

the more than half century since Maria Montessori's death. Tools that could be particularly helpful are the Big History Project and ChronoZoom; while developed with high school students in mind, they can be a rich resource for Montessori elementary teachers and their students. However, the Big History movement can also learn a lot from the more than century-old experience of Montessori pedagogy related to teaching elementary aged children the story of the universe and our place within it. Big History and Cosmic Education share the vision that we humans are truly 'Children of the Universe'.

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## Big History and the Secondary Classroom: A Twenty-First Century Approach to Interdisciplinarity?

Tracy Sullivan

### Abstract

*Big History poses big questions addressing big issues like 'How did we get here? Where are we going?' and it encourages exploration of deep philosophical questions about the meaning of life and the nature of the cosmos. Answering these questions pushes teachers and students to move beyond the confines of traditional disciplinary boundaries to examine the interconnections between knowledge, ideas, and phenomena. Does this make Big History interdisciplinary? Does Big History move beyond the interconnection of disciplinary knowledge to transcend these boundaries? Harnessing the experiences of Australian secondary Big History teachers, this paper explores the practical nature and definition(s) of the twenty-first century curriculum, learners, and interdisciplinarity in the secondary context. Through the lens of a pedagogical vehicle to equip future generations with the skills they need to live responsibly and effectively in an interconnected global community.*

**Keywords:** interdisciplinarity, curriculum, pedagogy, secondary.

There are two ways to live your life. One is as though nothing is a miracle. The other is as though everything is a miracle.

Albert Einstein

As both a high school teacher and a life-long learner, prior to engaging with Big History I did not much think about the Universe, my surroundings, or my place in them. I took my connection to our Universe for granted, as I am sure is the case for many people and students. As I learned more about Big History, I became increasingly aware of this vast expanse we inhabit, seeing wondrous things about me everywhere I looked. The mundane had become amazing and exciting. But beyond what I could see, at the level where I believe the transformative nature of Big History lives, was an approach to knowledge prioritising knowledge connection and exploration as an opportunity for learning and growth.

While Big History courses are growing in number at the tertiary level, the capacity of Big History to empower and engage secondary students is



great and much needed in a system traditionally dominated by disciplinary silos and a fragmented approach to knowledge dissemination.

This paper will explore the role of Big History as a model for interdisciplinary pedagogy at the secondary level, arguing for the powerful role of Big History as a vehicle for teaching students to make connections and understand the interconnected world in which they live. First, it identifies the characteristics that define twenty-first century learning at the secondary level. Second, it examines the 'spectrum' of disciplinary identifying where current integration attempts in the Australian context fall along this 'spectrum' and identifying what makes Big History different. Third, it will take preliminary reflections from the Australian secondary students currently studying Big History. It may sound trite and definitely cliché to say children are the future, but this is ultimately true and we need to prioritise examination and experimentation with curriculum models and structures that will best equip them to face this future. Big History as a learning opportunity for secondary students most definitely needs to be a part of that conversation.

#### What do Twenty-First Century Learners and a Twenty-First Century Curriculum Look like?

What is this 'twenty-first century learner' and what do they need and want in a valuable educational experience? 'Twenty-first century learner' is one of those ubiquitous phrases thrown around to describe students sitting in classrooms around the world. They are students for whom we are working hard to provide empowering educational experiences. Anne Shaw (2009: 14) has identified the following framework, defining the key characteristics of these learners:

- they are pragmatic;
- they want to know how what they are learning relates to them and their lives;
- they want to know how will what they learn be of use to them as they navigate their practical day-to-day lives;
- the majority do not appreciate the process of learning for learning's sake;
- they are curious;
- they want to understand things and solve problems;
- they understand that knowledge is limitless and they want to know more, a critical characteristic of life-long learners;
- they are flexible, willing to follow their curiosity and be taken on a journey of discovery regardless of the 'rules' or perceived 'boundaries' of disciplinary knowledge, to make connections enacting their individuality and personal curiosities in the process;

- they are resourceful, understanding there is no one path to a destination, and keen to meet challenges, exploring options and possibilities as they are confronted.

From this arises the question of what characteristics a curriculum needs to embody to meet the needs of these learners and engage them in the learning process. Anne Shaw (2009: 13) has outlined six key characteristics of this type of curriculum (all of which are embedded in Big History through its themes and in its delivery). Primarily it is interdisciplinary (a more detailed discussion of interdisciplinarity will follow), providing enough flexibility for students to follow their curiosity and enact their resourcefulness. Big History aligns to these criteria via the posing of big picture questions requiring the connection of knowledge across disciplines as diverse as physics, chemistry, economics, archaeology, and anthropology. It is project-based, enacted as a pedagogical tool in Big History through the 'Little Big History' project. It is research driven, not only through student-based research as a vehicle for learning but at a curriculum assessment and measurement level. This is an area yet to be full developed in the field of Big History, but one with a huge growth potential as the popularity of Big History courses continues to expand at both the tertiary and secondary levels. It is community-connected: using the themes of increasing complexity and scale Big History helps students to see that community connection is enacted at the local, national, global, and universal levels. A twenty-first century curriculum requires students to engage multiple literacies, they need to be able to read across disciplinary-based literary conventions and make connections. An example in Big History would be reading across star charts, maps, the periodic table, narrative text, and film, to form hypotheses and answer large-scale questions. Finally, this curriculum embraces technology and multi-media as a tool for delivery and student engagement. The Big History Project course is a unique and valuable example of how this can be done effectively for the students' benefit.

Of the outlined six key characteristics of a twenty-first century curriculum it is no coincidence that interdisciplinarity is first and given a primary focus. Without a structure flexible enough to allow for students to read across disciplines and make connections, the requirements that follow cannot operate in a meaningful way. However, like the phrase 'twenty-first century learner' the word 'interdisciplinary' is often used without a clear understanding of what it actually means and how this looks in a curriculum model. This understanding is crucial if any model developed is to be effective.

#### What is 'Interdisciplinarity' and What does it Look like?

Terms related to the relationship between disciplines are commonly used in education circles, but what is less common is a clear definition



of what these terms mean: multi-disciplinary, interdisciplinary, trans-disciplinary *etc.* (Bahr, Bahr, and Keogh 2005: 3). Is this a question of semantics? Are these terms interchangeable? These terms definitely have their own unique meanings and to have a clear understanding of this is essential when undertaking curriculum development as a tool for enhancing student engagement and improving learning outcomes. Godinho and Shrimpton (2008: 3–12) have put forward the following basic definitions:

- **Disciplinary silo:** A branch of knowledge or teaching with a distinct set of rules or methods guiding its practise;
- **Multi-disciplinary:** Examination of a problem or question through a specific discipline focus, with content from other disciplines added;
- **Interdisciplinarity:** Integration of knowledge to solve problems or answer questions that cannot be adequately addressed by one discipline alone;
- **Transdisciplinarity:** Transcending discipline boundaries, juxtaposing disciplinary perspectives, and interrelatedness of disciplines.

These categories may be interpreted as forming a hierarchy (Limerick and Thomas 1990: 3) of levels that one must successfully achieve before 'moving-up' to the next. I would rather view these categories as sitting along a spectrum allowing the flexibility for curriculum models to sit between categorisations (see Fig. 1). I would argue that historically 'traditional' curriculum models at a secondary level have been positioned strongly at the level of the disciplinary silo.

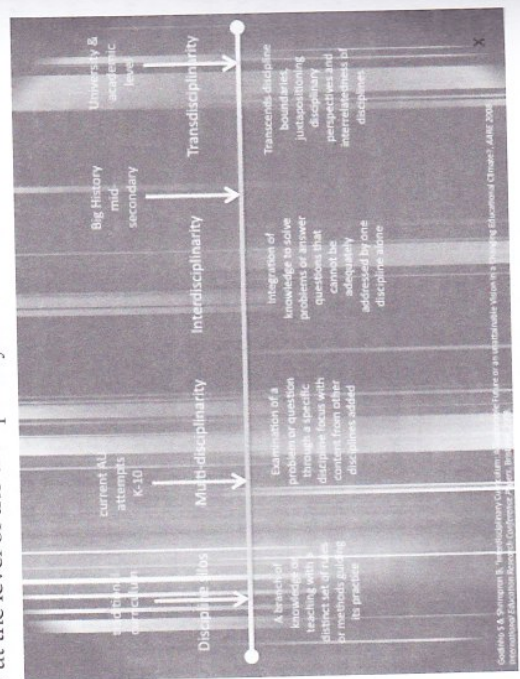


Fig. 1. Categories spectrum

In recent years in the Australian secondary educational landscape there have been large-scale attempts to embrace an interdisciplinary curriculum model, including developing:

- **Key Learning Areas** (Marsh and Harris 2005: 5): The grouping of disciplines is perceived to be complementary but the realities of school-based delivery are predominantly executed as discrete disciplines, for example Human Sciences and Environment (History, Geography, Commerce, and Legal Studies *etc.* [Board of Studies NSW 2008]); Technology at School (Computing, Industrial Arts, and Child Studies *etc.*); Studies of Sciences and the Environment (Collins 2009: 5) (an integration of History, Geography, and Social Studies *etc.*).

- **Cross-Curriculum Priorities and General Capabilities:** A key feature of the recent move to a nation-wide Australian Curriculum (Australian Curriculum and Reporting Authority 2011). Worthwhile and intended to be integrated into the delivery of all subjects. However, in light of time constraints and the reality of the day-to-day classroom environment may be viewed as having partially political underpinnings and essentially unrealistic considering prevailing resourcing and time issues.

- **'Interdisciplinary' electives:** Offerings such as Environmental Studies, Humanities, and International Studies. These offerings stretch disciplinary boundaries to incorporate other content or sub-divide the broader discipline to incorporate knowledge from across these sub-divisions. These electives often do not necessarily use content and knowledge from other disciplines to answer broader big picture questions in a holistic way.

- **Inquiry-based curriculum models** (Board of Studies NSW 2003): In Australia, the examples of this type of framing include disciplinary-based questioning such as, in History: 'How did new ideas and technological innovations develop to contribute to the change during the period from 1750 to 1918?' or in Science investigate: 'How did the theory of plate tectonics develop, based on evidence of sea-floor spreading and occurrence of earthquakes and volcanic activity?' These are two very isolated content examples within much broader and complex curriculum documents, but it is the nature not the content of the questions that is the focus of this examination. This type of framing does go beyond detailing simple content lists of information that students must 'know', and it does require the integration of disciplinary skills to address the inquiry. However, they fall short of posing a broader problem (Williams 1996: 2) through which to direct the inquiry or investigation and pull together or integrate the varied disciplinary knowledge. There is no big picture question to umbrella the inquiries in a larger interdisciplinary context.

Thus, I would argue that in Australia the current attempts at producing large-scale interdisciplinary curriculum models move beyond the tra-



ditional disciplinary-silo bound structure to a more multidisciplinary approach, examining questions and problems from a key disciplinary focus by bringing in the content from other disciplines, but do not qualify as being interdisciplinary (see Fig. 1).

So what makes Big History different? I would argue that there are four key characteristics that define Big History as interdisciplinary: scope, balance, relevance, and interrelatedness. The fundamental questions posed by Big History, as a contemporary scientific origin story – where did we come from? How did we get here and where are we going – are broad enough in scope, so it is impossible to answer them using the content or conventions of a single discipline (Christian 2011: 1–4). They are also expansive enough to engage the pragmatism, flexibility, and curiosity of the twenty-first century student. The key themes and the narrative of increasing complexity and thresholds provide a balance whereby the framework is flexible enough for students to follow their curiosities but tight enough for them to enact their resourcefulness without becoming lost. This balance also gives voice to their pragmatism as they constantly face problems and inquiries perceived as relevant to their lives and the world around them not for the process of inquiry itself. The nature of the fundamental questions posed in Big History means that at every stage of the course students are continually being reminded of the relevance of what they are learning to their lives and the world they live in. Big History is not an offering that jumps from discipline to discipline for the sake of trying to make a connection. It demonstrates how within the scope of big picture questions, knowledge is intuitively interrelated and these connections appear naturally, not as a kind of forced symmetry. These factors move Big History along the disciplinary spectrum past being multidisciplinary to interdisciplinary, ‘integrating knowledge to answer questions or solve problems that cannot be addressed by one discipline alone’ (Godinho and Shrimpton 2008: 3–12) (see Fig. 1).

I would, however, argue that at a secondary level Big History does not present as trans-disciplinary. This is not because of the inherent structure or content of Big History but because of the learning and conceptual capabilities of secondary students, especially at a pre-senior secondary school level. In terms of a spiralled approach to developing understanding (Bruner 1967: 29) a student needs to be aware of disciplinary boundaries before they can transcend them, thus this is a pedagogically based distinction. At tertiary level and beyond, the argument for Big History being defined as trans-disciplinary is valid and the one that, while not being in the context of this discussion, could be made (see Fig. 1).

### The ‘Big History Quilt’: A Powerful Example of Interconnection

This is a photograph of the ‘Big History quilt’ (Fig. 2) and an excerpt from the accompanying blog (Fig. 3). It is appropriate and necessary to discuss student learning, approaches to curriculum frameworks, and pedagogies from theoretical and large-scale perspectives. However, the most meaningful enactment of all this discussion and decision-making plays out in the experience of an individual student. This is one such example.



Fig. 2. Big History quilt

Source: Diniyoyo 2012a.

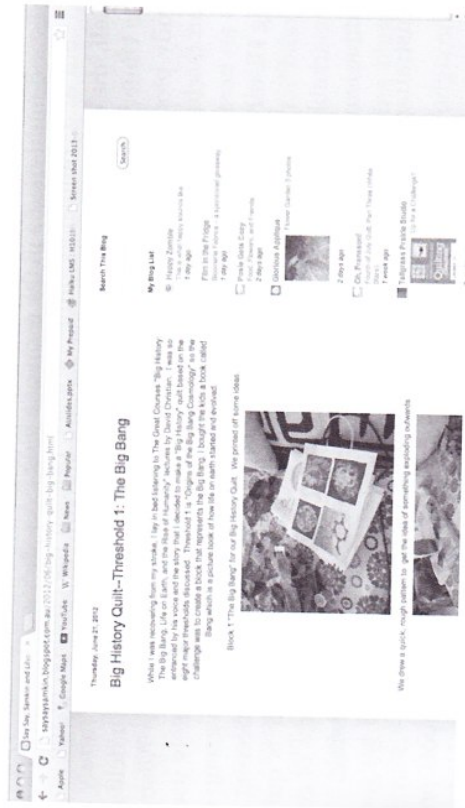


Fig. 3. Big History Quilt blog

Source: Diniyoyo 2012b.



This woman, an avid quilt maker recovering from a stroke, listened to Professor David Christian's Teaching Company lectures (Christian 2008) while recuperating. She was inspired to create this quilt based on the eight thresholds of increasing complexity. Introducing her children to the field of Big History she enrolled them in the process of designing and creating this magnificent quilt. She also recruited them in creating a blog to accompany the quilt-making process cataloguing its creation and their journey of Big History discovery.

I would like to focus on the children's experience. Here is an example of the power of Big History as a framework to develop meaningful learning experiences for students, meeting their needs and the characteristics of a twenty-first century curriculum. Through this endeavour these children/students have engaged with the Big History narrative and themes to think critically about which images and patches are most appropriate to represent the eight thresholds of increasing complexity. They have developed an in-depth and meaningful understanding of the concept of increasing complexity including goldilocks conditions and emergent properties in the process of selection and creation of the patches. They have engaged in using multiple literacies, not only in creating and designing the quilt (calculating dimensions, sourcing information for varied texts and the quilting process itself), but have produced a narrative for a specific audience and purpose, harnessing digital technologies and multi-media in the form of a blog.

But at a completely different level, beyond the creation of the quilt itself, the connective power of Big History is demonstrated. A family in the United States created a quilt and blogged about it; based on a field of study pioneered by a British-Australian academic, located by an Australian teacher surfing the internet for presentation images, ultimately used as an example of implied Big History pedagogy presented to a group of Big History experts and enthusiasts from around the globe at a meeting in Grand Rapids Michigan. That level of interconnection in itself is quite remarkable not to mention the powerful back-story of the process of collective learning that over millennia has made these processes possible.

#### Australian Big History Student Preliminary Reflections

Throughout 2012, as part of the Big History Project pilot schools program, two Australian schools trialled a secondary course in Big History for Year 9 students. Below is a selection of quotes from a group of mixed-ability Big History students. Each demonstrates a different aspect of the power of Big History as an interdisciplinary and pedagogically

empowering tool for developing critical thinking in high school students.

*I do enjoy Big History a lot. It lets me know what I am part of in the universe. But I feel there isn't enough evidence to be completely dependable. But I really love this course; it's amazing to learn about what's out there... Katarina*

By identifying that 'there is not enough evidence to be completely dependable' Katrina is actually making a judgement about the information that has been placed in front of her and has been empowered and given the flexibility to challenge the information presented.

*I love Big History because it gives answers and asks great questions, for us to optimise with. It isn't like here's this, deal with it. It gives us a choice and we can ask questions for those choices... Lachlan*

Lachlan is demonstrating the power of Big History to empower him as having the ability and encouragement to ask questions rather than feeling his role is as a receptacle to store static information and content.

*I love Big History as it teaches everything I want to know and tries to answer the questions I'm seeking. I find it so extremely interesting and it's the only subject I see a purpose in... Dana*

Dana is making a clear distinction between the enactments of Big History as interdisciplinary and combining her knowledge, in comparison to disciplinary-based subjects that do not necessarily speak to her pragmatism as a twenty-first century learner.

*I enjoy Big History as it gives me a better understanding of the world around us... Caitlin*

*Big History teaches and supports my view on history that not everyone understands. Every subject in Big History has interested me most of my life. Finally getting the answers to the questions I have kept bottled up makes me feel much better and confirms that I am part of something much bigger... Kayla*

Both Caitlin and Kayla are reflecting the sense of connection and belonging that comes with being able to place themselves in the bigger picture.

*I enjoy Big History because it gives me a sense of understanding. It brings together different opinions; beliefs and values, which together help me, understand that things change. The main thing that I enjoy about Big History is that it changes as new evidence is discovered changing what we understand... Elisha*



However, this quote from Elisha really encapsulates the power of Big History in developing students understanding through developing a meaningful relationship to how knowledge is built and constructed.

This paper began with a well-known quotation from Albert Einstein 'There are two ways to live your life. One is as though nothing is a miracle. The other is as though everything is a miracle'. To truly appreciate the 'miracles' that surround us in everyday life we must first be able to see them, but how? Like all things we need to be taught. Throughout the inaugural International Big History Association conference the words 'awe' and 'wonder' emanated in some form or another from lecture halls, classrooms, and over lunch and dinner conversations for days. These are not words that are often associated with student experiences of traditional curriculum models. But they can be. I believe the power of Big History lays in its ability to transform the way we see the universe, our place in it and our connection to all that surrounds us. I also believe in the transformative (Pugh *et al.* 2009: 3) power of Big History for a generation of school students in offering a pedagogical tool to meet their needs as learners. To teach them to appreciate and understand the interconnection of knowledge and empower them to ask important questions that cannot be answered by looking to one discipline alone. To teaching them how to make connections across the boundaries of perceived discipline-based knowledge to find meaningful answers to questions relevant to their experience of the world around them. It is through providing opportunities for learning of this type and scale that we can teach students of all types and ages, including myself, to live and view life as if everything is a 'miracle'. That is a truly empowered learner.

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