

The Technological Enframing of Mathematics Education

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In this paper I seek to critique pervasive notions of what counts in mathematics education using Heidegger's notion of the technological enframing. I suggest that early childhood and schooling have become technologies in themselves, casting students and teachers as part of the standing reserve within the inexorable drive for economic advancement. I seek to problematise notions such as evidence-based practice and school improvement by analysing the text in a current state numeracy policy. I then outline an alternative that I term "coming into the world of mathematics" to provoke new insights into the purposes for mathematics in early childhood and school settings.

Contemporary educational policy talks extensively about issues such as school improvement (Masters, 2010), teacher capacity building (Ingvarson, Beavis, Bishop, Peck, & Elsworth, 2004) and diagnostic nets (Department of Education and Training, 2011) all framed within a language of accountability and achievement standards (Australian Institute for Teaching and School Leadership, 2012). The discourse of standards and accountability permeates educational debate to the extent that alternative discourses such as creativity, risk and the notion of being an educated being are silenced, or at best marginalised. In Biesta's (2010) terms the language of learnification has usurped the educational endeavour.

In this paper I look at the specific case of school mathematics, and argue that the lens of efficiency and effectiveness has caused us to lose sight of what it is to engage with mathematics as a cultural, human pursuit. I argue that agendas such as school numeracy plans, achievement targets and numeracy intervention programs are deeply rooted in a way of looking at the world that resonates with German philosopher Martin Heidegger's notion of the technological enframing (Heidegger, 1977). I suggest that the means-end rationality of the technological enframing dehumanises students by reducing them to statistics to be aggregated for the purposes of evaluating the performance of a school or system, and positions teachers as technicians whose role is to enact externally determined performance-enhancing strategies. I argue that this is in direct competition to the goals of the *Early Years Learning Framework* (Australian Government Department of Education, 2009) and to those in the rationale of the *Australian Curriculum: Mathematics* (Australian Curriculum and Assessment Reporting Authority, 2013).

This is an essentially philosophical paper, illustrated by discussion of a State education system numeracy and literacy policy paper. I commence with a brief, and admittedly inadequate and selective discussion of Heidegger's concept of technological enframing (Heidegger, 1977). In doing so I do not subscribe to the entirety of Heidegger's philosophy; rather I employ the terms and concepts involved in his view of the enframing to shed light on current educational policy. I then review the strategic markers in the South Australian Department of Education and Child Development *Numeracy and Literacy Strategy B to 18* (Department for Education and Child Development, 2013) to show the extent to which the enframing has permeated current policy. I do not argue that agendas such as school improvement, intervention or evidence-based practice have no value, however I do argue that they are currently located within an invisible technological and dehumanising agenda. 2014. In J. Anderson, M. Cavanagh & A. Prescott (Eds.). *Curriculum in focus: Research guided practice (Proceedings of the 37th annual conference of the Mathematics Education Research Group of Australasia)* pp. 613–620. Sydney: MERGA.

Finally I argue for an alternative, more humanising agenda based on students coming into presence with the world and with the discipline of mathematics.

Heidegger's Technological Enframing

While one might wish that all political and educational debate be idealistic and visionary, the reality is that it forms part of the wider fabric of societal expectations that have arisen in a time of economic rationalism. Much current educational policy is thus deeply rooted in a technological approach to life that Heidegger (1977) terms *Gestell*, or the enframing. Here Heidegger does not talk of technology as a tool or set of tools, but rather as a way of seeing the world that has, at its heart, a means-end instrumentality. His argument is that our whole way of thinking has become technological, colonising the world with an associated focus on issues such as accountability, standards, improvement and managerialism.

Technology treats everything with "objectivity". The modern technologist is regularly expected, and expects himself, to be able to impose order on all data, to "process" every sort of entity, nonhuman and human alike, and to devise solutions for every kind of problem. He is forever getting things under control (Lovitt, in Heidegger, 1977, p. xxvii).

Heidegger introduces two important terms in his discussion of the enframing. One is *Dasein*, which has no direct translation into English. Roughly speaking *Dasein* is "an openness for Being", or "the Being for whom being is the question". So it is simultaneously singular, plural and conceptual, representing a particular individual reciprocally related to society as a whole immersed in the question of being itself. In the current educational climate Heidegger may claim that the focus on capacities and achievements that are located within the technological enframing dehumanise the individual and limit the capacity of *Dasein* to fully express itself in relation to the world.

The second important term Heidegger introduces is *Bestand*, or loosely translated standing reserve. As standing reserve individuals are relegated to a potential pool of energy to be called on as and when needed.

...things are not even regarded as objects, because their only important quality has become their readiness for use. Today all things are being swept together into a vast network in which their only meaning lies in their being available to serve some end that will itself also be directed toward getting everything under control (Lovitt, in Heidegger, 1977, p. xxix).

In the case of education, particularly of science and mathematics education, the end in question is one of the nation becoming more economically competitive. In the words of former Prime Minister Julia Gillard, it is one of "winning the education race" (Tovey & McNeilage, 2012), itself a depersonalising metaphor for education (Thornton, 2013). In this race the results of individuals are aggregated to give a picture of the performance of the school, system or nation, and policies are put in place to attempt to improve performance. Students are thus rendered as part of *Bestand*, important primarily because of their potential in the immediate goal of improving performance and the longer-term goal of enhancing economic competitiveness.

The enframing identified by Heidegger is so pervasive that it has become largely invisible as a taken-for-granted way of seeing the world. Indeed, it is this invisibility that gives it its power in shaping the world, and that results in humanity becoming increasingly estranged from itself. "But we are delivered over to it in the worst possible way when we regard it as something neutral; for this conception of it, to which today we particularly like

to do homage, makes us utterly blind to the essence of technology” (Heidegger, 1977, p. 4). Commentators have argued that the enframing manifests itself in virtually all areas of schooling, from the governance of childhood through the school improvement agenda, to teacher education and educational research (Flint & Peim, 2012). In particular I argue that technological enframing permeates the language of official policy documents to the exclusion of any other possible discourses of educational purpose. “At a policy level, educational achievement has been redefined as ‘effectiveness’ within the terms of competitive market systems and official versions of ‘school improvement’ have served to occlude the spread of alternative visions” (Wrigley, Lingard & Thomson, 2012).

To illustrate the argument I examine the language located in the *SA DECD Numeracy and Literacy Strategy Birth to 18* (Department for Education and Child Development, 2013) to reveal the extent to which the technological enframing is embedded in government numeracy policy. I must emphasise that there is much of merit in the Strategy and that rather than wishing to negatively critique the SA DECD document per se I see it as representative of similar documents that exist in every state, and indeed, most Western countries. Thus I am using the SA DECD Strategy purely as a vehicle for problematising pervasive notions of numeracy teaching and learning in early childhood and school and for highlighting how, in the current educational debate, documents such as this are strongly located within a pervasive view of the nature and purpose of early childhood and school education¹.

The SA DECD B to 18 Numeracy and Literacy Strategy (the Strategy)

The Strategy, sub-titled *Great Start, Strong Foundations, Powerful Learners* (Department for Education and Child Development, 2013) was launched in April 2013. It establishes a five year window of goals “to ensure that all young people leave school able to understand and use mathematics in their everyday lives and in further learning” and “to prepare all young people for the future by enabling them to become confident and powerful learners, who use numeracy and literacy successfully in every aspect of their lives”. This is seen as necessary “[f]or our State to thrive in a rapidly changing global economy” (p. 7).

Justifications for the Strategy include that “nearly a quarter of young children in this State are developmentally vulnerable at the time of school entry [which has] a direct influence on their numeracy and literacy development” (p. 11), that “there is a group of students who do not achieve the National Minimum Standard” in NAPLAN, and that all national and international assessments point to the need for young people to develop “greater capability to solve problems” (p. 11).

The Strategy then details the three central challenges (p. 13):

Challenge 1: A great start

To ensure all children are given the support they need to develop their language and learning skills so that the gap in numeracy and literacy growth between young children is narrowed and that all children start school with age-appropriate numeracy and literacy awareness and skills.

¹ In order to maintain ethical standards I have sent a copy of this paper to the Director of Numeracy and Literacy in SA DECD.

Challenge 2: Strong foundations

To increase the number of children who attain foundational numeracy and literacy skills in their first four years of school, and ensure these strong foundations are consolidated and built upon throughout their years of schooling.

Challenge 3: Powerful learners

To build the learning power of all children and students by increasing their ability to use high-level thinking skills and apply what they have learned in new and increasingly complex situations.

The Strategy unpacks each of these challenges with specific recommendations for action that will be evaluated “to ensure that actions being undertaken through the strategy...are resulting in improved educational experiences and outcomes for our children and young people” (p. 7).

In the next section of the paper I show the extent to which the language of the Strategy is framed within a depersonalising agenda of measurement, improvement, accountability and standards. It is important to emphasise here that I am not opposed to the desire to establish high education standards, nor to the collection and use of evidence to promote improvement. Indeed, like commentators such as Biesta (2010), I would argue that the productive and balanced use of measures of achievement is an important element of a coherent approach to numeracy, providing these have been established following democratic discourse on the educative purposes they are aiming to support. However I suggest that in an education located within Heidegger’s technological enframing (Heidegger, 1977), everything becomes subservient to one agenda: that of improving the achievement of the system on measurable scales.

Discussion of the Numeracy and Literacy Strategy

Challenge 1: A Great Start

The first challenge in the Strategy, *a Great Start* is explicitly about starting school with “age-appropriate” numeracy and literacy awareness and skills and “narrowing the gap in numeracy and literacy growth” (Department for Education and Child Development, 2013, p. 13). Thus for mathematics the early years of childhood are recast as preparation (a *start*) for the more important agenda of learning mathematical knowledge and skills that will dovetail into and support the school curriculum. This purpose is in stark contrast to that articulated in the *Early Years Learning Framework*, which views the early years of learning as “a time to seek and make meaning of the world” (Australian Government Department of Education, 2009, p. 7) and children’s lives as a process of “being”, “becoming” and “belonging”. Rather than seeing activities such as play as a means to developing literacy and numeracy skills, play is valued as an activity in itself through which children make sense of the world, and actively participate in shaping their lives.

Challenge 2: Strong Foundations

Like the recasting of the early years of childhood as establishing a *Great Start*, the primary years of schooling are cast as a *Foundation*, suggesting that the real business of learning happens later. Again, I argue that goals for primary schooling that are associated with being a child and learning about self and the world become subservient to the numeracy and literacy achievement agenda driving the Strategy. However it is in this

challenge that the means-end rationality of the technological enframing becomes most apparent.

Within the Strong Foundations challenge, the Strategy lists a number of ways in which teachers, educators and leaders will be supported, together with associated benchmarks for achievement. Teachers will be supported to “plan for numeracy and literacy *improvement*” by “*monitoring* students achievement...to determine progress”, which then helps to “identify and determine effective *intervention* strategies” (Department for Education and Child Development, 2013, p. 25, italics added). This language is firmly rooted within the means-end rationality of Heidegger’s technological enframing (Heidegger, 1977). The term *improvement* is derived from a managerial agenda and implicitly assumes both a deficit model and a technology for measuring what counts as improvement. The terms *monitoring* and *intervention* imply a technology of control, particularly in the absence of any alternative humanising terms that hint at flexibility or creativity. Of course, these terms are common throughout much current educational policy and strategies that use such terms form much of the current agenda. My concern is that they are largely unexamined in the discourse. Alternative voices are silenced by the seductiveness of the terms used: after all who could argue that we should promote improvement or that we should continually seek to see how well students are achieving desired numeracy goals and to take action when necessary? However the use of such language silences alternative goals of coming to be in relationship with the world or of coming to understand mathematics as a cultural and historical pursuit.

In order to ensure a *strong foundation* the Strategy adopts a *benchmarking* agenda, again emphasising control in the technological enframing. It includes each “preschool and school developing annual numeracy and literacy *targets*”, “implementing *progress indicators*”, “implementing a ‘*one plan*’ approach”, “regularly assess[ing] and report[ing] on progress against year-level *standards*”, “using annual norm-referenced tests and other *benchmarks*” and “using *audit* processes” (Department for Education and Child Development, 2013, p. 25, italics added). Again who could dispute the value of targets, progress indicators, plans, standards, benchmarks or audits? However each of these terms highlights a managerial education agenda, realised by a planned, technical approach. Yet teaching is not a technology, and teaching and learning are not controllable activities with linear, goal directed and incremental processes. Both the processes and outcomes of teaching and learning are characterised by unpredictability and uncertainty: teaching can and does prompt learning but it cannot control pre-determined outcomes (Askew, 2012).

Challenge 3: Powerful Learners

I certainly commend the Strategy in attempting to describe the characteristics of students who can use numeracy and literacy creatively to solve important problems. This section of the Strategy is much less focused on the use of the managerial language of improvement, standards or accountability to describe students who are conceived as powerful learners. However I argue that the very notion of being “powerful” is problematic within the technological enframing that is obsessed with control. Arguably the language of control has so permeated our collective consciousness that we are unable to conceive of alternative terms. Furthermore in a world where many, including many of the students in our schools, are disenfranchised through various forms of disadvantage, equating success in education with power has the potential to alienate and exacerbate feelings of powerlessness. Of course, the Strategy does not suggest that only some learners can

become powerful; indeed it is explicit in saying that all students should become “powerful learners”. What does concern me is that the use of the term powerful, particularly in conjunction with mathematics, privileges those who are already successful and “may be unwittingly reinforcing social orders we wish to change...Trying to change the game may be much more ‘empowering’ than trying to make everybody join in and play it well” (Sfard, 2012, p. 8).

An Alternative: Coming into the World of Mathematics

I have argued that within the technological enframing of the Strategy, children are positioned as powerless participants in a world of progress indicators and achievement against norm-referenced tests that provide measures of the extent to which children meet age or year level norms. As such children become part of the standing reserve, valued primarily by the extent to which their achievement on standardised tests contributes to a school or system measure. Those who are “behind their year or age level” (Department for Education and Child Development, 2013, p. 25) require intervention to enable schools or systems to reach targets by increasing the proportion of students reaching minimum standards. The implicit goal is to minimise diversity by bringing all to an acceptable level. Yet children are diverse; each brings her unique knowledge and experience and will respond to educational environments in a unique way. I suggest that this diversity is to be valued, encouraged and fostered. However the technological enframing, with its emphasis on managerialism and quality control, sees diversity as something to be feared and minimised.

Thus I propose an alternative agenda, one focused on the relationship of each student with the world and knowledge. I term this *coming into the world of mathematics*. This is in direct contrast to a view of mathematics as something external that students need to master, implied by the language of meeting standards and progress indicators. I use the progressive tense (*coming*) to emphasise that this is an ongoing process, never completed, yet always part of a journey towards new knowledge and relationships. I use the phrase *into the world* to emphasise that the individual is both a participant and an observer of the world, free to act in unique ways that express their subjectivity. I have unashamedly borrowed from Biesta (2010), who uses the phrase “coming into the world” to express notions of presence, plurality and uniqueness in the educational endeavour.

On the one hand I have replaced the idea of education as the production of a particular kind of subjectivity—as a process where we as educators try to bring about a particular kind of human being—with the question of how we, as unique individuals, come “into presence” and, more specifically, how we come into presence in a world of plurality and difference (p. 80).

I have appended the word “mathematics” to Biesta’s phrase to emphasise that mathematics is both part of the world and a world of its own. I argue that appreciating the cultural and historical roots of mathematics is at least as important as learning mathematical skills and ways of thinking.

Conclusion

In this paper I have argued that current policy in numeracy education is rooted in the philosophy and language of what Heidegger (1977) terms the technological enframing. I have used a current state Strategy document to show how the language positions the early years of childhood and primary school as preparation for the real business of later learning.

I have shown how the Strategy's emphasis on measurement, intervention and accountability against standards dehumanises the education process and positions numeracy as little more than learning a set of predefined skills or concepts. I have not singled out the particular document for any reason other than geographical: it is likely that every such systemic document is pervaded by similar language.

Nor have I suggested that scientific evidence, the measurement of achievement or improvement strategies are unimportant. However as they are currently constructed they are only one part of the story. I have proposed a much broader, more inclusive and more ambitious goal of *coming into the world of mathematics* as one that has the potential to humanise mathematics and to enable students to see themselves as participants in the traditions of the discipline of mathematics. Such a goal values mathematics for the general good of society (Atweh, Miller, & Thornton, 2012), as well as for its social, cultural and historical setting.

If we take seriously the goal of education as one of *coming into the world of mathematics* then at the very least I suggest that:

- Curriculum should be reconceived as an opening up of possibilities rather than a specification of content. It should be seen as an opportunity for students to engage with the discipline of mathematics as a historical, cultural pursuit in its own right;
- The notion of what constitutes evidence in evidence-based practice must be broadened to take into account the broader goals of schooling;
- The school improvement agenda should move beyond setting targets for student achievement as its only measure of success and encompass a much more holistic purpose of education; and
- Teacher education should move beyond a teacher as practitioner view to one of teacher as representative of the discipline who enables students to form their own relationships with mathematical knowledge and ways of being.

This paper is the beginning of an attempt to widen and humanise discourse and policy around mathematics education. I do not propose a watering down of the discipline by immersing it in other disciplines or de-emphasising knowledge of content. Rather I propose that if we are serious about agendas such as social justice and raising standards, then all students need to engage with the tradition and culture of the discipline of mathematics. This includes engaging in rigorous mathematical thinking that develops the core disciplinary knowledge of mathematics, but it must do so in way that moves beyond current measures of achievement enshrined in the technological enframing of mathematics. Ultimately my agenda is to provide opportunities for all students to participate in a process of *coming into the world of mathematics*, not only to serve the technological and economic competitiveness purposes of the nation, but also to serve a higher ethical purpose of humanising society. The tradition and culture of mathematics is as central to a just and humane world as any other field of knowledge.

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