Learning Online: Multiliteracies and inquiry-based digital pedagogies for the middle years

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ABSTRACT
This paper reports on the theoretical and pedagogical framing for the development of a digital resource designed by staff of the Melbourne Graduate School of Education (MGSE) and the Australian Venom Research Unit (AVRU) at The University of Melbourne. The resource, *The Venom Patrol*, is an interactive website that is designed to support science-based student learning, extend students’ multiliteracy skills, and maximise learning opportunities through the use of inquiry-based and integrated learning pedagogies.

The resource’s design is underpinned by research highlighting the role of digital pedagogies and electronic resources in the middle years of schooling (see Culican, Emmitt & Oakley, 2001; Luke et al., 2003). Empowered deployment of specific multiliteracy skills (New London Group, 1996; Cope & Kalantzis, 2009) fostered through critical and creative engagement with digital tools is posited as essential for rich learning in contemporary classrooms (Anstey & Bull, 2006; Unsworth, 2002; Zammit & Downes, 2002). In this paper we argue digital tools such as *The Venom Patrol* that facilitate cross disciplinary connections have the potential to make learning more relevant and cohesive and to cultivate student voice and engagement (Apple & Beane, 2007).

With *The Venom Patrol* website becoming available to schools Australia-wide in 2011, there is an immediate need to trial its implementation in a range of classrooms. Therefore, we conclude with an outline of the qualitative case study research that is currently being undertaken in four school settings to investigate the effectiveness of the resource, its pedagogy and curriculum support materials.

Introduction: *The Venom Patrol* website
The challenges of facilitating engaged and empowered student learning in the middle years of schooling (Years 5-9) are well documented. A number of large scale inquiries and research projects have been conducted here in Australia to identify issues around student disengagement and underachievement, and to posit informed curricular and pedagogical recommendations in response. Middle years related research has taken many forms: those that focussed particularly on areas of literacy and numeracy (Culican, Emmott & Oakley, 2001; Culican, Milburn & Oakley, 2006; Luke et al., 2003); investigations of issues of gender and learning (Alloway, Freebody, Gilbert & Muspratt, 2002; Cuttance et al., 2007; Lingard, Martino & Mills, 2009); and specific year level investigations (Department of Education, Employment and Training, 2001). Although many of these studies are close to a decade old, and there is a need to move beyond artificial separations of middle years from earlier foundational stages and later post compulsory schooling pathways (Luke et al., 2003), the issues they raise remain relevant and salient today.

This paper reports on the development of a digital resource, designed by staff of the Melbourne Graduate School of Education (MGSE) and the Australian Venom Research Unit (AVRU) at The University of Melbourne, with funding from the Australian Government Department of Health and Ageing. The resource, *The Venom Patrol*, is an interactive website designed to support science-based student learning.
in the middle years of schooling. The website’s non-linear design allows for different entry points and pathways into and around the site. *The Venom Patrol* offers users the opportunity to investigate four habitats (arid deserts, suburban parklands, rainforests and tropical coasts); a medical clinic, a ranger’s office and a venom laboratory. Through these sections of the site, students are able to build knowledge about venomous animals, treatment of bites and stings, and scientists working in the area of venom research.

In line with middle years research that recommends maximising student agency in their learning (Beane, 2006) along with curriculum content that is relevant to their lives, the website provides learners with choices in terms of what they would like to explore. It offers multiple ways by which students might develop and communicate new knowledge gained through their investigations. For example, students might choose to investigate the history of antivenom research, explore the venom ratings of animals in the habitats, or learn more about how venom affects the body. In addition to honouring student choice, student voice is emphasised in the design of this digital resource in a number of ways such as: inquiry questions to support a dialogic approach to teaching and learning (Alexander, 2008; 2010); scenarios and role plays to encourage student interaction and discussion; and webinars to enable students to pose their own questions to scientists online.

*The Venom Patrol* website provides an inquiry-based planner to support teachers in framing and identifying the learning experiences they want their students to have. With the intention of supporting students to develop skills around use of multimodal electronic resources, the website includes film clips, animations, timelines, visual and written information for students to predict, investigate, analyse, and synthesise new knowledge.

![Home page of The Venom Patrol website](image)

This website aims to address recognised gaps in particular areas of science, public health and safety, as well as enhancing scientific literacy. It is acknowledged that while the quality of science teaching and learning in Australia is not high (Goodrun,
Hackling & Rennie, 2001; Angus, Olney & Ainley, 2007), and the level of student achievement in Year 6 national science assessments is low (Ministerial Council on Education, Employment, Training and Youth Affairs, 2005; 2008), the effective implementation of innovative science programs is costly in terms of the provision of professional learning facilitators and the training of science curriculum leaders and classroom teachers (Hackling, 2008). The Venom Patrol resource is a cost effective innovation that attempts to address some of these issues by its use of videos and interviews with key scientists and interactive inquiries with a scientific mentor in a Venom Laboratory. Through the resource, scientists demonstrate methods of scientific inquiry, and reveal ways of formulating questions, planning investigations, and of collecting and interpreting their data. This approach draws on research (Mortimer & Scott, 2003, Norris & Phillips, 2003) which proposes that specific literacies of science are required to interpret science texts, reason with scientific ideas, make and evaluate claims, and communicate findings from science investigations.

The Venom Patrol website aims to impact student engagement with scientific content and concepts through deploying multimodal design elements that activate and extend students' multiliteracy skills. This paper documents the theoretical framing which underpins the design of the resource and the pedagogical practices that support the implementation of an inquiry-based, integrated approach to learning. It concludes with an outline of a research plan to investigate the use of The Venom Patrol in middle years classrooms.

Middle Years Issues
Although concerns around the middle years of schooling are hardly new, and despite a concerted focus on issues of adolescent learning, the uptake of recommendations around school organisation, curriculum, pedagogy and resourcing (and the success of these interventions) are, arguably, uneven. The seminal work of Jeanne Chall and colleagues in the USA, that spawned the term ‘fourth grade slump’ (Chall, Jacobs & Baldwin, 1990), re-focussed attention on the socio-economic status differentials around educational success and underachievement as students reached the middle years of schooling. Such concerns figure in Australian studies that reveal different levels of student educational success linked to their levels of economic (dis)advantage, linguistic and cultural background, and geographic (urban/suburban/rural/remote) location (see Masters & Foster, 1997; ACARA, 2010). In addition, the registers and discourses of schooling requiring academic language proficiency have been particularly noted in terms of linguistically and culturally diverse student populations (Cummins, 2000; Gee, 2004; Schelpergrell, 2004).

Much of the research focus has nonetheless concentrated on adolescence as a period of universal challenge where young people’s social, physical, psychological and educational wellbeing requires attention, irrespective of background. In constructing adolescence as a time where significant levels of disenchantment and alienation beset learners, Culican, Milburn and Oakley (2006) recommend rich, authentic, world-connected teaching and learning that acknowledges students’ interests, builds on their abilities, and addresses their literacy and learning needs. Likewise, Luke et al. (2003) emphasise the need for integrated approaches to maximise student engagement and facilitate the making of connections across learning areas.

The use of learning technologies, alongside informed scaffolded instruction, has been posited (Culican et al., 2001, p. 30) as a means of addressing issues of student engagement and motivation, as well as assisting students to develop skills in
powerful forms of literate practice relevant to the students’ in-school and out-of-school lives. The incorporation of texts reflective of youth culture, mass media and popular culture, and the inclusion of information and communication technologies (ICT) into the classroom in the service of enhanced learning and improved literacy have been strongly advocated (see Cope & Kalantzis, 2009; Luke et al., 2003). The role that complex, interactive, multimodal texts like computer/video/internet games can play in supporting students’ creative and critical engagement with ideas and knowledge has likewise been extensively detailed, particularly by Gee (2007, 2010) and Beavis (2004, 2007). Yet the deployment of such digital media texts in the classroom is contested at a number of levels. Snyder (2008), for example, comprehensively documents the anxieties unleashed around children’s access, particularly in schools, to the internet, cyberspace and computer games. In addressing such tensions, Mills (2005) exposes the notion of multimodal texts and computer-based technologies as being at odds with more traditional, print-based texts, identifying this as a false binary. In reality, Mills argues, supporting students to be ‘multiliterate’ necessitates that print-based literacy be extended, but not replaced, to incorporate skills and understandings about the construction and use of screen-based, digital texts.

Multiliteracies
The term ‘multiliteracies’ was coined by the New London Group (1996) as the new millennium approached, and the possible textual demands of the 21st Century were considered. The concept of being multiliterate was built on changing notions of identity and literacy in a world that, for many, increasingly offers opportunities for transglobal movements and transcultural flows of ideas and information (Pennycook, 2007). These exchanges are frequently mediated and brokered by new forms of technology, making possible and necessitating new ways of being, communicating and interacting. ‘New’ as a descriptor became synonymous with conceptualising 21st century life: new literacies and new learning for new times (Cope & Kalantzis, 2000; Lankshear & Knobel, 2003; New London Group, 1996). Change as a concept was equally prevalent in the articulation of a multiliteracies pedagogy, with the New London Group (1996) identifying how changing work, technology, citizenship, service relationships, identities and cultures characterise Hall’s (1989) idea of ‘New Times’.

The spoken, written and electronic texts of the classroom, home and community were identified as increasingly complex and multimodal, employing a combination of linguistic, visual, audio, spatial, and gestural communicative modes (New London Group, 1996). Cope and Kalantzis (2009) have more recently reconfigured and reworked these semiotic modalities, noting that contemporary texts deploy combinations of written and oral language, and visual, audio, tactile, gestural and spatial representations as they communicate meanings on representational, social, structural, intertextual and ideological levels. Effective skills around such texts continue to be seen as requiring coding, semantic, pragmatic and critical competencies — reader resources first iterated by Freebody and Luke (1990), but since reflected in writings around multiliteracies pedagogies (Anstey & Bull, 2006; Healy, 2008; Healy & Honan, 2004; Unsworth, 2002) as well as in reiterations, in the form of the Four Resource Model, by the original authors (Freebody & Luke, 1999; 2003).

Different, but complementary, frameworks for implementing a multiliteracies pedagogy have emerged since 1996. A feature of the original New London Group (1996) iteration was a pedagogical model incorporating:

- situated practice which involves immersion and investigation of texts with students actively drawing on their reserves of knowledge and experience;
• overt instruction where students explicitly develop a metalanguage appropriate to the texts and ideas being investigated;
• critical framing where students are supported to interpret the social and cultural meanings a text conveys; and
• transformed practice where the students transfer, apply and build on their textual knowledge through creation of a new text.

These ideas permeate newer framings of a multiliteracies pedagogy. For example, Zammit and Downes’ (2002) curriculum framework for new learning supports students to locate, comprehend, use, critique and create using paper-based, electronic and live texts. Anstey and Bull’s (2006) pedagogical recommendations enable students to develop an empowered literacy identity that connects their lifeworlds with their school based worlds through the development of a repertoire of practices related to diverse texts, contexts and audiences.

The Venom Patrol digital resource reflects a multiliteracies pedagogy in two ways. Its multimodal design features allow for both in-depth learning of content and in-depth learning about ways the meaning can be communicated in electronic, web-based texts. Students can undertake sustained focus on the content and design of the resource, noting its non-linear structure, identifying and working with the semiotic modes it employs to convey meaning, and explicitly developing a metalanguage related both to the design features of the resource and its scientific content. Students can critique both functionality and content, as they locate relevant information, read, view, listen, write and relate new knowledge, and use and transform their newly developed understandings.

An important consideration in designing a web-based text such as The Venom Patrol is the teachers’ technological pedagogical content knowledge (TPCK). Building on Shulman’s (1987) seminal framing of teacher knowledge, Mishra and Koehler (2006) describe this technologically focussed content knowledge as:

the basis of good teaching with technology [that] requires an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students’ prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge and to develop new epistemologies or strengthen old ones. (p. 1029)

Yet, as Lang (2007) attests, the way in which multimedia learning is defined and taken up in classrooms depends very much on the relationship between the multimedia designers’ conceptions of learning and how this correlates with teachers’ theory and practice. In addition to a multiliteracies pedagogy, the development of the Venom Patrol resource has appropriated inquiry-based integrated pedagogies.

Inquiry-based Pedagogy

The resource’s focus on questioning resonates with inquiry-based pedagogy. Using inquiry methods in teaching is often attributed to John Dewey’s (1916) initiation of the progressive movement and his reform of the education system. But inquiry practices predate Socrates and his method of leading students to self-knowledge through questioning. In current curriculum frameworks, inquiry learning has a highly visible presence and likewise in the draft version for the national Australian Science Curriculum reference is made to ‘Science inquiry skills (incorporating skills and understanding of science as a way of knowing and doing)’ (ACARA, 2010, p. 1). In accordance with The Venom Patrol’s emphasis on inquiry learning, questions are
constantly posed that invite students to recall and imagine, classify and generalize, to compare and evaluate, to analyse and synthesise and also to deduce and infer – skills fundamental to inquiry learning. Students are encouraged to predict their answers to questions before checking the responses. For example, students are asked, *What is the name of this animal? Is it venomous or non-venomous? What venom rating would you give it? Where would you find this animal?* They are then invited to explore further by following links or viewing a video clip to access more information. In the spirit of inquiry learning, there is also the opportunity for students to direct questions they have to the AVRU scientists for their responses on webinars. There are a number of contemporary models or approaches that identify different stages as a way of guiding students through an inquiry (see for example, Department of Education, Employment and Workplace Relations - DEEWR, 2010; Wilson & Wing Jan, 2009). These stages are not necessarily linear, but provide some structure and suggestion of a logical sequence of learning experiences. *The Venom Patrol’s* inquiry-based planner has adapted the Primary Connections 5E inquiry model of engage, explore, explain, elaborate and evaluate adopted by the Australian Academy of Science (DEEWR, 2010) – a model that has gained widespread curriculum and systems endorsement in Australia and the USA. A sixth E: “enact” is added to the planner to provide opportunities for students to take appropriate personal and/or social action, thereby further cultivating students’ voice and sense of agency. In Australian schools inquiry-based pedagogy is often associated with an integrated approach to learning where connections are made across the disciplinary divides.

While some teachers will prefer to determine their own approach to using the digital resource with their classes, an inquiry-based planner with an integrated learning focus is provided in the ‘For Teachers’ menu. This resource offers ideas for investigating the Habitats, the behaviour of venomous animals and people’s safety around them. The planner’s structure is sufficiently flexible to be adapted to suit the specific needs and interests of individual classes and an additional blank proforma enables teachers to scope their own integrated unit, if they wish to do so.

### An Integrated Approach

There are many approaches to crossing the disciplinary divides that are often grouped under the umbrella term ‘curriculum integration’. As Colin Marsh (2007) claims, there are different rationales for schools adopting an integrated curriculum, and so too there are different ways of approaching an integrated curriculum design (e.g. see Wallace, Sheffield, Rennie & Venville 2007). Not surprisingly there is a ‘bewildering range of terms’ (Dowden, 2007, p. 55) that refer to integrated approaches, including *multidisciplinary, interdisciplinary, transdisciplinary, cross-disciplinary and integrated curriculum* — terms often used interchangeably, albeit inappropriately (Godinho & Shrimpton, 2008). Sometimes approaches are referred to as being on a continuum that ranges from subject-based teaching to integration of all subjects in the school program (e.g. Jacobs, 1989). But a continuum assumes the superiority of some approaches, rather than recognizing the significance of the rationale in determining which approach is taken.

The guiding principles for the Australian Curriculum, which will in effect define the scope and content of curriculum for all states and territories, purport to support a cross-disciplinary approach. In defining the deep knowledge and skills students need to develop, the National Curriculum Board (replaced by Australian Curriculum and Reporting Authority- ACARA) states:

- Rather than being self-contained or fixed, disciplines are interconnected, dynamic and growing, and a discipline based curriculum allows for
cross-disciplinary learning that broadens and enriches each student’s learning. (National Curriculum Board, 2009a, p. 11)

Alan Reid, at the biennial conference of the Australian Curriculum Studies Association, described this approach as ‘enhancing the learning of students within a discipline’ rather than ‘exploring problems and issues by using the knowledge and skills across a range of disciplines’ (2009, p. 17). Terms and definitions are highly contested and Reid claims this cross-disciplinary approach is a somewhat emaciated version of integrated curriculum.

In determining how the resource was theoretically positioned, we were mindful of Howard Gardner’s (1999) statement that interdisciplinary work cannot be undertaken until students are conversant with the epistemological and the methodological contributions of at least two disciplines. This is essential as interdisciplinary work involves a ‘dynamic synergy of different disciplinary perspectives’ (Nikitina, 2002, p. 8). The approach adopted by The Venom Patrol resource connects with transdisciplinary curriculum (International Baccalaureate Organisation, 2007) and the integrated learning model used in many Victorian primary schools (e.g. Pigdon & Woolley, 1992; Murdoch & Hornsby, 1997; Wilson & Wing Jan, 2003). Here, content is drawn from a host discipline, with content from other disciplines added, if relevant, to the concepts and big ideas that underpin the planning.

In a transdisciplinary/integrated learning approach, the fluidity of the curricular frameworks and the interrelatedness of learning areas are emphasised but without oversimplifying complex ideas and thinking (Boix Mansilla & Gardner, 2008). By contrast, a multidisciplinary approach brings together different subjects or learning areas under one umbrella topic but without the deeper connectedness to a conceptual framework (Erickson, 2002). The rationale for adopting our approach is the intent to enhance students’ learning of scientific knowledge and skills but while doing so to make authentic curriculum connections to Geography and use English, ICT and Mathematics to process information. While acknowledgement is made that disciplines are constructed through purpose built discourses, technical vocabulary, and spoken and written genres (Luke, Weir, & Woods, 2008; McKeon, Owen & McKeon, 2001), it was not the intent per se of this digital resource to achieve a dynamic synergy of different disciplinary perspectives.

Curriculum integration has been widely promoted as a middle school reform strategy (Beane, 1997; 2006; Wallace, Venville & Rennie, 2005). It is viewed by many educational theorists as a means for making learning more relevant, engaging and cohesive, and for providing opportunities to cultivate student voice and civic engagement (Apple & Beane, 2007). Langer’s large scale study (2001) in the USA found that schools which were performing more strongly than demographically predicted on reading and writing in English implemented an integrated pedagogy. In these schools, although teaching and learning focused on curriculum content they also made connections between knowledge and skills across multiple curriculum areas instead of treating each domain of knowledge and skill as discrete. This corresponds with integrated learning approach used within The Venom Patrol digital resource.

Australian states and territories have embraced curriculum integration approaches in their frameworks. This is most notably evidenced in the New Basics Project (Department of Education and Training, Queensland, 2004), identified by Bill Green (2003) as one of the greatest innovations in Australia’s history of curriculum design. New Basics has impacted curriculum documentation Australia-wide, for example Tasmania’s Essential Learnings (Department of Education, Tasmania 2002, 2006) and the Victorian Educational Learning Standards (Victorian Curriculum Assessment
Authority, 2005). Likewise, the International Baccalaureate (IB) endorses an inquiry-based, transdisciplinary approach to curriculum design for the Primary Years Program (children aged 3–12) and the Middle Years Program (students aged 11–16). In keeping with the IB curriculum planner and some current curriculum integration planners (e.g. Churchill et al. 2011), The Venom Patrol inquiry-based planner embraces an understanding by design (UbD) approach to learning.

Understanding by Design (Wiggins & McTighe, 2005)

The resource’s inquiry-based planner works the tension of knowing and understanding that Wiggins and McTighe (2005) pose in their Understanding by Design (UbD) model. Connections are established with the Science (National Curriculum Board, 2009c) and English (National Curriculum Board, 2009d) age-related aims for the discipline strands; also the big ideas and conceptual understandings that underpin the planning. In addition, the knowledge it is intended that students will acquire and the capabilities that they will demonstrate are explicitly stated. The assessment performances are articulated, prior to outlining the inquiry-based sequence of learning experiences. This approach is referred to by Wiggins and McTighe as backward design. In the non-linear way a website operates this is not always observable but the design of the resource overlays pedagogy, curriculum and assessment; viewing these as interconnected with the learner placed at the centre of the design process.

The inquiry-based planner emphasizes the need for formative and summative assessment of students’ learning (Black et al. 2004). Formative assessment mechanisms include tasks that emphasise reflection and re-iteration of new knowledge and reinforcement of a specialized scientific metalanguage related to venomous animals and venom research. Students undertake formative tasks in the form of quizzes and word challenges that they complete while exploring different sections of the website. Summative assessment takes the form of performances of
understanding designed to reveal whether they can apply the knowledge they have constructed in novel situations (Boix Mansilla & Gardner, 2008). For example, students prepare a role play response to a specific scenario involving some kind of venom detective practices and resolutions. Using the clues in the scenarios, students access the website to: identify the venomous animal; note the symptoms associated with this attack; determine the first aid procedures that need to be enacted; reflect on what safety procedures might have prevented this encounter with the venomous animal. The assessment also accords with research in cognitive science that provides evidence of the value of students incorporating newly acquired knowledge into their existing frameworks or schemas and then applying this in new contexts (e.g. Greeno, Collins, & Resnick, 1996).

With the completion of *The Venom Patrol* website and its availability to schools Australia-wide (through Educational Services, formerly the Curriculum Corporation), there is an immediate need to investigate the implementation of the resource in middle years classrooms to determine the extent to which the underpinning pedagogical and curriculum theories support classroom practice. In this final section of the paper, a research plan probing teachers’ and students’ use and evaluation of the resource is detailed.

The Research
As a vehicle for researching the implementation of the digital resource in schools, a pilot study in four schools is underway. The aims of this study, a precursor to a large-scale project, are:

- to gain insights into the impact on students’ learning and engagement with *The Venom Patrol* website as a digital pedagogy;
- to seek teacher responses to the inquiry-based pedagogy of *The Venom Patrol* website; and
- to determine the effectiveness of the teacher resources.

Specifically, this initial research explores teacher and student responses to *The Venom Patrol* website at two primary schools (Years 5-6) and two secondary schools (Years 7-8). Two independent schools and two government schools are involved as research sites, and two teachers in each school are using the website and the inquiry-based curriculum unit with their classes. Students from these eight classes (N=200) and their teachers (N=8) will be invited to complete an online survey after having used the resource. A purposive sample of these students (N = 50) will be selected by their teachers to participate in focus group interviews. The teachers will be invited to participate in individual interviews after trialling the unit.

In investigating teachers’ and students’ perspectives on the functionality of this multimodal learning resource and the effectiveness of the cross-disciplinary inquiry-based unit that accompanies it, a qualitative case study approach (Merriam, 2009; Stake, 2005; Yin, 2009), with some quantification of data, is being implemented. This strategy, using a range of qualitative methods, allows a focus on interpretation in context, and the construction of a holistic description of teacher and student perceptions of the digital learning resource. Questions that are guiding the research are:

- Do the teachers find the pedagogies of the website functional and appropriate for their teaching purposes and strategies?
- Do the students find this to be an engaging digital resource that supports their learning?
- Does the curriculum unit support teachers in framing the students’ learning experiences?
The data collection involves five methods: **an online survey** to generate quantifiable data about the effectiveness of the resource as a teaching and learning tool; **interviews** with teachers who are trialling the resource; **a skype discussion forum** for teachers across the two primary and two secondary schools to share their experiences; **student focus groups** to explore student perceptions and responsiveness to the website resources; and **observations** of classes at key points of the unit’s implementation — preferably at the engagement stage of the inquiry when pre-assessment occurs and at the evaluation stage when summative assessment is undertaken. The online survey entails quantitative analysis of data, and the qualitative methods involve the coding of data to identify to emergent themes (Miles & Huberman, 1994; Richards, 2005; Silverman, 2006).

**Conclusion**

Advances in computer-based technologies have stimulated an expansion of thinking about conceptions of learning and of being multiliterate (Anstey & Bull, 2006; Cope & Kalantzis, 2009; New London Group, 1996). This interface between ICT, literacies and learning has been posited as vital to the redesign of middle years learning environments to more effectively engage and support adolescent learning (Culican et al., 2001; Luke et al., 2003). While Lelouche (1998) saw as inevitable the erosion of the traditional teacher-centred classroom due to the incorporation of ICTs in education, more recently attention has been drawn to the insufficient extent to which “the new media are being used to promote discernible changes in the mainstream schooling experience” (Kalantzis & Cope, 2008, p. 9). This situation risks being compounded by an increasingly test-focused school system in Australia, which has been critiqued as potentially resulting in a narrowing of curricula and pedagogies (Mills, 2008), denying students – especially those in low socio-economic status communities – the sorts of outcomes now deemed necessary for a globalised knowledge economy (Lingard, 2010, p. 131).

There is, consequently, an urgent need for the production of quality digital learning resources and accompanying integrated curriculum approaches that can facilitate deep levels of student learning, enhance cognisant, critical and creative engagement with diverse texts and deepen multimodal textual competencies. A digital tool like *The Venom Patrol* website, developed by those with expertise in its specific scientific content and its pedagogical applications, is therefore timely. Yet, its use in schools needs to be rigorously monitored and comprehensively documented, and the pilot study to which this paper functions as a theorised and conceptualised forerunner, addresses the paucity of research into the classroom implementation of inquiry-based, digital learning. As such, this project seeks to illuminate understandings of best practice around digital pedagogies that are *making a difference* to student engagement and learning.

**References**


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