
<td>4.52 (1.5)</td>
<td>0.46 (0.89)</td>
<td>3.49 (2.3)</td>
</tr>
<tr>
<td>Don’t enjoy (n=19)</td>
<td>3.03 (1.6)</td>
<td>3.84 (1.6)</td>
<td>0.68 (1.0)</td>
<td>2.63 (2.3)</td>
</tr>
<tr>
<td>Pos. towards school (n=51)</td>
<td>3.28 (1.5)</td>
<td>4.5 (1.5)</td>
<td>0.59 (0.9)</td>
<td>3.52 (2.4)</td>
</tr>
<tr>
<td>Neg. towards school (n=9)</td>
<td>2.17 (1.0)</td>
<td>3.24 (1.0)</td>
<td>0.22 (0.4)</td>
<td>1.44 (1.7)</td>
</tr>
<tr>
<td>Enjoy discussions (n=35)</td>
<td>3.47 (1.4)</td>
<td>4.64 (1.3)</td>
<td>0.63 (1.0)</td>
<td>3.77 (2.3)</td>
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<tr>
<td>Don’t enjoy (n=25)</td>
<td>2.62 (1.5)</td>
<td>3.85 (1.7)</td>
<td>0.40 (0.8)</td>
<td>2.44 (2.3)</td>
</tr>
<tr>
<td>Pos. ICT learning (n=15)</td>
<td>2.43 (1.3)</td>
<td>3.51 (1.6)</td>
<td>0.33 (0.7)</td>
<td>2.0 (2.1)</td>
</tr>
<tr>
<td>Neg. ICT learning (n=45)</td>
<td>3.33 (1.5)</td>
<td>4.58 (1.4)</td>
<td>0.6 (1.0)</td>
<td>3.62 (2.3)</td>
</tr>
<tr>
<td>Enjoy Non-Fiction writing (n=29)</td>
<td>3.49 (1.4)</td>
<td>4.55 (1.1)</td>
<td>0.62 (1.1)</td>
<td>3.52 (1.9)</td>
</tr>
<tr>
<td>Don’t enjoy Non-Fiction writing (n=31)</td>
<td>2.76 (1.5)</td>
<td>4.09 (1.8)</td>
<td>0.45 (0.7)</td>
<td>2.94 (2.7)</td>
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</table>
Appendix 10  Task sheets for student pre and post-writing essays

Year 10 Assessment Task

<table>
<thead>
<tr>
<th>Topic</th>
<th>Conflict in Shakespearean drama</th>
</tr>
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<tbody>
<tr>
<td>Date</td>
<td>16/09/14</td>
</tr>
<tr>
<td>Weighting</td>
<td>15% Writing</td>
</tr>
<tr>
<td>Time/ words</td>
<td>One period. 500-800 words.</td>
</tr>
</tbody>
</table>

Instructions:
- Write an essay in response to the following topic
- Use blue or black pen and the writing paper provided
- Use your student code number and not your name

Topic:
“Shakespeare’s play Macbeth presents us with the dangers of ambition”¹⁵⁴

To what extent¹⁵⁵ do you agree with this statement? Use your understanding of the play to support your point of view.

You will be marked on how well you:
- Use the appropriate language and structures of the essay form to communicate your ideas
- Develop an answer in response to the question
- Use supporting detail from the text to develop your ideas

¹⁵⁴ Other topic questions for Year 10 included: ‘Les Murray’s exploration of the human experience makes him relevant to the modern reader’; ‘The characters and situations considered this term demonstrate that humanity cannot learn anything from the past’.

¹⁵⁵ All task questions, both pre and post-test were constructed as ‘To what extent…’ type questions for consistency.
Appendices

Year 9 Assessment Task

<table>
<thead>
<tr>
<th>Topic</th>
<th>Conflict in Shakespearean drama</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>17/09/14</td>
</tr>
<tr>
<td>Weighting</td>
<td>10% Writing</td>
</tr>
<tr>
<td>Time/words</td>
<td>One period. 500-800 words.</td>
</tr>
</tbody>
</table>

Instructions:
- Write an essay in response to the following topic
- Use blue or black pen and the writing paper provided
- Use your student code number and not your name

Topic:
“Shakespeare’s play Romeo and Juliet shows us the conflict caused by thoughtless teenagers”\(^56\)

To what extent do you agree with this statement? Use your understanding of the play to support your point of view.

You will be marked on how well you:
- Use the appropriate language and structures of the essay form to communicate your ideas
- Develop an answer in response to the question
- Use supporting detail from the text to develop your ideas

\(^{56}\) Other topics for Year 9 included: ‘Hinton’s The Outsiders shows us that conflict is usually the result of misunderstanding’
Appendices

Appendix 11 Student essay writing samples (4), with marking rubrics
Whether the point is “we can’t learn anything from the past” I think the point should be “what can we learn from the future.”

Many films have been created on the topic of science fiction, of course many are based in the future. Included in these films are certain elements that we do not currently possess. And as humans, we strive, it is in our DNA, we always try to improve, become better than we already are. I think that we are using these films and ideas to build the future. Only looking back on the past to go forward. Using the past as a reference so in this being said I believe that we do learn from the past.

There is currently a product in production, soon to be introduced to the world. The google glass, this product is a set of glasses of which the lenses are viewing screens. What do you think this idea came from? Dragonball Z? Star Trek? This is only one example.

Many other items have been created from science fiction films, such as: Lazers, manual droidics, robots, the idea of the speed of light, and the reflectors on their points. Who look at the mobile phones we have looked back on the past in order to improve. Move forward. The speed of light, star trek and others.
Films have given us the idea of travelling at the speed of light. We have created certain vehicles such as fighter jets, that can travel at the speed of sound! This is over 700 mph, roughly translating to 1300 km/h! And we are only improving every day that passes. The light bulb, inspired by the Tesla coil. Now in modern society we have hundreds of different light bulbs.
Ambition. One of the many keys needed to succeed in life. Ambition gets us places. Motivates us. Gives us something exciting to work towards. The question is... How far will you go? We are shown many different views towards ambition within Shakespeare’s “Macbeth.” Whether it’s good or bad.

Macbeth. Symbolized as strong, lucky, loyal, wealthy, and highly respected by the king for his efforts. Although his glory is still, it is still not achieved. We are shown throughout the play that Macbeth's ambition to be king involves the well-being of others. As he becomes selfish, cruelly, dangerously and eventually evil.

There are the results of his Excessive ambition, creeping through his skin, trying to escape.

I have no idea if you can notice the visitor at my tent, but only vividly ambition which (sleep) and fell on the other. Here we are shown, even through the eyes of a woman that Macbeth being the main is actually the visitor of long intent like a joker would wish his reader in. Even through lacking the force the harshest but what he does have is growing and when ambition. All her needs is a key to his mind so he can change. From this we learn that too much ambition, excessive...
Lady Macbeth. A very important character in the story, strongly portrayed as cunning, strong, and manipulative. Though we are shown she looks originally good through her husband, his ambition is now her ambition. Her essentially in the next part of the play is the key to Macbeth's nature. She is much shrewder than Macbeth, reasoning, not turning.

"I have given such, not to know how much, by the love that we bear, that wills us, I would while I'm smiling in my sleep, have plotted..."

"You are indeed a woman, a woman who will do anything to get what she wants..."

"...I will instantly kill the brave Macbeth..."

"...it is more than..." "Strong" she is. "The son of..."

"...we must love each other..."

"...she is not as about and capable as she thought she was..."

"...Out damned spot...!

"...After the killing of duncan, though he serves me well, she is still trying to wash away the blood of the innocent..."

"...symbolized our guilt and betrayal, eventually driving her mad..."

"...in the fact that she raised the blood..."
and stuff and life or just images. It does not
merry, living or dead.

Macbeth, this view of ambition portrayed very differently.
Using this ambition to escape punishment from the
lurking evil of Macbeth. But how is it different?
"That calls upon us, green of grace, we will
return, in weapon line and piece. So kindly he
will at ease not to each one whom we invite to
see us crowned majesty at last."

Macbeth’s shining shows control and balance. The
perfect revenge to Macbeth’s vengeance. Malcolm
is very selfish, going behind the veil of glory,
behind the name for the good of justice and
wise people.

This is the perfect example of how ambition can
be acquired by good and not punishment. That
something that gets you there” yourself in the
end.

Ambition is necessary to human society. Without
it then would be no social hierarchy and we
would wander aimless achieve their goals. I believe
Ambition is a good thing. Macbeth is a great
example of showing hate and greed.
Shakespeare's "play" of *Macbeth* shows and depicts both the positive and negatives of ambition. Shakespeare shows that ambition is an important aspiration to have, but ultimately the outcome and consequences of this ambition is dependant on a person's morals and character.

People are never happy with what they have. Macbeth's desire for more is pricked after the witches' prophecy and lady Macbeth's interest in Seizing the Crown.

"Let light not see my black and deep desires. The eyes wink at the hand: Yet let that be which the eye fears, when it is done to see."

Shakespeare uses the diction of "black and deep" to describe Macbeth's ambitions as something that is evil and wrong. He also refers to the statement of the "eyes being the window to the soul" and this makes us believe these desires are the true Macbeth.

Excessive ambition causes people to abandon their good morals. Lady Macbeth, upon learning of the arrival.
of King Duncan is instantly power hungry and ambitious, hatching a plan with Macbeth to seize the crown through the most bloody of actions:

"Come you spirits that tend on mortal though unsex me here, and fill me from the crown to the toe top-full of divest cruelty."

Shakespeare's use of blunt and harsh diction forces the audience or reader to believe that Lady Macbeth isn't bluffing—Lady Macbeth & implies of evil spirits to unsex her & stop her of all womanly qualities so that she may have the cruelty and ability to do the bloody deed of murdering Duncan.

The use of "unsex" referring to both men and women as Shakespeare subtly makes the audience realise both genders have consciences.

To conclude, Shakespeare has shown that whilst ambition can be a good, excessive amounts can lead people away from good moral standards and down a dark path, The consequences and outcome of a person's
ambition's and desire depend on their strength of character.
Les Murray incorporates a rhyming style which reflects on the country and city lifestyle. Poetry is an artistic form of literature, some poets such as Murray bring realistic imagery into their poems. Some readers may find it easy to relate to than other poems about imaginary fantasies. Les Murray explores human experiences and makes them relevant to the reader by doing the following things I will be talking about.

Murray explores human experiences through most of his poems but one poem in particular, "The Mitchell's". He uses the impression of an omniscient narrator.

The Mitchell's is a poem which recognizes the calm unhurried way of bushmen. Murray aims at an almost cinematic presentation of the two men. The present tense conveys a sense of immediacy as if the scene is suddenly opened up as it is just as enviously closed. 'The men eat big meat sandwiches out of a styrofoam box with a handle'. This quote here gives a actual Australian human experience, because 50% or even more men would do this 'one has been rich but never stopped wearing his oil-stained felt hat!' another one of Murray's ways to incorporate actual experiences into his poems.
Another one of Murray's poems, 'Sydney and the Bush', has a physical location and talks about the 'original sin of their wander ancestors'. You can already tell by the title that it's going to be a realistic poem. This poem is about the segregation of the city and the bush, not only is the land separated but the cultural and social standards differ greatly. Murray has written the poem to make people aware how far apart the city and the bush have become. It also shows his wish for the city and bush to share a common respect for one another to give Australia its characteristics as a nation.

Just by looking at two of Murray's poems, you can tell he explores human experiences quite alot, with also using rhyming styles, personification and other techniques he seems to maintain that human experience style.
Marking rubrics - scripts A and B.

### Appendices

#### Argumentative Writing Rubric

<table>
<thead>
<tr>
<th>Component</th>
<th>0 = Not Evident</th>
<th>1 = Limited</th>
<th>2 = Competent</th>
<th>3 = Effective</th>
<th>4 = Skilful</th>
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<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b Structure</td>
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<td>3</td>
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</tr>
<tr>
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<td>d Incorporation of alternative viewpoints</td>
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<td>4</td>
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<td>3</td>
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<tr>
<td>h Conceptual quality</td>
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<td>1</td>
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Marking rubrics – scripts C and D.

<table>
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<th>2 = Competent</th>
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<td>a Development of thesis</td>
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