

History, Philosophy and Science Teaching: A Personal Story

Michael R. Matthews, School of Education, University of New South Wales
Email: m.matthews@unsw.edu.au

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Preamble

In 2008 I was asked by the Philosophy of Education Society of Australasia (PESA) to write a short intellectual autobiography that would appear, alongside others, in a special 2009 issue of the Society's journal [*Educational Philosophy and Theory*](#) to celebrate and appraise the Society's first 40 years. I responded with enthusiasm, as in 1969 I was a foundation member of PESA and the society was an important part of my early intellectual development; it launched me on my educational/philosophical career path.



In 2020 during the COVID-19 lockdown in Sydney, I thought that perhaps some good and not much harm might come from amplifying and refining the original 2,000-word manuscript.

This amplified manuscript is considerably longer, and it focuses on the domain of 'History, Philosophy and Science Teaching' (HPS&ST) that has occupied so much of my time for the past 30+ years. I have written and edited a good deal on the subject, including founding and editing for 25 years the Springer journal [*Science & Education: Contributions from the History, Philosophy and Sociology of Science*](#). I hope the charting of my own intellectual maturation and career, along with some elaboration of various scholarly arguments, might be of use to other researchers, teachers and students.

The academic arguments are here more indicated than developed. But hopefully enough is elaborated to give intellectual underpinning to my career steps of high school science teaching, teaching philosophy of education at Sydney Teachers College and University of New South Wales, being Foundation Chair of Science Education at University of Auckland, and returning to science education teaching and research at UNSW until my retirement in 2008 and transition to being an honorary associate professor. The essay is an intellectual autobiography; it is not meant to be an overview or summation of HPS&ST research.

Details of the disciplinary arguments, and my own positions on them, can be read at length in the books, articles, anthologies that are mentioned here, and that are listed on the UNSW [School of Education website](#). With perhaps the 3-volume [*Handbook of Research in History, Philosophy and Science Teaching*](#) (Matthews 2014) being the best place to start for overview purposes.

The main 'take home' lesson from my personal story might be that science education, at all levels from classroom teaching to university research, is enhanced if teachers and researchers have competence and interest in HPS because this makes unique and necessary contributions to the numerous theoretical, curricular and pedagogical issues that occupy science students, teachers, curriculum writers and policy makers.

I have aversion to the use of personal pronouns in scholarly writing. I tell my students and authors whose work I edit that they should be struck out on the twin grounds of redundancy and promotion of narcissism. If a claim is made in a publication then the assumption is that the writer ‘believes’ it, ‘maintains’ it, or ‘asserts’ it, and so adding ‘I believe’, ‘I maintain’, ‘I assert’ adds nothing to the claim. The statement ‘I believe that Canberra is the capital of Australia’ adds nothing to the statement ‘Canberra is the capital of Australia’. This applies equally to evaluative claims where adding a personal pronoun is near to an automatic impulse. So, we standardly see: ‘I believe that Hume is a misunderstood philosopher’; ‘In my opinion inquiry learning is overrated’, and so on. In all of these cases the first three words add nothing to what follows. The pronouns are superfluous, they occupy space and do no work. They are just along for the ride. And once admitted, or given permission to ride, there is no limit to how many can jump on to the page. Thus, in one book, by an acclaimed science educator, the personal pronoun occurs a staggering 56 times on one page. And the book is not an autobiography. The repetitive ‘I’ bespeaks a psychological problem of a Trumpian kind. But this essay is explicitly autobiographical, so the personal pronoun is unavoidable. With this explanation, I hope the reader will be forgiving of its constant appearance.

Irish-Catholic Family (b.1948)

I was born in Sydney on 19 May 1948, the only child of Alice Fitzpatrick (1908-85) who was the twelfth of fourteen children fathered by Patrick Fitzpatrick (1836-1918). In 1851, in the aftermath of the devastating [Irish Famine](#) during which a million starved to death and another million were forced to leave the country, my grandfather, aged 15, left his parents and the village of Coon (Cuan) near Kilkenny to seek work in New Zealand. His siblings went to the USA. After eleven years working as a stonemason and other jobs, in 1861 he joined with multiple thousands from around the world in the [Australian Gold Rush](#), seeking gold in the Victorian fields of Ballarat and Bendigo. By 1875 he was fortunate to find enough to enable him to buy 1,240 acres of land on the Talbragar River near [Dubbo](#) in central New South Wales, 400 kms from Sydney.

He cleared the land to create a sheep and wheat property which he named ‘Coon Hill’ after his Irish village. At age 42 he married Bridget Kilfoyle and they had 11 children. After her death in 1903, at age 43, he married Catherine Reid, who had been born in Kilkenny, and had another three children, of which my mother was the first. At least the first surviving. The first born, Robert Joseph, sadly just lived long enough to be baptized. The Fitzpatrick family’s life, and that of a good many of their Dubbo neighbours, embodied all the strengths and weaknesses of the religious, moral and social traits of Australian rural Irish-Catholicism that has been so well captured in stories, poems, ballads, and histories (Franklin 2019). In an obituary published 9 July 1918 the [Dubbo Liberal and Macquarie Advocate](#) newspaper wrote of him:

As a man he was respected amongst his fellows for his honesty, integrity, and fair dealing. His hospitality gained for him a wide reputation, and no man ever visited the Fitzpatrick homestead without partaking of the open-hearted good cheer of this big-hearted, honest Irishman.

The funeral cortege, which was one of the largest and most representative seen in Dubbo for a long time, was another striking testimony to the worth of the deceased and the great respect in which he was held by all classes of the community.

Until her death in 1957, my grandmother Catherine Reid lived some of her time with us in Waverley, and we spent time with her in Dubbo. Whilst there I used to attend the small North Dubbo convent school that had a huge pepper willow-tree in its yard, something I am always reminded of whenever I see one and crush a fragrant seed.

Despite the Irish owing nothing to the English, indeed the contrary, and despite Archbishop Daniel Mannix of Melbourne (formerly Principal of Maynooth College in Ireland) denouncing the war as a 'Trade War between British and German industrialists', and being a leader of the Anti-Conscription campaign, three of Patrick's sons volunteered to fight for the Mother Country in the Great War.

My mother's step-brother, John Bede Fitzpatrick, was 33 years old and working on the Coon Hill property when he enlisted. His 3rd battalion was sent to France. He remained there, buried in the military cemetery at Villiers Bretonneux, having been killed on the Western Front in 1917 at age 34.



John Bede Fitzpatrick (1884-1917)

Two other brothers, Charles Edward and Edward Anthony, died shortly after their return to Dubbo. Charles served in Egypt and on the Western Front before being medically discharged. Edward was twice wounded before being medically discharged. Sadly, he took his own life in 1924. This might well have been 'war related', but such happenings were shrugged off at the time; recognition of Post-Traumatic Stress was decades away. In 1921, after Patrick Fitzpatrick died, the family sold Coon Hill property and moved to Darling Street in Dubbo township. The property was subsequently renamed *Marrington* on account of the property's Irish name also being a derogatory term for aborigines.

My mother was a devout Irish-Catholic who married late at 38 years. She met my Newcastle-raised father Robert Alexander Matthews in Dubbo. After returning with the 2/2nd battalion from the Middle East campaigns in Libya, Syria and Greece, he was sent in 1942, as an instructor, to an army training camp outside Dubbo (now the site of the Dubbo Zoo). He was doubly fortunate to be sent to Dubbo as, apart from meeting my mother, the rest of the battalion went on to the horrors of fighting in the jungles of New Guinea. To marry my mother, he converted to Catholicism. His first wife, with whom he had two daughters, June and Bonny, had died before he enlisted.

Alice came down to Sydney to do war service as a clerical assistant in the navy's Garden Island base and was entitled to a two bedroom, rent-controlled flat in Henrietta Street Waverley. In 1946 my parents married at the local Mary Immaculate Church. I was born two

years later. On account of my mother being born late in Patrick Fitzpatrick's life, and me being born late in her life, I have the distinction of having a grandfather born in the first half of the nineteenth century.

As with most returned servicemen, my father said nothing about his war experience, zero. Even though, and perhaps because, it involved the chaotic and desperate [retreat of the Australian and New Zealand forces](#) back through Greece and evacuation from Crete.



Alice Fitzpatrick



Robert Matthews & Alice (1946)

A constant refrain at home was: 'It is the Mass that matters'. We lived with rosaries, Our Lady of Fatima statue, Sacred Heart picture, brown and green scapulars, St. Anthony medals, and other Catholic devotional aids. I was an altar-boy, rising early and walking up the hill once a week to the imposing 'Mary Immaculate' Franciscan church, to serve at 7am morning mass.

My father left our home when I was 12 years of age. It was a reflection of the times that he just left, giving no explanation to me. This was before the counselling, express-your-feelings, talk-it-through, and shared custody era. It was twenty years before I saw him again. I asked him what he had thought of me, his tearful answer was: 'I tried to forget you'.

My mother had a wide-circle of long-time friends and relatives; weekend visiting of sisters, brothers, nieces, nephews and friends, by bus, tram, and train, was part of my growing-up. As were occasional steam train trips back to Dubbo to stay with old friends.

Through my entire life at home we had no phone but a near by friend of my mother's did have a phone and she would use that to organise our weekend visiting itinerary. When I was 18 years old, I bought a second-hand motor bike, a Zundapp, of which the dealer confidently

asserted that ‘the Czechs have forgotten more about motorbikes than the Japanese will ever know’. My near 60-year-old mother comfortably rode pillion from the first day. Having a bike took the transport bother out of the visiting and extended our visiting range into the Blue Mountains where a special old Dubbo friend lived. Never in my life did I hear her swear, curse or even talk ill of anyone. She was sincerely loved by all who knew her. After struggling for some years with dementia, she died on 18 June 1985 at age 77 years. As with so many, it would have been fitting for her to have easier twilight years but alas she did not have them.

At my mother’s Requiem Mass, the most fitting tribute I could pay to her was the recitation of the classic Australian Catholic bush poem [The Little Irish Mother](#) by John O’Brien (the pseudonym of Father Patrick Joseph Hartigan 1878-1952). Its penultimate stanza:

There's a Little Irish Mother sleeping softly now at last
Where the tangled grass is creeping all around;
And the shades of unsung heroes troop about her from the past
While the moonlights scatters diamonds on the mound.

Christian Brothers Schooling (1952-64)

I attended a small local Christian Brothers parish school, St. Charles, until the Intermediate Certificate. It was a working-class school of the kind envisaged by Edmund Rice, the Irish founder of the Christian Brothers as the very purpose of the teaching order. With a May birthday, I was youngest in the class. I did well enough to come third in my final year, in a class of about 40 taught by a solitary brother. Pleasingly, through all the school years, discipline was not something that occupied teachers’ time: ‘be quiet’ meant be instantly quiet and pay attention. I have no memory of a teaching brother ever having to repeat themselves, even in the lower years when there were near 50 in the class. It was a different educational era.

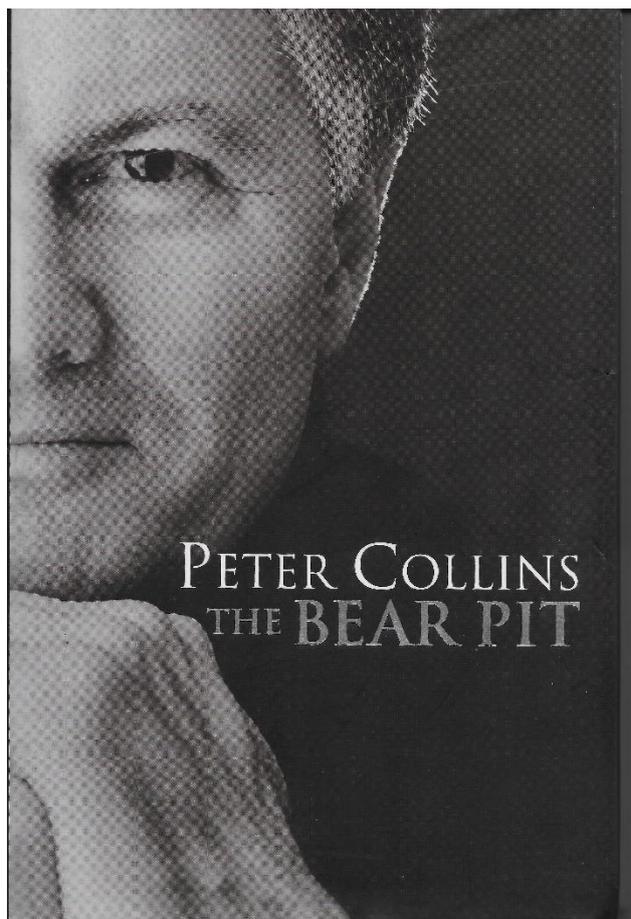
At the Intermediate Certificate I ‘won’ a scholarship to complete my Leaving Certificate (Year 11) at the more prestigious Christian Brothers Waverley College which sat atop the nearby ‘Our Lady’s Mount’. The school’s elevated roof-top statue of Our Lady was the highest point south of the Harbour.



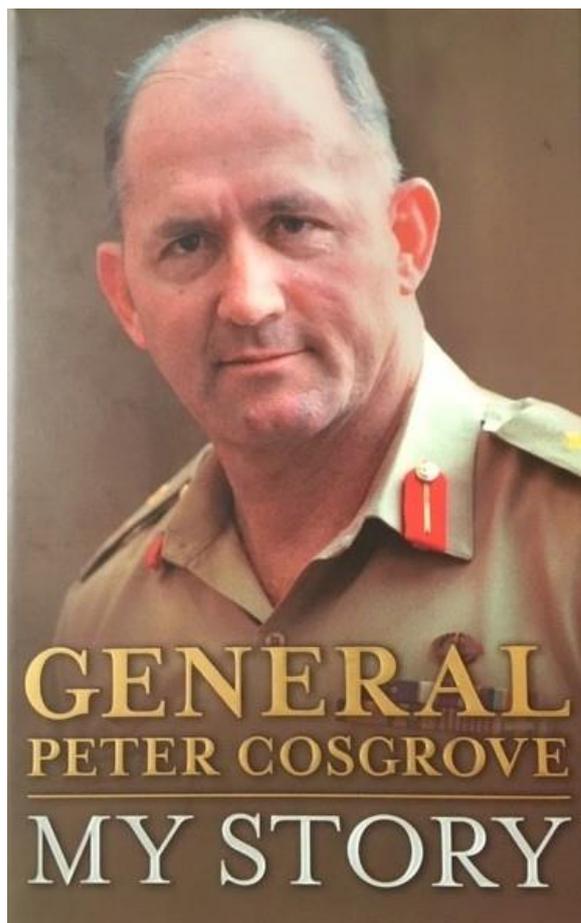
St Charles, Year 8, 1961 (MRM 3rd row, 2nd right)

‘Winning a scholarship’ meant that the Irish principal of the college, Brother Maximus (Mick) O’Connor, told my mother: ‘There is no need for Michael to attend a State school, just buy a uniform and send him up here when the school year commences’. So, my final two years of schooling were courtesy of the Irish Christian Brothers. Without this I probably would have, as so many did, left school and begun a trade – wool-classing was investigated - at Technical College. There was no fuss, no bother, no applications; just a brief meeting between Brother O’Connor and my mother, with me in tow. That my mother was one of 14 siblings and her father was named Patrick Fitzpatrick, certainly did not count against my getting a ‘scholarship’ from Brother O’Connor, of whom someone said ‘you could still smell the peat on his habit’.

The two Waverley years were happy and full, with rugby, debating, swimming and enough study to ensure success in final exams. The brothers were all fine men and conscientious teachers. Many of my classmates went on to be doctors, lawyers, bankers, politicians, businessmen, farmers, academics, engineers, accountants, teachers, and sundry other trades and occupations. One, Peter Cosgrove, became head of the Australian Army and Governor-General of Australia. Another, Peter Collins, became leader of the NSW Liberal Party and, but for an intra-party coup, had a chance of becoming Premier of NSW at the 1999 election. Another classmate, Michael Matteson became Australia’s most celebrated draft dodger and in-principle objector to conscription and to the Vietnam War. In 2019 fifty Class of ’64 fellows attended the 55th year reunion. There is class-wide gratitude for the education and experience that the school and its under-resourced, to put it mildly, teachers provided. When Brother O’Connor died, his entire estate fitted into one suitcase and his clothes were too worn to be given to the St Vincent de Paul store.



Peter Collins *The Bear Pit* (2000)



Peter Cosgrove *My Story* (2010)

At the final assembly in 1964, among other things, Brother O'Connor said: 'Now don't any of you boys study philosophy at Sydney University, if you must then make sure you also attend the Aquinas Academy'.

The Church and Thomism in Sydney

Since the colonial period, Australian Catholicism had been bound up with Scholastic philosophy or Thomism as it was loosely called. In seminaries, all priests studied 3-4 years of philosophy as part of their training. Select ones went on to Rome, Louvain or Maynooth for higher degrees, where they were further immersed in the metaphysics, ethics, political philosophy, natural philosophy, and anthropology of the 'Perennial Philosophy'. Understandably, Thomism was also the 'official' philosophy for Catholic lay people who had need of philosophical education. In Sydney, this was provided by the Aquinas Academy.

The Academy was founded in 1945. It was presided over by the charismatic, Rome-trained, Thomist priest, Dr. Austin Mary Woodbury. Dr Paddy Ryan, the crusading anti-communist Sacred Heart priest, was also prominent in Sydney Thomism and Catholic life. Brother O'Connor's warning about Sydney Philosophy was given in nigh on all Catholic schools, and perhaps many other religious schools. During the Cold War era when in Australia there was a national referendum (1951) to render the Communist Party illegal, there was a very public clash of philosophies between Marxist Materialism, intimately associated with Communism, on the one hand and various forms of religion-sympathetic philosophies on the other. Here Thomism was the best grounded and most popular option even outside the Catholic Church.

There is, for instance, a strong Anglican Thomist tradition. This is perhaps best seen in the writings of Eric Lionel Mascall (Mascall 1943, 1971) whose *Christian Theology and Natural Science* (Mascall 1956) had an influence on me.

In 1879 Pope Leo XIII had decreed Thomism to be the official philosophy of the Catholic Church; it was taught, elaborated and defended in all seminaries, and in some version or other in schools. In 1914 Pius X issued his *Doctoris Angelici* decree, stating that:

We desired that all teachers of philosophy and sacred theology should be warned that if they deviated so much as an iota from Aquinas, especially in metaphysics, they exposed themselves to grave risk. (Weisheipl 1968, p.180)

A few years later the *Code of Canon Law*, promulgated by Pope Benedict XV in 1917, reinforced the position by requiring that all professors of philosophy hold and teach the method, doctrine and principles of St Thomas. The papal endorsement of 13th century philosophy continued through to 1950 when Pius XII in *Humani generis* maintained that in the seminary, priests be instructed in philosophy ‘according to the method, doctrine and principles of the Angelic Doctor’ (Weisheipl 1968, p.183).

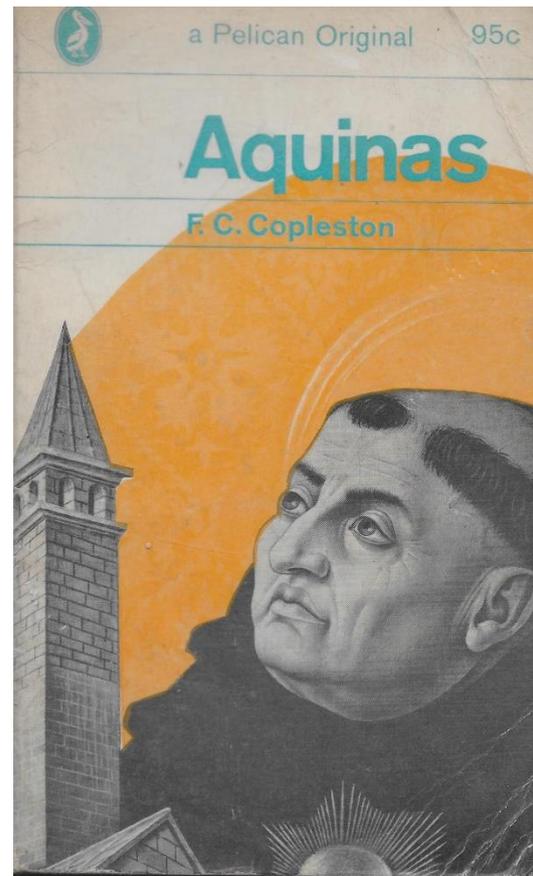
Thomist philosophy underpinned the Catholic Catechism that was learnt by rote. Catholic teaching on the existence of God, the reach and limits of reason, the status and authority of conscience, the existence of the soul, the reality and functioning of grace, the reality of free will, mind/body relations, the Trinity, Eucharistic transubstantiation, the inherent wrongness of contraception, powers and limits of the State – were all explicated and made intelligible in Thomistic terms. The Nicene Creed, for instance, was formulated by Church Fathers in 325, and has ever since remained a touchstone for Catholicism, and for all Christian Churches. Consider:

We believe in the Holy Spirit, the Lord,
and the giver of life,
who proceeds from the Father and the Son,
who with the Father and the Son
is worshiped and glorified

Making sense of its Trinitarian formulations was a struggle, but the option of ‘they make no sense’ was not available. To say ‘I believe in something, but I do not know what’ is equally unsatisfactory. Thomist categories and philosophy helped in this task of making Christian mysteries understandable.

The Aquinas Academy introduced the Thomist tradition to Sydney Catholics. In the 1960s Academy evening courses were taught in Moral Philosophy, Metaphysics, Catholic Doctrine, Latin, History of Philosophy, Psychology, Political Economy and Social Theory. Thomist political and social theory informed Pope Leo XIII's influential 1891 *Rerum Novarum* ('On Rights and Duties of Capital and Labour'), and in developed forms was appealed to by Australian Catholics in the momentous 1930s-70s social, cultural and political battles with Communism.

There was a spectrum of views concerning the papal endorsement of Thomism. Liberals saw it as requiring that Thomism be taught and elaborated, but not that it had to be entirely assented to; conservatives saw *Humani generis* as pronouncing the truth or correctness of Thomism and thus it had to be believed and defended in its entirety.



Frederick Copleston (1955) *Aquinas*

Liberals thought that Thomism was a good model for philosophy, in that it was systematic, consistent, and acknowledged the connectivity between the different branches or spheres of philosophy. They agreed that becoming competent in its elaboration was good intellectual training, but Thomism had to stand on its own philosophical merit; papal endorsement did not repair or cover-up philosophical weakness.

The mid-twentieth century was at the high-water mark for Thomism in Australia and internationally in the Catholic Church. Ralph McInerny's *Thomism in an Age of Renewal* (1966) is an informed even-handed account of the contested position of Thomism in the Church. Subsequently there has been a steady decline, if not collapse, of Thomism. Some years ago I went to the Catholic University of Louvain in part because I had an uncle priest, Harry Reid, who did his DD degree there before WWII. Louvain used to be a powerhouse of Thomism led by scholars such as Cardinal Mercier and then Joseph Maréchal, but to my astonishment no courses on Thomism were offered in the Philosophy Department. Phenomenology, Existentialism, Personalism, yes; but Thomism, no. I was not so attached to be dismayed by this, just astonished.

In the final years of the twentieth century Pope John Paul II's 1998 encyclical, *Fides et ratio*, relaxed the Church's attachment to Thomism as an official philosophy; the philosophical and theological doors were opened a little. But by that time, it seems that the Scholastic horse was near dead. This fate should not be taken as judgement on the intellectual and philosophical statue of Aquinas. In anyone's reckoning, he is among the great thinkers of all time (Copleston 1955, Weisheipl 1974).

Scholasticism was not entirely dead, as Aristotelianism was reviving in philosophy; and neo-Thomism, or at least Aquinas-influenced philosophy, was being advanced by philosophers such as Bernard Lonergan (1957, 1972), Elizabeth Anscombe (1981), Peter Geach (1969), and others. The name ‘Analytic Thomism’ has been coined (Haldane 2004). James Weisheipl, the Dominican historian and philosopher of science, well observed that:

There developed in the period of Neo-Thomism an unfortunate dichotomy between careful historians of St. Thomas and speculative ‘Thomists’ that led to the decline of Thomism in our day. The only satisfactory way to understand the sublime doctrine of Thomas Aquinas is to see it in a historical and speculative perspective. This is neither to say that his ideas do not transcend time, as historicists would have it, nor is this to say that history should replace ideas. What is needed is a unification of historical method and philosophical acumen. Strange as this may seem, unless the teaching of Aquinas is seen in its true historical perspective, there is not only the danger of misunderstanding his teaching, but also the danger of rendering Thomas irrelevant to our age. (Weisheipl 1974, p.1)

The desirability, indeed necessity, of combining historical method and philosophical acumen applies equally to the study of all philosophers: Aristotle, Locke, Hume, Kant, Marx, Mach, Russell, and anyone else of substance. I later develop this point in discussing the scientific background to early modern philosophy. Likewise, understanding and learning from educationalists such as Comenius, Rousseau, Dewey, Hutchins and others, benefits from the same combination of history and philosophy.

Into the Australian bipolar debate between materialism and Thomism, was inserted Sydney University’s Andersonian-Empiricism (Anderson 1962). This was brought to Sydney by [John Anderson](#), the controversy-seeking, Glasgow-trained philosopher who was appointed Head of Sydney Philosophy in 1927 and who held this powerful position till his retirement in 1958, just six years before Brother O’Connor’s presumably annual warning to final year Waverley students. Anderson identified himself as an empiricist but he was a philosophical realist, saying in one of his best-known essays: ‘The view that knowledge is a relation implies that knower and known are two different things or that, in knowledge, the knower is not the known’ (Anderson 1962, p27). And: ‘... there are reasons, which I think conclusive, for holding that a realist can only be an empiricist’ (Anderson 1962, p27). This is very formal and abstract, but as he spelt out his philosophical system, he separated it from classic British empiricism as articulated by Locke, Hume and Berkeley, and from that of his own British ‘positivist’ contemporaries such as Alfred Ayer. For Anderson, beliefs cannot be justified by sense data, sense impressions or raw experience; beliefs can only be justified by other beliefs. There is no sensory foundation for knowledge, nor should one be sought as it is not there to find. He was an atheist, a socialist, an ethical relativist, an advisor to the Australian Communist Party, and much else that brought him social opprobrium (Kennedy 1996).

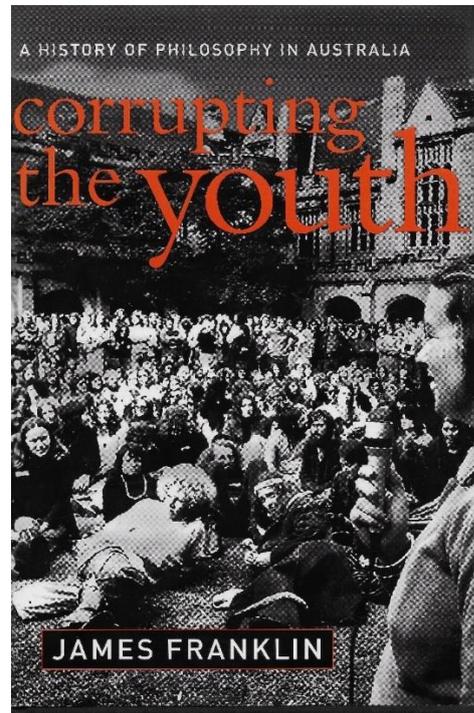
Philosophical debates were regular features on radio, in the press, at ‘Speakers’ Corner’ in public parks, and occasionally in parliament. Hundreds attended debates on whether only *homo sapiens* had a soul, on whether materialism is coherent, and so on. Woodbury opined that:

The department of philosophy in the University of Sydney is a cancer at what ought to be the heart of the scholastic life of this city ... I would warn students, and the parents of students, that a grave risk to their future intellectual and moral life is incurred by students who follow the course of philosophy at the University of Sydney without at the same time taking courses at this Academy (Franklin 2003, p.81).

Hugh Gough, the Anglican Archbishop of Sydney, publicly denounced the Sydney department; it was the subject of a NSW Government Inquiry into the corruption of youth.

James Franklin's *Corrupting the Youth: A History of Philosophy in Australia* (2003) provides an excellent 'big picture' of Australian philosophy, including seminary philosophy, along with fine details of the history, personalities and politics of the Sydney Philosophy Department.

That the philosophy curriculum of a university could be the subject of such popular debate bespeaks a different era; there is no longer any public interest in philosophy much less controversy about whether modernism, post-modernism, phenomenology or anything else is being taught in philosophy departments. Though there is occasional concern, if not outrage, expressed about the deleterious impact of post-modernism in university English and Social Science departments, and the flow-on to secondary schools.



James Franklin, *Corrupting the Youth* (2003)

The exception to 'no interest' in university philosophy is the current debate about the private multi-million dollar [Ramsay Foundation](#) funding of courses on Western Civilization. Only [three Australian universities](#) have taken up the Ramsay offer. Astonishingly, the history of science is not included and funded in the Ramsay packages. It is a mystery how the proposal could be overseen by a learned committee, get so far through the cash-starved university system so to be accepted by three universities, and yet the history of science be left out of the package. This is an indictment of the advisory committee and the public responsibility of the Australian HPS community. How can the history of Western Civilization be studied without attention to its most influential achievement?

Predictably enough, my own intellectual formation would be influenced by the Sydney Philosophy Department that Brother O'Connor warned against.

University of Sydney BSc Degree (1965-67)

I won an Education Department scholarship to study science at the University of Sydney, and thus in 1965 at age 16 became the first of the Fitzpatrick family to attend university. I was in the 'younger' end of the fresher age-spectrum. I recall our mathematics teacher, Brother MacKay, saying that 'being a teacher means you can help people grow up'. These words made an impression especially when combined with economic imperatives.

My mother had little income, living on an alimony of ten pounds per week, of which three pounds three shillings went in rent payment, and the scholarship would pay my university

fees. Further, my mother's situation meant I could receive a 'living away from home allowance' despite continuing to live with my mother in the 2-bedroom flat in Henrietta Street Waverley a short distance from Bronte beach. The lack of money did not impinge on my early life: no one had much money anyway, and our flat was 'rent controlled', and thus 'eviction proof'. This was the case for the 45 years that my mother lived there. It was an enlightened public policy for low-income families.

The only career competitor during early university years was becoming a Franciscan priest. Pleasingly the vocations advisor said that I should first complete the science degree for which I had a scholarship before considering the priesthood. He did not factor in the impact of philosophy and female students on my priestly aspirations.

Relatives and close family friends were priests, and a number of them had studied philosophy in Rome, Louvain, and one, Julian Miller, at Oxford. Philosophy was something that I had some inkling of when I started university. The Catholic Church was much involved with philosophy; it took philosophy seriously, perhaps more than other Christian denominations and perhaps other faiths. I, along with whatever thousands of others, listened on radio station 2SM to the Sydney radio philosopher-priest, Father Leslie Rumble where week-by-week Materialists, Marxists, Methodists, Masons, Muslims, Mormons (these being just the 'M's'), were all in a scholarly, quiet and deliberate manner shown the error of their ways. No yelling, screaming, table-thumping, just calm argument and evidence to demonstrate that the Church was right and everyone else was wrong.

I bought and read the numerous Catholic Truth Society pamphlets available in the vestibule of Mary Immaculate Church on the Church's approach to philosophical questions. Early in my teenage years I acquired a regular little library of Catholic books featuring authors such as Fulton Sheen, Christopher Dawson, Martin D'Arcy, Barbara Ward, Hilaire Belloc and G.K. Chesterton. To these would shortly be added books by Catholic philosophers such as Étienne Gilson, Jacques Maritain, Bernard Lonergan, Stanley Jaki, John Courtney Murray and Frederick Copleston. These books are still in my library.

After completing compulsory physics, chemistry, biology and geology in first year Science, the Teachers College advisor said I could do two years of philosophy as part of my science degree. Brother O'Connor's warning notwithstanding, this is what I commenced in 1966 in second year at university. Thereafter life was never the same.

The Sydney University Philosophy Department thought itself the best in Australia and, even considering Melbourne University's competing claim to the title, it probably was. Some staff thought it the best for a considerable distance beyond Australia. The Scottish realist, materialist and atheist philosopher John Anderson created a unique Australian department.



Sydney University Philosophy Corner

Anderson had an appetite for controversy and polemic of all kinds, especially political and religious. He also had an evangelical bent; convinced of his own rightness, he encouraged

and promoted disciples. He and other luminaries of the department - Alan Stout, John Mackie and John Passmore - had passed on by the time I arrived at the university, but David Armstrong (appointed Head in 1964), Charlie Martin, David Stove, Graham Nerlich, Tom Rose, Wallis Suchting, Keith Campbell, John Burnheim and others ensured the department's elevated place in the philosophical scheme of things.

Staff members were committed, broadly, to the Andersonian tradition of realism, rationality and science. Oxford linguistic philosophy was not represented except by occasional visitors. David Armstrong had been to Oxford in the 1950s and was distinctly under-impressed by Strawson and Grice and the 'philosophical' programme they were promoting. One Oxford visitor was an Ethics lecturer, from memory Philippa Foot, whose course text was Richard Hare's *The Language of Morals* (1952). I should have a better memory of this course because I obtained a 'HD+' in the essay, a result which I never equalled in any subsequent university course. A worry to think that one peaked intellectually at age seventeen!

When beginning first year, I borrowed a Waverley school friend's, Michael Matteson, philosophy lecture notes. On one page he had drawn a caricature of Wallis Suchting writing underneath: 'Avoid this man like the plague'. As Suchting was to become a close friend and philosophical mentor, I am pleased that I discarded this piece of collegial advice.

Logic amounted to half of the compulsory first year course and it was wonderfully taught by [David Stove](#) (1927-94). The text was Irving Copi's just published second edition of *Symbolic Logic* (1965). For any slab of argument, the simple tasks of identifying premises, intermediate premises, and then working out which ones are necessary, sufficient, or necessary and sufficient to affirm or deny, in order to accept or to reject, the argument's conclusion, made an immediate and lasting impression on me.

A logic course, especially one that combines informal with formal, symbolic logic, disciplines reasoning: it 'structures' the brain, especially a teenage brain. Stove followed this introduction by another excellent course on Induction in second year. This was old-fashioned enough to involve working through portions of John Stuart Mill's *A System of Logic* (1843). Twenty years later Oxford University Press published his against-the-philosophical-tide defence of induction, *The Rationality of Induction* (1986).

Stove's second year course was on Inductive Logic. It began with Hume's formulation of the problem of induction and worked its way through to contemporary philosophy of science. Much of the material, along with his blackboards of structure diagrams, would later appear in his book *Popper and After: Four Modern Irrationalists* (Stove 1982). This was a critique of the common argumentative thread found in such philosophical luminaries of the time as Popper, Lakatos, Kuhn and Feyerabend. Stove claimed that for 'These authors' philosophy of science is in substance irrational. They doubt, or deny outright, that there can be any reason to believe any scientific theory; and *a fortiori* they doubt, or deny, for example, that there has been any accumulation of knowledge in recent centuries' (Stove 1982, p.viii). For Stove the common source of the luminaries' irrationalism about science is their wholesale endorsement of Hume's argument for the irrationalism of inductive arguments. This endorsement is overt for Popper, and simply assumed for Lakatos, Feyerabend and Kuhn.

For Popper: 'I agree with Hume's opinion that induction is invalid and in no sense justified. Induction is invalid *in every sense*, and therefor *unjustifiable*' (Popper 1974, p.1015). And elsewhere:

Hume's logical problem of induction is the problem whether we are entitled to infer unobserved cases from observed cases, however many; or 'unknown' (unaccepted) statements from 'known' (accepted) statements, however many. Hume's answer to this problem is clearly negative; and, as he points out, it remains negative even if our inference is merely to the probability of a connexion that has not been observed rather than to its necessity. (Popper 1972, p.89)

As Stove points out (Stove 1982, chap.3), when scepticism about inductive inferences (from some to all, from a sample to a population) is combined with empiricism (that all knowledge claims have to be traced to sensations or experience), as it was for Hume and Popper, then the basic scientific inference from experiential premises (observations, measurements, data) to unexperienced theoretical constructs, or to universals such as law statements, becomes irrational and without justification. Science is rendered irrational.

Thomas Kuhn, as will be mentioned below, for the most part avoided serious engagement with philosophical argument, and with the philosophical tradition. He was just not trained in philosophy. But he knew enough to know that Hume had created the seemingly unsolved 'Problem of Induction'. In his 1973 lecture on 'Objectivity, Value Judgment, and Theory Choice' Kuhn says:

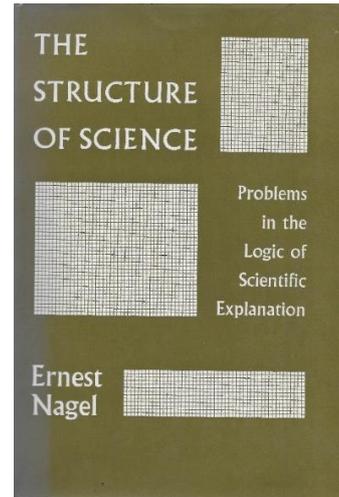
Even those who have followed me this far will want to know how a value-based enterprise of the sort I have described can develop as a science does, repeatedly producing powerful new techniques for prediction and control. To that question, unfortunately, I have no answer at all, but that is only another way of saying that I make no claim to have solved the problem of induction. (Kuhn 1977, p.332)

Later I would learn that the arguments of Stove's 'modern irrationalists' for the unjustifiability of any scientific theory were lauded and utilised in the science education community. This poses a seldom tackled problem when promoting the importance of science, scientific methodology, and Nature of Science (NOS) in school curricula. Some of course do recognise the problem and say that it opens the curriculum for alternative knowledges, and for pseudosciences.

Stove addressed students by their family names. So as an 18-year-old I was 'Mr. Matthews'. He was an atheist but nevertheless went out of his way to arrange for me to meet in his office with Laurie Alexander, an Anglican visiting lecturer in philosophy of religion, who was fresh out completing a Cambridge MA: 'Mr Alexander, I would like you to meet Mr. Matthews. You have beliefs in common.' In 1994, rather than continue a painful and losing battle with oesophageal cancer, he took his life among the trees he had long-ago planted on his small rural holding outside of Sydney.

Jumping ahead in this story, it is worth noting that at my last faculty meeting at the University of New South Wales in mid-2008, the UNSW Faculty of Arts agreed with its School of Philosophy and voted to make Logic optional for majors in philosophy. I pointed out that at Sydney University in 1965 one could not even progress to second year philosophy without completing the first-year logic course; but in post-Modern, student-seeking times, my argument fell on deaf ears. The Head of Philosophy countered that 'if we made logic compulsory, we would lose students'. Allowing students to graduate in philosophy (or indeed in any subject) who cannot think straight is an indictment of contemporary university education.

Returning to my Sydney science degree, the second-year philosophy of science course was straight Logical Empiricism with Nagel's *The Structure of Science* as the text. The writing of Ramsey or Carnap reduction sentences was a standard tutorial exercise. The idea was to get from non-empirical, theoretical statements to empirical, testable statements without too much loss of meaning. I do not remember whether the crucial idea of the necessity of *idealisation* in science was discussed, but perhaps it was. This would have rendered the very idea of reduction sentences problematic.



Ernest Nagel *Structure of Science* (1961)

Logical Empiricism's programme and style - its concepts of law, theory, observables, reduction, explanation and its obvious concern with clear and unambiguous writing - also made an impression.

Now after reading the post-modern avalanche of unintelligible sentences and excruciating verbiage in *Education*, the era of logical positivist clarity is luminous. I tried to air some of this 'nostalgic' respect for positivism by putting together a special issue of [Science & Education \(Vol.13 Nos.1-2, 2004\)](#) on this theme, and reproducing two educational articles of the great positivists Philipp Frank and Herbert Feigl.

The second-year honours seminar (1966) was taken up by David Armstrong defending for fourteen weeks his anti-nominalist, realist account of universals. His lectures were later published in his *Universals and Scientific Realism* (1978). Philosophy of Religion was taught by Graeme de Graaff, a visitor trained in Oxford analytic philosophy. Sadly the course made no impression at all. I was young enough to want to talk about God, not talk about 'God talk'. From memory, Ian Ramsey's *Religious Language* was the text.

University Newman Society

Because I was playing and training for rugby, and involved in student activities, I did not get to attend Brother O'Connor's recommended Aquinas Academy antidote to intellectual (and moral) infection by Sydney Philosophy. Although the standard adolescent lusts might have been troubling my Catholic Faith, philosophy was not. I joined the Newman Society in my first week at university and was President in the final year of the science degree. Many long-time friends were made in those years. The much-admired, and later champion of Aborigines, [Father Ted Kennedy](#) was chaplain. Cardinal Newman's *The Idea of a University* (Newman 1852/1959) was commonly read, or at least parts were. Gustave Weigel, a Jesuit priest, wrote:

John Henry Newman is beyond doubt one of the genuinely noble figures produced in the nineteenth century. In him we find a winsome combination of learning, insight, sound judgement, and humility. ... His lucid, harmonious English style will always make him a classic English author. (Weigel 1960)

Newman's core philosophical, or more accurately, epistemological commitment was that the growth of knowledge was a communitarian enterprise; the branches of knowledge, the disciplines, were interrelated; they had to attend to, learn from, and be reconciled with each other. As he wrote:

I have said that all branches of knowledge are connected together, because the subject matter of knowledge is intimately united in itself, as being the acts and work of the Creator. Hence it is that the sciences, into which our knowledge may be said to be cast, have multiplied bearings one on another, and an internal sympathy, and admit, or rather demand, comparison and adjustment. They complete, correct, balance each other. (Newman 1852/1959, p.127)

Thus, Newman's insistence that the new Catholic University of Ireland, of which in 1854 he was the founding Rector, be structured on Liberal Education principles. The disciplines were not isolated silos, nor should they be studied as such. Newman was the foremost nineteenth-century champion of Liberal or General Education (Tristram 1952). He advocated cross-disciplinary research and for students to learn a range of disciplines. This extended to the then, for Catholics, near heretical claim that the sciences and theology had to respect and learn from each other. This position was articulated in his 1855 lectures on 'Christianity and Physical Science' and 'Christianity and Scientific Investigation' (both contained in Newman 1852/1959). In the second lecture he says: '

... if we invite reason to take its place in our schools, we must let reason have fair and full play. If we reason, we must submit to the conditions of reason. We cannot use it by halves; we must use it as proceeding from Him who has also given us Revelation. (Newman 1852/1959, p.428)

This was just five years before the famed Oxford University evolution debate between Thomas Huxley, Darwin's 'bulldog', and Bishop Wilberforce who asserted that science had to learn from religion.

Newman was far more relaxed about Darwinism than many around him. He was content to accept the fact of biological evolution over millions of years if this is what reputable science established. Theologians needed to reconcile their faith and theology to this. As with so much else in Scripture, the book of Genesis did not have to be understood literally. His lengthy 1845 *An Essay on the Development of Christian Doctrine* (Newman 1846/1960) prepared the intellectual ground for appreciating the inherent growth, amplification and change of not only religious doctrine, but of other 'disciplines' or spheres of knowledge.

Newman was serious about doctrines and truths, yet he rejected all fundamentalist options which might have given him emotional comfort and intellectual ease. He had a profound historical sensibility. No serious body of intellectual understanding could be frozen in time; growth and deepening were essential to the development of understanding. As will be mentioned later, this is a feature that separates science from pseudosciences and fundamentalisms: the latter do not grow, they do not deepen, they are stalled or frozen in time.

In an address to English Roman Catholics, Newman wrote:

I want an intelligent, well-instructed laity ... I wish you to enlarge your knowledge, to cultivate your reason, to get an insight into the relation of truth to truth, to learn to view things

as they are, to understand how faith and reason stand to each other, what are the bases and principles of Catholicism. (Newman 1851/2000, p.390)

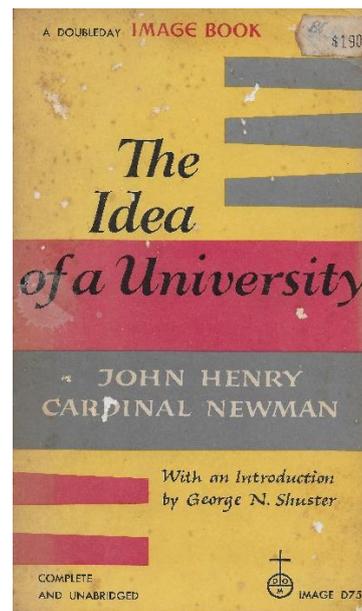
Such a collegial view provided an intellectual network, or at least theoretically so, for the Newman Society where members were undergraduate and graduate students in diverse disciplines. There was however recognition that we had something in common; we should be able to learn from each other and benefit from different perspectives. This Newman model was reinforced, as my own studies and teaching in history, philosophy, and science education developed. Everyone should learn from ‘what is going on next door’. To combine science with history and philosophy was natural. Not to do so became the unnatural position.

Newman was canonized in 2019 by Pope Francis.

Given the very non-Newman, utilitarian and commercial goals driving contemporary universities, where universities are seen as businesses and students as customers, one might wish that Newman was read more widely by administrators and writers of government policy. Jaroslav Pelikan has explicitly taken on this task in his *The Idea of a University: A Reexamination* (Pelikan 1992). Newman’s core liberal-education conviction that education was an end in itself, and not just a means to some other commercial, vocational or political goal, is in full retreat and has been depressingly documented (Hook, Kurtz & Todorovich 1975, Zakaria 2015, Nussbaum 2017, Roth 2015).



Cardinal John Henry Newman



Newman *Idea of a University* (1858)

A century after Newman, another Oxford scholar, R.G. Collingwood in his 1945 *The Idea of Nature*, wrote on the history of mutual interdependence of science and philosophy. He commented that:

The detailed study of natural fact is commonly called natural science, or for short simply science; the reflection on principles, whether those of natural science or of any other department of thought or action, is commonly called philosophy. ... but the two things are so closely related that natural science cannot go on for long without philosophy beginning; and that philosophy reacts on the science out of which it has grown by giving it in future a new

firmness and consistency arising out of the scientist's new consciousness of the principles on which he has been working. (Collingwood 1945, p.2)

Catholicism, and certainly Catholic philosophers, have long had a place in Australian university philosophy. In my undergraduate years at university, the Catholic philosopher Hugh Lacey, after his undergraduate study at Melbourne University and graduate study at University of Indiana, was appointed in 1966 as the foundation lecturer in the university's history and philosophy of science programme (a position later filled by Alan Chalmers); Catholic priests such as Eric D'Arcy, John Burnheim, Paul Crittenden, Barry Miller were valued members of Australian philosophy departments, as were Catholic philosophers such as Tony Coady, Bill Ginnane and Max Charlesworth. Many of these philosophers, along with poets such as James McAuley and Vincent Buckley, took part in local Newman Society meetings and National Catholic Students Conferences (UCFA). So did many high-calibre Anglican and Protestant philosophers – notably [Angus Holland](#) and Crawford Miller.

[Thomas Gilby](#), a noted English Thomist and expositor of Thomist social theory (Gilby 1951, 1955), was a plenary lecturer at one of the conferences. In the Vietnam War and Cold War period, with conscription for service in Vietnam having been introduced in Australia in 1964, a systematic philosophy of the State dealing with the limits of State power and also obligations to the State, was more than just topical. It facilitated clarification of agreement and disagreement on the tumultuous issues of the day. For Thomism, discussion of the State was important, but more important was its lead up, namely discussion of community and society and how they best flourish. Those lectures and conversations were a formative part of my university education, and that of so many others.

The following conference lecture titles, from a personal 1968 notebook, give a sense of the preoccupations of at least some Catholic students of the time: [Vincent Buckley](#) 'Contemporary Attitudes to the Sacred'; [Frank Knopfmacher](#) 'Marx and Religion'; [Tony Coady](#) 'Christianity and the Moral Order'; [Hugh Lacey](#) 'The Church and the University'; [Bill Ginnane](#), 'The Church and the Sacred'; and [James McCauley](#) 'Faith and Authority in the Church'.

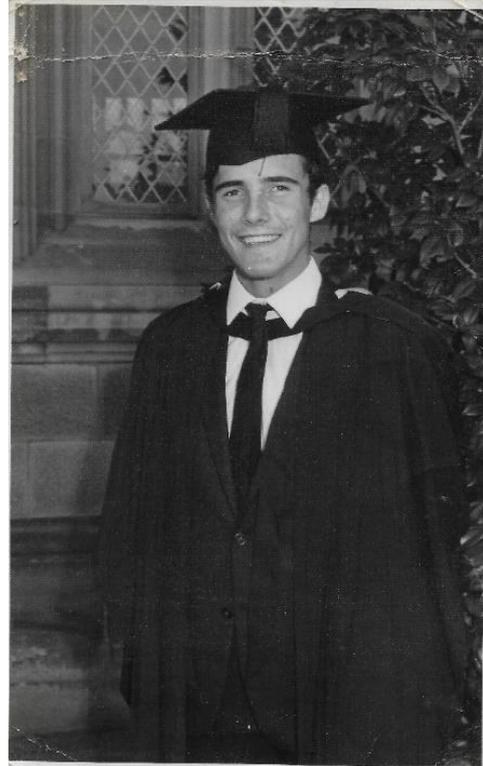
A paper given by one student who had been studying philosophy at [Villanova University](#) was succinctly titled: 'Sex and the Sacraments'. It drew attention and an audience. He was in the University of Sydney honours stream for both English and Philosophy. Eventually he gave up the latter saying that the two modes of thought were too deeply irreconcilable and, literally, brought on headaches. In other philosophy departments, in other countries, there may not have been the problem.

The overwhelming sense was that you were at university for an education; to learn things beyond whatever degree you might be enrolled in. Students being employed 20-30 hours a week to earn money to pay fees and lodging, and doing semester essays in one or two days knowing that nearly all students had to be passed, was in the sad future when education was struggling to find a place in universities. In 1997, less than three per cent of university entrants nominated 'interesting courses or social benefits of university' as a consideration in going to university (Macintyre & Marginson 2000, p.68).

For a variety of reasons, the scores of Catholic Thomist philosophers in the seminaries had little interaction with university philosophy. There was suspicion on both sides. During my term as Newman Society president, I tried to arrange for the newly appointed Catholic Chaplain, Fr Frank Mecham, who had been teaching Thomism in the Springwood seminary, to engage with the Sydney philosophers, but this came to naught.

With good reason, university philosophers were suspicious of the philosophical education provided in seminaries. Fundamentally, they correctly thought it was not open-minded, which was the *sine qua non* for philosophy.

Barry Miller (1923-2006), the well-regarded Marist priest who studied Thomism at the Angelicum University in Rome, and who published substantial books on logic and metaphysics (Miller 1963, 1992), was removed from teaching at the Marist Fathers Sydney



Science Graduation (1967)

seminary because his open-minded style of teaching was, according to the Principal ‘not suitable for forming the students into disciples of Aquinas’ (Kremer 2014). The seminary’s loss was, in 1968, the University of New England’s gain.

The Sydney Philosophy Department’s embrace of realism, rationality and science sat comfortably with my experience of the Catholic Aristotelian-realist philosophical tradition. At the end of 1967, at age 19, I graduated in Science, having majored in Geology, with sub-majors in Mathematics and Philosophy, and completion of first year Chemistry and Biology.

Teacher Education, DipEd, at Sydney Teachers College (1968)

In 1968 I enrolled in the Diploma of Education at Sydney Teachers College (STC). This was the beginning of my long involvement with the Philosophy of Education Society of Australasia (PESA).

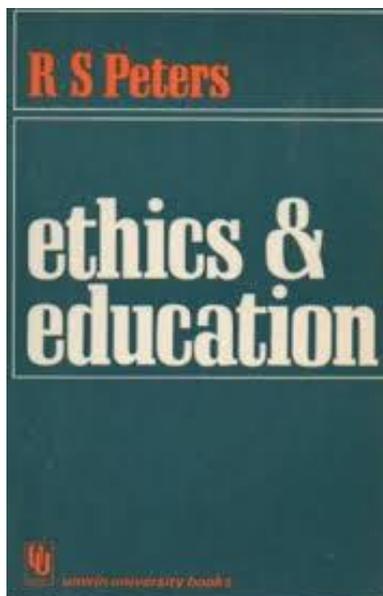
Along with science methods, physical education, and classroom practice, I did a course in Philosophy of Education taught by [Anna Hogg](#) (1910-2011), a Scottish Christian academic who in 1932 was the first woman to be awarded the University Medal in Philosophy at Sydney University. In 1968 she had recently returned from studies with Richard Peters at the London Institute of Education. She was one of many who spread the London Institute's Analytic Philosophy of Education (APE) programme to the far corners of the globe.



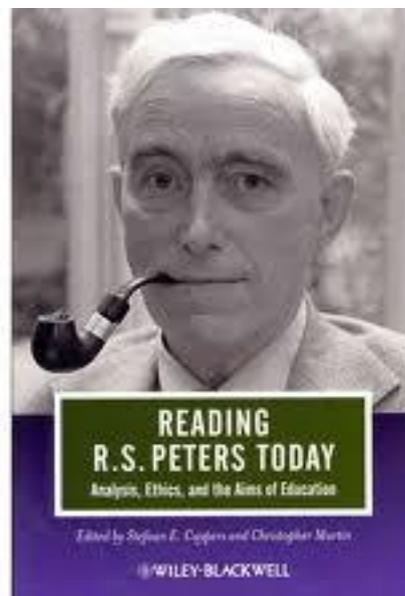
Anna Hogg

At the time, Jim Walker, later a senior education professor and university administrator (and friend), was on a one-year, junior lecturer (tutor) appointment in philosophy of education at the College.

The standard philosophy class was compulsory for all DipEd students (numbering probably 150), but Anna invited those five or six who had previously studied at least two years of philosophy into an informal 'honours' class for whom the semester was spent reading Richard Stanley Peters' just published *Ethics and Education* (1966).



R.S. Peters *Ethics & Education* (1966)



Richard Stanley Peters

For me, the close reading of Peters' book was a pivotal experience; without too much exaggeration it might be called a life-defining one. It certainly was a career-defining experience. The Peters' liberal education 'package' provided a coherent sense of the educational enterprise: an enterprise that is marked by cognitive breadth and depth, intimately linked to reasons, understanding and rationality, and has ethical norms built into both its processes and outcomes. He argued that each of these characteristics of education flowed from an analysis of the concept of education. Each characteristic was independently argued

for and developed. So, Peters wrote: ‘It would be a logical contradiction to say that a man had been educated but that he had in no way changed for the better’ (Peters 1966, p.25). Reform, or moral betterment, was built into the concept of education.

Peters led the application of post-war, Wittgenstein-influenced, British analytic philosophy to educational concerns. More pointedly, the application was to the concepts utilised in stating and arguing about those concerns. At the ‘object’ level there is, for example, dispute about aims of education; for Peters and analytic philosophers, the first philosophical step is to clarify or analyse what ‘aims’ mean. Hence his paper: ‘Aims of Education – A Conceptual Inquiry’ (Peters 1973). Others analysed ‘needs’ (Dearden 1972), ‘indoctrination’ (Snook 1972), ‘learning’ (Hamlyn 1973), ‘autonomy’ (Telfer 1975), ‘teaching’ (Hirst 1971/1973), ‘creativity’ (White 1972), and so on. An influential ‘handbook’ of the APE programme was the 3-volume anthology edited by Dearden, Hirst and Peters (Dearden, Hirst & Peters 1972).

Peters and the analytic philosophers were careful to distinguish ‘education’ from related, but importantly different, concepts and activities. As distinct from teaching, coaching, indoctrinating, instructing, or learning, education was distinguished by the breadth and depth of its cognitive aims or ends, and the ethical or moral constraints on its processes and outcomes. You can teach, instruct, or coach someone in a morally reprehensible manner to be a bad person; you cannot so educate someone. You can teach or instruct someone to know just one thing, but if you have done that, you have not educated them. To do so is a contradiction. Built into education is some breadth of knowledge.

Concerning science teaching, Peters sensibly maintained:

... a teacher might teach a subject such as science with purely vocational or economic ends in view. He might regard himself just as equipping people for vocations or as serving a national need for trained manpower, without much thought about the development of the individuals concerned, as individuals. He might conceive of what he was doing just as contributing to economic growth. But teaching science with these limited ends in view should be distinguished from educating people. Teaching, as has already been pointed out, is not necessarily educative. On the other hand, though not unmindful of the nation’s needs, a teacher might also teach science because he regarded this form of understanding as central to his concept of an educated person. (Peters 1973, p.57)

The Peters’ ‘package’ is comparable to the long-established German idea of *Bildung* (Lövlie & Standish 2002, Siljander, Kivelä & Sutinen 2012). This refers to the socially established, institutionalised process of intellectual and character formation that is consciously governed by ethical considerations, among which autonomy and respect are vital. Human flourishing in coordination with social/cultural development was the goal of *Bildung*. Some teaching arrangements and processes warrant identification as *Bildung*, others fall short; still others, indoctrination for instance, actively thwart its realisation.

The years of Newman Society activity, and reading *The Idea of a University*, had primed me for Peters’ view of education, but the notions of respect, freedom, autonomy, understanding, curriculum breadth and its need for justification, the moral dimension of education, the difference between just teaching and education – all of these took root during the semester’s weekly meetings.

I came away from the course convinced that there is nothing so practical and useful for beginning teachers as a good introduction to philosophy of education. I became a champion

of liberal education and have remained such. It set my educational and classroom goals and aims, and guided processes and pedagogy.

The Peters' conception, and more generally the analytic philosophy of education programme, did not lack critics in philosophy of education, of which I was one (Edel 1973, Adelstein 1972). Twelve years after completing Anna Hogg's course, my own UNSW Education PhD was awarded with the title: *Epistemology and Education: A Critique of Analytic Philosophy of Education*. What eventually became clear to most was that despite his, and other analytic philosophers, best intentions, the educational concepts being analysed by Peters and colleagues were culturally *local* not universal. There could not be any transcendental, supra-cultural, argument whose conclusions were the listed cognitive and moral characteristics of education detailed in the APE programme. This had been the great hope and expectation of the programme. The analysed concepts were the educational concepts and understandings of the Liberal or General Education tradition.

This was a single tradition though sometimes given the first name, other times the second. It had classical Greek origins, existed through medieval and renaissance times, then through the 19th and 20th centuries to the present. A paradigmatic 20th century exposition of the tradition's theory and practice was the 1945 Report of the Harvard Committee chaired by James Bryant Conant *General Education in a Free Society* (Conant 1945).

Among analytic philosophers, Paul Hirst provided the most sustained exposition and defence of liberal education, writing:

A liberal education approached directly in terms of the disciplines will thus be composed of the study of at least paradigm examples of all the various forms of knowledge. This study will be sufficiently detailed and sustained to give genuine insight so that pupils come to think in these terms, using the concepts, logic and criteria accurately in the different domains. (Hirst 1974, p.48)

An immediate implication is that first teachers, then students, come to have knowledge or appreciation of the history and philosophy of the different domains; the epistemology and methodology of the domains. They need to know, for instance, if there are truth criteria for a domain, and if so what they are.

Traditional societies had different understandings of education, as did dictatorships of every stripe, ditto different cultures and sub-cultures. Despite trying to avoid simple prescriptivism, which was its initial attraction, APE finally had to recognise that it was analysing a particular tradition's understanding of education and related concepts. Scientific terms can take on different meanings depending on the theories or paradigms in which they occur, so to for commonplace and educational terms. Colin Evers expressed the matter as: 'For claims about education, the interesting question shifts therefore to what counts as justification for choosing between theories of education' (Evers 1979, p.14).

For my own part, the arguments for liberal education were powerful and could be advanced a long way with a Broad Church backing and in a common front. The tradition had a clear core but this became less clear as it diffused in society and culture. The tradition was geographically or nationally confined, it was not peculiar to the West. Eastern cultures had their own equivalents. In many cases the core just needed to be restated and folk concurred: Who did not want music and the arts in the curriculum? Who thought history could be omitted from school programmes? Who thought logical thinking need not be cultivated?

Who thought that development of character and promotion of moral sensibility was irrelevant to education? And so on. Manifestly these concerns were not confined to the West.

Peters, and proponents of Liberal Education, assumed, usually without explicit argument, the principles of the Western Rationalist Tradition that had its beginnings in the ancient Greek world of the pre-Socratics, Plato and Aristotle, and was embodied in the Enlightenment. John Searle (Searle 1994) usefully summarised these as: (1) Reality exists independently of human representation. (2) Language enables speakers and hearers to successfully refer to objects and states of affairs in the world. (3) Truth admits of degrees or approximation but is a matter of the accuracy of representation, ultimately a matter of correspondence between statement and reality. (4) Knowledge is objective and does not depend on nor derive from the subjective attitudes and feelings of particular investigators. The truth or falsity of claims are unrelated and independent of the motives, morality, gender, race, or ethnicity of the person making the claim. (5) Logic and rationality are formal; they judge the adequacy of arguments, not the content or reference of arguments. (6) There are both objectively and intersubjectively valid criteria of intellectual achievement.

These principles might have been in the foreground in typical London Institute Analytic Philosophy discussion, but clearly they underwrote all debate about teaching, curriculum, discipline structure, assessment and so on. If you are not a realist about historical events – the assassination of Martin Luther King – why is it in the curriculum. If different accounts, or hypotheses, about his death cannot be evaluated against evidence, why ask students to do so? Elaboration and defence of the Western Rationalist Tradition's principles, along with educational implications to be drawn from them, will be returned to later in this autobiographical essay.

Science Teaching at Dulwich Hill (1969-72)

In 1969, at age twenty I began science teaching at Dulwich High School, a lower middle-class school, close to the city with a substantial Greek and other immigrant component. This was very good fortune. I could have been posted anywhere in the state, and anywhere in huge metropolitan Sydney, but my first school was just 10 kms from the University of Sydney.

Full of Peters-inspired ideas of liberal education, I put enormous energy into the school. I coached the school's moderately successful First XV rugby team, ran a debating group, and taught an optional General Studies class. I had internalised the idea that being an educator involved more than classroom teaching.

But my teaching career got off to a rocky start. On the second day I was involved in an argument with the Head of Science. He had given me my programme for the Year Nine class. Week one was 'the eye', week two 'sedimentary rocks', week three 'batteries', week four 'flowers', week five 'falling bodies', week six 'acids', and so on to week twenty-eight. I told him that this was silly; that no student could come to *understand* the subject matter when it was so salami-fashion sliced up. He told me that this was the new 'Spiral Curriculum' (something he wrongly thought was promoted by Jerome Bruner from Harvard University), where subject matter was constantly changed to prevent boredom setting in. I repeated that spiral or not, it was a stupid (I perhaps said 'undesirable') way to organise a programme, and suggested that at least for my class, all the chemistry, biology, geology and physics topics be grouped and taught together so as to give kids some chance of understanding what was being

taught. I later learnt that by the time the Spiral Curriculum reached the science department at Dulwich High School it had almost no relationship with what Bruner, in his *The Process of Education* (Bruner 1960) was advocating, indeed almost the reverse.

My argument depended upon accepting that a chief goal of education was the promotion of understanding of subject matter, not the avoidance of boredom, keeping children busy or enabling them to pass final exams. As such it was a philosophical position. The department head had little time for philosophy, and furthermore explained that my proposal could not happen as students had progressive year-wide exams across all classes in weeks five, ten, fifteen etc. So reluctantly I had to teach the spiral curriculum.



Dulwich High School

This experience at Dulwich Hill was the first of innumerable occasions in my teaching career where I came up against structures defeating good education. At the time I had perhaps a too idealistic view of education, and thought these structural barriers were accidental impediments. Later I would come to have a more ‘non-accidental’ and Marxist-informed view of ‘structures’. The Illich-Freirean radical position that I flirted with was that schools, and their structures, were set up and organised *precisely* in such a way as to minimise the possibility of good education and thus the possibility of an informed and critical citizenry. I began to appreciate how one could have a Marxist theory of *schooling*, and a liberal theory of *education*: there was no contradiction.

On the third day at Dulwich Hill, the Year Seven students, about 160 of them, came fresh to their new high school from various primary schools. The deputy principal called out 30 names and told them they were in class 7A and their teacher would take them marching smartly and proudly to their classroom, another 30 were told they were in 7B and given a teacher, and so on, each group marching a little less smartly and proudly, until there were about 20-30 students left who were told that they were in the ‘General Activities’ class and to wait in the playground until someone came to collect them. Welcome to high school. Robert Rosenthal and Lenore Jacobson’s classic *Pygmalion in the Classroom* had been published the previous year (1968) but it did not figure in our DipEd course of readings. At Dulwich High, one did not have to read it to recognise the essential correctness of its claims about the deleterious impact of low teacher expectations: if you were one of the ‘left overs’ in General Activities, that is where you most likely were going to stay to the end of school.

Anna Hogg’s philosophy course informed my teaching life. Philosophy was very practical, indeed the most practical part of my teacher education programme. Apart from teaching science classes, I ran an optional after-school class for an examined, but not usually taught subject, called ‘General Studies’. This was a wonderful HSC optional subject that ranged over philosophy, social and topical issues, cultural developments and criticism, and so on. In 1969, 26,500 students in NSW sat for the exam. In very few schools, and even fewer government schools, was timetable space allocated. At Dulwich I taught it one afternoon per

week after school and ran occasional weekend camps. To these camps various university Newman Society and other friends would come and talk about diverse subjects – the writings of George Orwell and Eric Fromm, the Enlightenment, Anarchism, the Vietnam War, and so on.

Students from lower middle-class, migrant backgrounds were engaged by such extra-curricular questions and investigations. (Fifty years later I am pleased to be still in touch with some of the students, including at some funerals.) In addition, I coached the school's rugby team, ran the debating group, and set up periodic senior school 'symposia evenings' with neighbouring schools, including a nearby Christian Brothers' school where a Christian brother and former Waverley teacher was then working. It was debatable whether his boys' enthusiasm for this venture was fuelled by the topics discussed or by the attraction of the senior girls that Dulwich High provided. While doing all of this, I commenced part-time university studies.

Philosophy of Education MEd Degree (1969-73)

In 1969, my first year of school teaching, I enrolled part-time in a Master of Education degree at Sydney University. The programme involved four year-long subjects. I did all three available philosophy subjects and one sociology of education. William (Bill) Andersen (1924-2019) was director of the philosophy programme. Like Anna Hogg he was a Christian academic, indeed the very model of 'A Christian Gentleman'. After psychology training, he did a doctorate in analytic philosophy of education with Richard Peters and Paul Hirst at the London Institute of Education. At the time, this was one of two powerhouses in international philosophy of education, the other being Israel Scheffler's programme at Harvard. The London Institute provided well-trained philosophy of education teachers to universities and teachers colleges throughout the far-flung British Commonwealth.

Andersen brought the London School of analytic philosophy of education to Sydney. He was a gentle, non-dogmatic, thoughtful teacher who in those years of the late 60s and early 70s encouraged an enormously enthusiastic, and one can probably say gifted, group of graduate students to apply themselves to philosophical issues in education.

There was a core group of perhaps 10-15 students in the graduate philosophy of education programme. Most became professors of education: Kevin Harris, Brian Hill, Jim Walker, Paul Hager, Gabrielle Lakomski, Bob Mackie and Colin Evers come to mind, but there were assuredly others. Many graduates of the programme had their administrative, teaching, and research lives enriched by Bill Andersen's patient guidance and simple good example of an academic life.



Bill Andersen

They were heady days. Each eight weeks or so, the Thursday evening class would morph into the Sydney Philosophy of Education Society of Australasia (PESA) branch meeting. Local philosophers such as David Armstrong, John Kleinig, George Molnar, Wallis Suchting, and Paul Crittenden would present papers; as would visitors such as Richard Peters and Paul Hirst. Educational sociologists such as Robert Young and historians such as Bob Petersen and David Hogan used to attend and contribute to the meetings. With Bill Andersen's class as a core, attendance would perhaps vary from 25 to 50 for each PESA branch meeting.

As I write this, I have in front of me an old weathered Gestetner-copied paper of Wallis Suchting titled 'Capitalism and Education: Some Marxist Bearings' subtitled 'Paper to the Philosophy of Education Society of Australasia, July 12, 1973'. The references cited include Althusser, Aptheker, Blackburn, Bowles, Gintis, Freire, Gramsci and Wittgenstein. We proto-philosophers thought that we were close to being at the intellectual heart of Australian educational studies.

Unfortunately, there was not much interaction between the Sydney educational philosophers and other educationalists. This was pure hubris: we saw ourselves as an intellectual elite without much to learn from colleagues. Some ten years later this distance, if not disdain, would become pretty much open warfare at the University of New South Wales.

Psychology Honours BA Degree (1969-73)

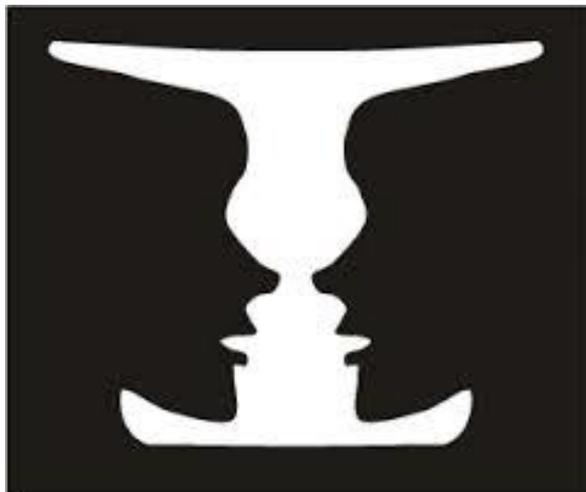
With teaching and extra-curricular activities at Dulwich, the master's degree, plus rugby football in season, I was leading a busy life, but not so busy as to prevent me enrolling in 1969 in a part-time double-honours Arts degree in Psychology and Philosophy. I wanted to continue philosophy studies; and the clear message from PESA colleagues was that educational philosophy is best done in conjunction with straight philosophy. The examples of Israel Scheffler at Harvard, Richard Peters in London and Paul Hirst at Cambridge, and closer to home John Kleinig at Macquarie University and Paul Crittenden at Sydney University, were ample testament to the wisdom of combining philosophy of education with academic philosophy. These examples were all philosophers first, and this enabled them to make substantial contributions to educational studies and analysis. Kleinig's *Philosophical Issues in Education* (1982) which came out of his own lecture course was a sterling local model of the genre. But for the BA degree I needed a second major and doing it in Psychology seemed a natural fit for a teaching career.

I was a part-time student in the Sydney University Psychology Department for five years (1969-1973) – three years undergraduate study, then two years part-time for the honours, or fourth, year. The period was the high-water mark for Behaviourism in Australia, and the Sydney department had sailed this tide for some decades. The Professor, Richard (Dick) Champion, used to only half-jokingly say that: 'I would like to study humans, but what do they tell us about rats?!' He was happy for other Australian departments to occupy themselves with social psychology, developmental psychology, personality theory, humanistic psychology, transpersonal psychology and the like, but these were side-shows at Sydney where the core teaching and research was experimental, behaviourist learning theory, and physiologically-informed studies of perception. There was a not very subtle assumption in the Sydney department that other 'non-scientific' approaches to psychology were all just a

one or two individuals (John Maze and Terry McMullin), no philosophical input entered into the subjects taught. For instance, was obvious that the course on Human Perception would have been greatly enhanced if something of the debates in philosophy of perception that began with Plato and have continued to the present had been included. The course text *Human Perception* (Day 1969) had 100 or so references, none of which were from philosophy. The inclusion of elementary distinctions between seeing and noticing, object perception and propositional perception, seeing as and seeing that, and something of the whole literature on theory dependence of observation – would have enriched the educational experience of students.

Likewise, the courses on Learning (Champion 1969) would have been enhanced if it included considerations from epistemology which also began with Plato, indeed with the pre-Socratics, and has continued to the present. In education, learning is intimately connected with the acquisition of knowledge, but ‘What is knowledge?’ remained an unasked question. For two thousand plus years, philosophers have been evaluating different answers to the question.

The same applies to the single course on cognitive psychology that was taught without any consideration of the two thousand plus years of philosophical writing on philosophy of mind. One result is that contemporary cognitive psychologists can breathlessly announce that they have discovered that how people see the world depends on their cognitive architecture; something that Plato long ago expressed when he said that: ‘we see through the eye, not with the eye’. What is seen, and how it is verbalised, is a function of what is out there (the world) and what is in here (the socialised mind). Norwood Hanson, a philosopher, stated it as: ‘Seeing is not only the having of a visual experience; it is also the way in which the visual experience is had’ (Hanson 1958, p.15). Psychologists, and also famously Thomas Kuhn, routinely made this point by reference to the much-displayed ambiguous figures where two people look at the same thing but see different things.



Vase/face figure



Old/young lady figure

When pushed, the more reflective of the cognitive psychologists would say that ‘knowledge is what is retrieved from long-term memory’. But it does not take much reflection, let alone philosophy, to see that this is hardly an adequate answer. All sorts of nonsense, falsehoods, prejudice and superstition can be committed to long-term memory, indeed they are everyday so committed by millions; amazingly, entire sacred scriptures can be committed to memory. But retrieving whatever material it might be from long term memory, does not convert it to

good sense, supported truth, or knowledge. Something other than retrieval is required for knowledge, but psychologists typically proceed no further.

Philosophy Honours BA Degree (1972-75)

In 1972, prior to doing the psychology honours year, I enrolled in third year philosophy having in 1966 completed second year in my Science degree. The outstanding and lasting impact of the year was the class on David Hume taught by Wallis Suchting. It was a methodical, diligently prepared, line-by-line, weekly study of Book One of Hume's *A Treatise of Human Nature*. The philosophical lesson was the inadequacy of empiricism as a theory of human knowledge and of the weakness of Hume's constant conjunction account of causality. But the lessons were only learnt after fourteen weeks of sweating blood, well almost. The message for students was that there could be no short-cuts in a philosophical argument; that rhetoric should not be substituted for analysis; and that the text of a serious philosopher should be accorded equally serious respect and attention.

Suchting took all of this very seriously indeed. In 1954 after completing an MA at Melbourne University on 'The Concept of Necessity in Marx and Engels', he commenced a PhD degree on 'The Criterion of Empirical Verifiability in Science' with Gerd Buchdahl as his supervisor. In order to read ancient texts on this subject he learnt Latin and Greek; and then German, Russian, French and Spanish to understand the texts and arguments of the European philosophers.

This concern with the mastery of languages was one reason why the thesis extended four years beyond his scholarship funds, and why during this time to support himself he became a high school history teacher. It was also a reason why one examiner described the thesis, awarded in 1961, as 'a terrifying piece of work'. The following year, 1962, he was appointed to the Philosophy Department at Sydney University.



Wallis Suchting (1975)

Later, although he had no sympathy for Hegel's philosophy, he spent years labouring on a translation of the *Logic* because he regarded the extant English translation 'careless and shoddy' work and he thought that Hegel had a misunderstood appreciation of the Scientific Revolution. He doubted whether the translator, the 'Prince of Translators' as the publisher called him, 'would be capable of ordering a meal in a German restaurant'. Suchting's translation was published in 1991. Despite being a life-long atheist, he did his best to read the Bible in Greek as he recognised its centrality for the Western tradition. He also did his best to read philosophers in their own language. His view was that if you respect an author, you should make the effort to read them in their own words. It is perhaps worth relating that in his entire academic career, he attended just three conferences and 'regretted the time he

wasted'. Sadly, for his family, colleagues, and friends, of whom I was a close one, in a bout of depression he took his own life in 1995.

With third year philosophy and psychology honours completed, I enrolled part-time in the philosophy honours year. In the five years that I had been away from the philosophy department, much had happened in Australia and in the university: Vietnam War demonstrations filled city streets and the university campus; the 1968 student revolutions spread from Berkeley to Paris to Rome to Sydney; and the reformist Gough Whitlam government was elected in Australia in 1972 after 30 years of conservative rule. Through the Schools' Commission the Whitlam Government provided Federal funds to all schools, public or private, on a needs basis. A revolutionary development in the financing of education in Australia.



Sydney University demonstration



Sydney University demonstration

In 1972, Michael Devitt and Wallis Suchting offered the first ever course in an Australian University on 'Marxist Philosophy'. I was one of the 40-50 students and university staff attending. It was largely an Althusserian-informed course on Marx's philosophy considered as a formal system, with each lecture printed in full. Subsequently Suchting articulated his position in two books *Marx: An Introduction* (1983) and *Marx and Philosophy* (1986). The following year, 1973, the Sydney Philosophy Department split into two schools – General Philosophy (the radicals), and Traditional and Modern Philosophy (the conservatives) (Franklin 2003, chap.11). I completed my honours year in General Philosophy.

My philosophy thesis on philosophy of mind emerged from a course by William W. Rozeboom, a visiting Canadian logical empiricist, who taught the post-graduate philosophy of mind class. Most were disappointed by the course, as it was overwhelmingly preoccupied with the grammar and syntax of talk about mind. Having read [Rozeboom's publications](#) in places like *Minnesota Studies in Philosophy of Science* (Rozeboom 1962, 1970), most students, and certainly Armstrong, and other Sydney faculty attending the course, were expecting a more full-blooded engagement with science of the brain and larger issues in philosophical psychology. This did not happen. Nevertheless, outside of the course he provided informed comment on philosophical and methodological matters.

My thesis, which was related to my psychology theoretical thesis, canvassed the action/movement distinction that was then widely elaborated in Anglo philosophy of psychology literature, for instance by Peter Winch in his 1958 Wittgenstein-inspired *The Idea of a Social Science*, and by continental *Verstehen* theorists such as Theodor Adorno, Wolfgang Stegmüller and Hans-Georg Gadamer. For these writers, the fact that the very same *external* behaviour by an individual could constitute different actions, depending upon

the *internal* intentions associated with the behaviour, meant that there could be no science of behaviour comparable to the sciences of nature. As Adorno stated the matter: ‘It is in the nature of society itself that the natural scientific model cannot be happily and unreservedly transferred to it’ (Adorno 1976, p.73). For those theorists, the aim of social science is to *understand* or *interpret* personal and social behaviour, not to *explain* it. Natural sciences explain, humanistic studies understand.

The behaviour of throwing a ball could constitute the action of trying to hit someone, warn someone of danger, or just exercising an arm. Purpose, intention, reasons and consciousness are constitutive and defining of actions and social conduct. This is why in the legal system, and in everyday life, the distinction between doing something accidentally and doing it on purpose, is so important. The behaviour can be captured by the measuring instruments of natural science, the actions not so easily. Indeed, Winch and the *Verstehen* theorists argued that this simply ruled out the possibility of any ‘scientific’ social science.

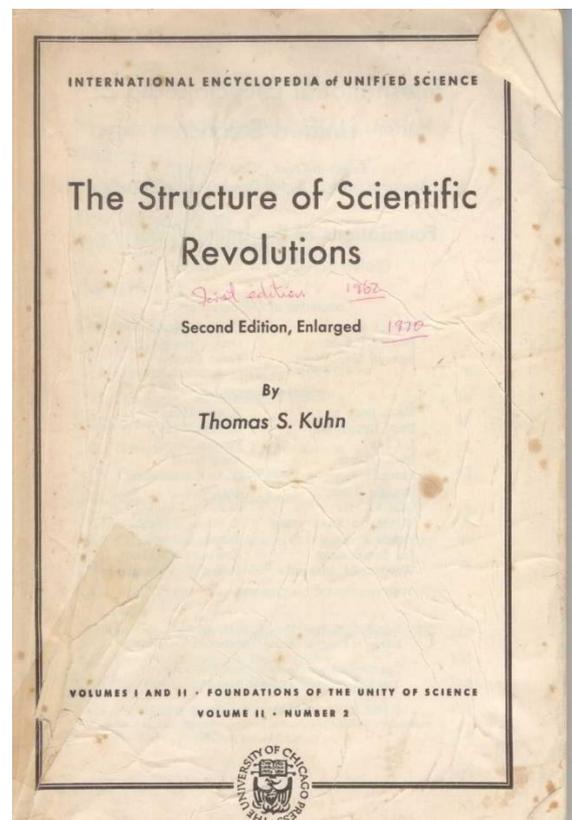
The thesis attempted a causal interpretation of action. It was awarded first-class honours, and I was placed second to Elizabeth Grosz who went on to fame as a feminist philosopher. Her subsequent writings, alas, lost a good deal of the precision and clarity that Sydney philosophy did its best to inculcate.

Thomas Kuhn Seminar (1973)

The compulsory fourth-year honours seminar was on Philosophy of Science. Here too, things had dramatically changed while I had moved sideways into science teaching and completing the psychology honours programme. In 1967 we were learning, in logical empiricist mode, about Ramsey sentences, how to write Carnapian reduction-sentences, and puzzling over the existential status of dispositional properties such as ‘solubility’.

In 1970 the second edition of Thomas Kuhn’s work *The Structure of Scientific Revolutions* (1962/1970) exploded over all disciplinary corners of the academic world, and many places outside the academia. The book brought the term ‘paradigm’ into everybody’s lexicon - from university students and professors, through newspaper reporters and editorialists, to coffee shop conversations. The inclusion of the word ‘paradigm’ was almost a requirement for the publication of any article in social science. The book was quickly translated into 16+ languages and sold over a million copies.

The 1973 honours seminar was devoted to a detailed reading of *Structure*, along with the essays in the Imre Lakatos and Alan Musgrave edited collection *Criticism and the Growth of Knowledge* (1970).



Structure of Scientific Revolutions (1970)

Wal Suchting was responsible for the seminar, but Devitt and the newly appointed Alan Chalmers took part in every meeting, as did other philosophy staff. PESA colleague Paul Hager, who was doing his honours year in the Traditional Department, was also a participant.

While a good many, if not most, scholars around the world were impressed, if not ‘blown away’ by Kuhn, the Sydney philosophers in 1973 were not. They were under-impressed with Kuhn’s philosophical arguments, indeed they thought there were barely any such arguments. They were also under-impressed with his historical analyses, especially his pivotal account of the Galileo episode which they thought was plainly mistaken. The Sydney department was a hold-out against the Kuhn tsunami that swept over academia and public discourse in the 1970s washing out ideas of truth, objectivity and universality.

Sydney philosophers were not the only holdouts; they were a minority but not alone. Mario Bunge recounts in his autobiography that he attended an influential 1966 colloquium on causality convened in Geneva by Jean Piaget in which Kuhn participated. Bunge observed:

Kuhn’s presentation impressed no one at the meeting, and it confirmed my impression that his history of science was second-hand, his philosophy confused and backward, and his sociology of science non-existent. (Bunge 2016, p.181).

John Searle, a philosopher, observed:

... the remarkable interest in the work of Thomas Kuhn on the part of literary critics did not derive from a sudden passion in English departments to understand the transition from Newtonian Mechanics to Relativity Theory. Rather, Kuhn was seen as discrediting the idea that there is any such [objective] reality. If all of ‘reality’ is just a text anyway, then the role of the textual specialist, the literary critic, is totally transformed. (Searle 1994, p.38)

Naomi Oreskes, an historian, philosopher, and co-author of *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming* (Oreskes & Conway 2010), surveyed Kuhn’s work and gave a very constrained account of his contribution to HPS:

Scholars generally agree that the largest impact of Kuhn’s work – besides adding the term *paradigm shift* to the general lexicon – was in helping to launch the field of science studies. (Oreskes 2020, p.66)

Philosophers cannot be entirely responsible for their followers, but given the very mixed bag of subsequent STS studies, Kuhn does have something to answer for even though he disowned much of what was being done in his name.

For over a century there had been historical, sociological and economic studies of the relations between science, technology and society. Marx, Mannheim, Pareto, Durkheim, and perhaps most notably Robert Merton, had all contributed to this (Curtis & Petras 1970, Merton 1973, Biagioli 1999). In the 1970s, at Edinburgh University, there began a school of Science-Technology-Society (STS) studies focussed on the production of scientific knowledge; not so much the sociology of science, but the sociology of scientific knowledge. Leading figures were David Bloor, Harry Collins, Barry Barnes, Stephen Woolgar and Bruno Latour. For this school, there was nothing epistemologically distinctive about science, much

less was there a distinction between Western and any other science. Truth claims were just claims about convenience, viability or instrumentality; not about correspondence or alignment with the world.

Three STS scholars acknowledged Kuhn as the founder of their discipline, and went on to say:

In the wake of STS research, philosophical words such as *truth*, *rationality*, *objectivity*, and even *method* are increasingly placed in scare quotes when referring to science – not only by STS practitioners, but also by scientists themselves and the public at large. (Brante, Fuller & Lynch, 1993, p.ix)

With confidence about universal science abandoned, relativism and agnosticism concerning knowledge of the natural, social, cultural and moral worlds became the academic, and indeed public, norm. We are told by two Cultural Studies researchers that:

Recent scholarship in science studies [STS] has opened the way for more thoughtful science education discourses that consider critical, historical, political, and sociocultural views of scientific knowledge and practice Increased attention to the problematic nature of western science's claims to objectivity and universal truth has created an educational space where taken-for-granted meanings are increasingly challenged, enriched, and rejected ... Thus, science's long accepted claim to epistemological superiority has now become bound to the consideration of cultural codes, social interests, and economic imperatives. (Bazzul & Sykes 2011, p.268)

Consider the claim by Marilyn Fleer, a senior science educator, that:

In recent years, the rational foundations of Western science and the self-perpetuating belief in the scientific method have come into question (Kuhn 1970, Bleier 1986). The notion of finding a truth for reality is highly questionable. (Fleer 1999, p.119)

This is just hand-waving; enough is said to be regarded as sophisticated or postmodern, to have a membership card, but characteristically there is no argument, just an unpaginated reference to Kuhn. This became the post-Kuhn disciplinary norm: make an outrageous claim, invoke Kuhn's name with or without pagination, and move on as if no argument or evidence is required. And, importantly, no attention needs be paid to the arguments of others that dispute, or refute, the outrageous claim. As countless have done with Kuhn's claims.

In Kuhn's *Structure* there is no prolonged analysis of any philosophical argument, except a brief discussion of perception, and what contributions the observer makes to the object as perceived. The historian Jan Golinski, wrote:

I see Kuhn as having little positive influence on philosophers and almost none (directly) on historians. His most significant influence within science studies was mediated by sociologists, whose reading of his work he specifically repudiated (Golinski 2012, p.15).

A recent sympathetic appraisal of Kuhn concluded that:

Kuhn's treatment of philosophical ideas is neither systematic nor rigorous. He rarely engaged in the stock-in-trade of modern philosophers, the careful and precise analysis of the details of other philosopher's views, and when he did so the results were not encouraging. (Bird 2000, p.ix)

This is one of the points that, 27-years earlier, the Sydney philosophers were making in the 1973 undergraduate honours seminar. Kuhn admitted in 1997 that his *Structure*'s treatment of the orthodox philosophical tradition was 'irresponsible' (Conant & Haugeland 2000, p.305). And elsewhere he confessed: 'I should never have written the purple passages'. This is a too easy *mea culpa*: A philosopher writing a purple passage is akin to a car mechanic not putting oil in a serviced car. It is a fundamental error in both practices.

Many would subsequently share Kuhn's own misgivings about his work, but such hesitation was rare made in the science education community where Kuhnian 'philosophy' became holy writ.

In the Kuhnian climate, the idea of 'multi-sciences' was born. But once *truth*, *objectivity*, *facts* and the rest are put into scare quotes, then 'human rights', 'women's rights', 'freedom of the press', 'right to life', 'liberty' and other moral and ethical commitments will likewise end up in scare quotes indicating not only that they are social constructions, which they are, but they are delusional, which they are not.

Not all quotation marks need be scary; the device can signify that a particular use of the concept is debatable or contested in a particular circumstance. As in "Donald Trump 'proved' that coronavirus was first manufactured in a Wuhan laboratory". Here the marks indicate that the author realises that in this particular case there was no such proof. But more commonly and destructively, the quotes mean that in principle the concept is delusional, there are no proofs, no truths, no objectivity, no facts, no falsehoods.

The function of scare quotes is that only unsophisticated or uneducated people could affirm what they designate. If you are sophisticated, you chuckle at the words or make quotation-mark signs when in a conversation or at a podium. Many students educated at the time have never recovered. They believe that, in principle, news and fake news cannot be distinguished; their memory is that Kuhn, or their philosophy professor, proved this.

The conversations, reading and writing for that 1973 Kuhn seminar shaped my 30-years-later [publication on Kuhn](#) (Matthews 2004).

Sydney Theological Studies Society

For a number of years while school teaching and doing my Arts and Education degrees, I was involved with the Sydney Theological Studies Society. This was a natural follow-on from Newman Society involvement. The Theological society was blessed, so to speak, with the participation of some outstanding philosopher-theologians - Crawford Millar, Barry Miller, Angus Holland, come to mind; some fine biblical scholars – [Barbara Thiering](#), and the Catholic priests Eugene Stockton and Bede Heather. Others involved were Jim Tulip, a professor of English Literature; Gary Trompf, the university's first appointment in Religious Studies; Godfrey Tanner, the Classics professor; and a good many other fine folk including mathematicians and scientists such as Charles Birch. Birch was professor and head of the Biology Department and in 1988 contributed a paper on '[Whitehead and Science Education](#)' to the very first of the [journal special issues](#) that I edited on History, Philosophy and Science Teaching.

My first academic conference papers were given to this group. The first was titled 'Christology Today' and dealt with the writings of, among others, Balthasar, Bultmann, Pannenberg, Moltmann and Crowe. The second was 'The Religious and Social Teaching of Reinhold Niebuhr'. A third was 'The Kingdom of God in Modern Theology'. These embarrassingly amateurish, Gestetner-printed papers are still in my files. I recall Barbara Thiering, remarking on the first paper that: 'It is a good synthesis, but makes no original contribution'. This is perhaps a fair call on most, if not all, of my subsequent scholarly work.

These engagements led to an invitation by the Anglican Rev. Rex Davis to join the Theological Commission of the Australian Council of Churches. There I was completely out of my theological depth, but the company was stimulating. Davis subsequently became Dean of Lincoln Cathedral, where I spent some happy days with him on a trip to England in the late 1970s.

Teaching Philosophy of Education, Sydney Teachers College (1972-74)

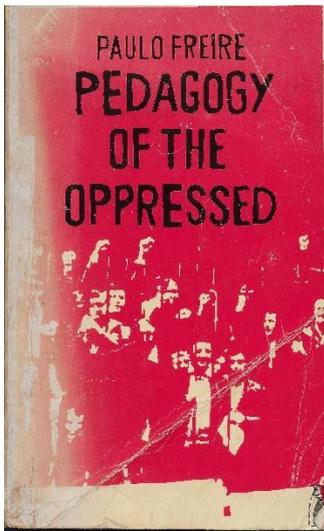
A career defining event occurred in mid-1972. While still teaching science and completing my BA and MEd degrees, I was offered an appointment as a lecturer in philosophy of education at Sydney Teachers College (STC). The appointment meant leaving classroom teaching and moving into teacher education. I was at the same time offered a tutorship in the Psychology Department but my enthusiasm for education, and high regard for Anna Hogg, meant accepting the Teachers College position.



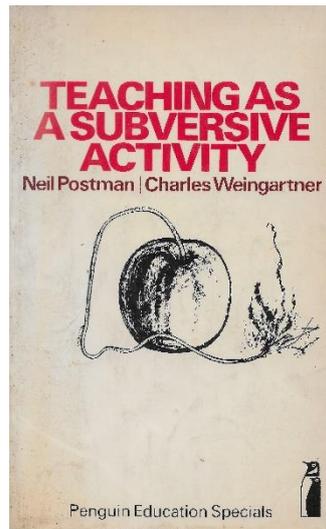
Sydney Teachers College

Having burnt the candle at both ends, and sometimes in-between, for four years, the opportunity to work on the Sydney University campus, where the Teachers College was located, and to be a short walk from the bountiful resources of Fisher Library, and to be close to the departments of Philosophy and Education, was irresistible. Thus ended my classroom teaching career, and began my teacher-education career. There were half-a-dozen philosophers of education on staff at STC.

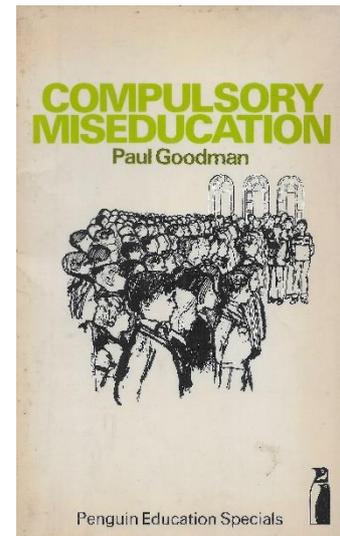
The Teachers College years were tumultuous. Radical education was in the air everywhere except at Sydney Teachers College which was caught in a 1950s, or earlier, time-warp. The 1960s and '70s saw a flood of progressive and radical education books: A.S. Neill *Summerhill* (1961), Ivan Illich *Deschooling Society* (1973), John Holt *How Children Fail* (1970), and Paul Goodman *Compulsory Miseducation* (1971). Others included Everett Reimer *School is Dead* (1971), N. Postman and C. Weingartner *Teaching as a Subversive Activity* (1971), Trevor Pateman *Counter Course: A Handbook for Course Criticism* (1972), and others. To these books should be added the important and influential paper of Louis Althusser 'Ideology and Ideological State Apparatuses' that appeared in his *Lenin and Philosophy* (1971).



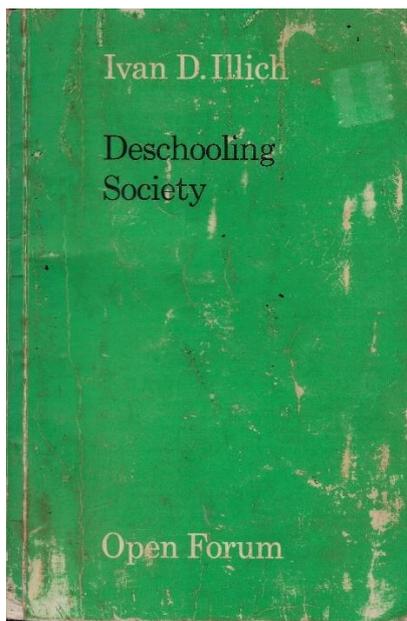
Paulo Freire (1972)



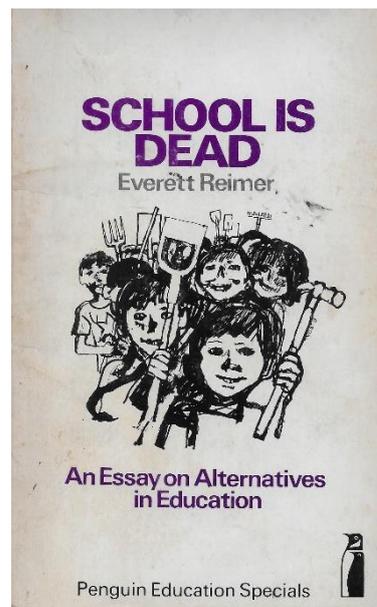
Neil Postman & Charles Weingartner (1971)



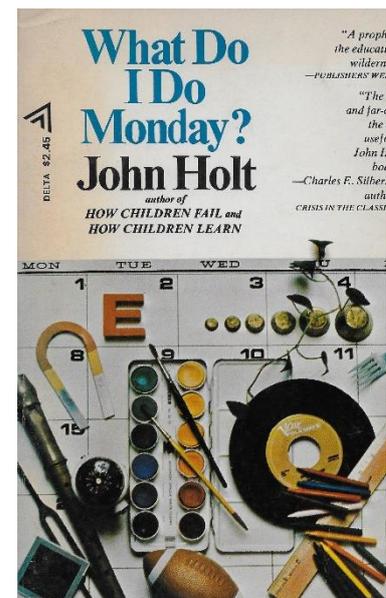
Paul Goodman (1962)



Ivan Illich (1971)



Everett Reimer (1971)



John Holt (1970)

The genre would grow exponentially in the late '70s, and change form to a more sociological, systematic, and Marxist-influenced analysis. Progressive, psychology-influenced education gave way to radical, class-theory influenced educational analysis. The major works of this period were Samuel Bowles and Herbert Gintis *Schooling in Capitalist America* (1976) and Michael Apple *Ideology and Curriculum* (1979). These authors lectured to packed houses in Australian lecture tours. Apart from core philosophy of education, staff offered seminars in their various research areas. My first, and most popular, was 'Ideology, Society and Schooling'.

Paulo Freire's *Pedagogy of the Oppressed* appeared the year I was appointed to STC; and in the second half of 1972 I taught, as an option, probably the first course in Australia on his

educational theory and practice. I was privileged to spend time with him during his Australian tour in 1973. My first ever publication argued that Freire's epistemology is best understood as an instantiation of that developed in Marx's *Theses on Feuerbach* (Matthews 1980). Another option course I taught was 'Christianity and Marxism' ambitiously based on Gustavo Gutiérrez's *A Theology of Liberation* (1973). One-hour option classes regularly extended to 2-3 hours.

These radical works examined the social, economic, historical and cultural contexts in which education was defined and conducted. They all challenged the standard Jeffersonian, liberal, individualist, meritocratic view of educational success, in which success and hence access to economic and career benefits, was the outcome of personal effort plus intelligence; and conversely social and economic failure was the result of inadequate effort or diminished intelligence. In contrast, the radicals were documenting the contribution of race, poverty, gender, class, ethnicity and culture to educational success, or more commonly failure. All of this ferment had by-passed most Teachers College staff. I recall a coffee-table conversation where colleagues derided the very idea of affirmative action for aboriginal entry to the college. The college sat fortress-like, isolated and unmoved within the university grounds. But the curriculum did allow for staff to contribute to a pool of options, one of which could be included in the compulsory programme.

For me, there were constant battles with Education colleagues, and with the wider STC staff, over assessment matters. One among many, but typical, was the 'Green Frog' case. In response to an Education exam question along the lines of 'Describe your ideal school', a student drew, for an hour or more, page after page of coloured cartoons, the final one being a large green frog saying 'an ideal school is children doing what they are interested in and teachers approving'. I did not know, and had not taught, the student, but I did supervise the exam and noted one student with a huge tin of Derwent coloured pencils drawing feverishly page after page. When exam scripts were collected and distributed for marking, Education staff were outraged; they saw the student as making fun of the course. The recommendation was that not only the student be failed, but he not be offered a try-again post-exam, no coming back to repeat the subject. Which would have meant unemployment and the end of a teaching career before it even began.

Philosophy colleagues, the English staff, other 'softies' and I, moved an amendment at the general College assessment meeting that he be given a deferred exam and told that written prose was required. The English staff wrote to the Principal: 'What disturbs us is the assumption that cartoons and/or drawings are necessarily lacking in seriousness and *ipso facto* a sign of contempt'. Students in school were expected to attempt non-written communication. This amendment was rejected in the College Education Department by about 20 votes to 5. On 4 December 1974 it was subsequently rejected by the entire STC staff by 85 votes to 32 (all department results had to be approved by a full STC staff meeting).

However, that was not the end of the story: The DipEd was taught and graded by STC staff, but it was formally under the power of the University Faculty of Education who granted the degree. The student had otherwise excellent results, with high distinctions in English and outstanding practice teaching reports. From one supervising teacher: 'X's lessons involved a rather difficult class of girls. His tact, discretion and presentation of drama lessons won them to a degree of co-operation in the lessons that was most impressive'. And another teacher: 'X's ability to establish instant rapport with a difficult 2B class can only do him credit.

Although normally bored with school, this class became so involved that they begged for extra lessons.’

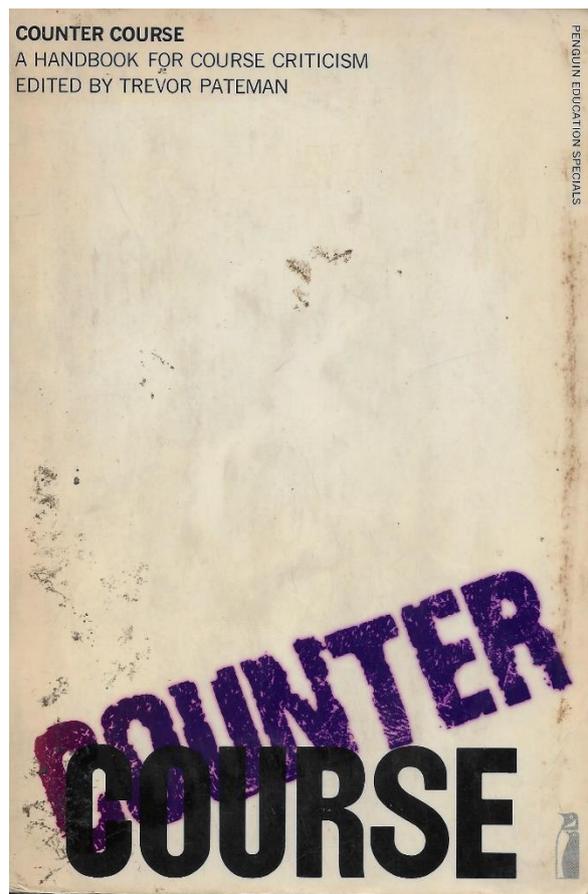
On 12 December 1974 the minority STC faction took all this information to the head of the University School of Education and indicated not just the injustice of the decision but the public relations disaster that was primed to follow if he endorsed the STC decision. Hopefully from wisdom, but it might have been institutional self-interest, he overturned the result and STC was directed to give the student a deferred exam in Education. He passed, taught briefly in a boys’ school, resigned, and went on to an outstanding international career in the theatre and cinema as an acclaimed choreographer for productions of *Moulin Rouge*, *Strictly Ballroom*, *The Great Gatsby*, *Shall We Dance?* and many other box-office hits. He became known as the ‘choreographer to the stars’. Of course, at STC he was just an unknown, but clearly creative student with which the system could not cope.

There was a string of other such cases, including that of a college Physical Education student who was failed PE for not attending the required number of practical classes. I pointed out at the full staff meeting that the student was a rugby union international who missed classes because he was in New Zealand playing for Australia against the All Blacks rugby team (there is no tougher assignment in rugby union). This argument fell on deaf ears, and he was drummed out by a vote of about 180 to 50. He was not a DipEd student, so the avenue of appeal to the University was not available. He subsequently became a dual international when he played rugby league for Australia. These cases went on and on. The battles pitched 1970s Progressives up against 1950s bureaucratic Conservatives and Traditionalists.

One response was that Barbara Bee, Kevin Harris, a handful of education progressives and I mounted an almost year-long series of lunchtime lectures and discussions. This was a sort of counter DipEd. It was partly inspired by Trevor Pateman’s then recently published anthology *Counter Course: A Handbook for Course Criticism* (Pateman 1972). We wanted to provide some alternative view of education and the role of teachers to that which dominated the College. As I was secretary of the NSW branch of the Philosophy of Education Society of Australasia, it was a simple matter to have the line-up of speakers for the evening branch meetings come to STC and repeat their lectures in daytime. Students engaged with serious scholars talking intelligently about topical, and not so-topical, issues in education. Sadly, they heard precious little of this in STC programmes.

There were other speakers apart from PESA presenters. For example, a lesbian student who had her education scholarship at Macquarie University withdrawn because she had published, over her name, a lovemaking poem in the university newspaper. This 'incident' had gotten into the popular press. Dunstan Kemp, the then Principal of STC called me to his office and threatened all manner of dire consequences if her appearance was not cancelled. I was stiffened by my newly embraced Richard Peters' account of what education should be, namely open debate and the appraisal of positions, and refused to budge on this matter. The lecture went ahead to a large and appreciative student audience.

Another speaker who triggered a similar threat, was Hugh Bygott, the head of a government school science department, who was dismissed from the state teaching service because he wore a 'Stop the War' badge to his school.



Trevor Pateman *Counter Course* (1972)

Bygott was a senior experienced teacher, who had himself completed a Sydney philosophy degree after his science degree. His dismissal crystallised issues about teacher professionalism and independence, the legitimate power of the State in education, the teaching of controversial issues, the role of schools as 'ideological state apparatuses' (to use Althusser's terminology), and so on. Students were deeply engaged by Bygott's talk, and indeed by most of the other talks in the programme. This engagement contrasted markedly with their almost complete lack of engagement and boredom in most STC education classes.

Promoting these lectures opened up the serious issue of what degree of control education authorities can reasonably and legally have over teachers' private lives and opinions. This is a perennial topic brought to the fore whenever controversial social issues - environmental, legal, gender equality, same-sex marriage, racial discrimination, industrial reform, climate change, logging, etc. - are debated in society: Should or should not teachers express or make known their views on the matter? This is just an extension of the more routine, everyday issue of the desirability or otherwise of teachers expressing opinions on evaluative matters in the subjects they teach; an issue daily faced by history, economics, social science, literature, and religion teachers. This is a routine topic in philosophy of education and students could benefit from the extant arguments and analysis (Warnock 1975, Norman 1975).

Apart from lunchtime talks we staged three weekend conferences attended by about 80-100 students with all manner of 'radical' speakers and workshops (this was before economic pressures meant that student weekends were taken up by employment at Bakers Delight, McDonalds and Kentucky Fried). For the record, and as an indicator of the 'Spirit of the 1970s', it is possibly worth recording that at these riverside camps, most staff and students

swam naked. Fifty years on with phone cameras and Facebook, not to mention abuse concerns, this would become newspaper material and trend on social media.

For the most part, being an education radical at the time meant striving for good education: namely, education governed by respect for individuals, that sought understanding of subject matter, supported personal, cultural and social flourishing, and was responsive to moral concerns. The Progressives took the view that it was just immoral, or unethical, for teachers to lose their livelihood because of their sexual orientation or their opposition to the Vietnam war, just as it would be to fail a student on account of their race. As Peters and others maintained, education had to be conducted in a moral framework. Anyone embracing the Peters, or most views of liberal education, could not just look the other way, much less endorse those kinds of moral transgressions in education. Opposition was not just political, it was moral; and it stemmed from the view that education could not be indifferent to moral issues that impinged upon it. A teacher or a coach can be indifferent to racial discrimination in schools ('only whites pass'), but an educator, *qua* educator, cannot be.

It is perhaps worth noting that all this 'extra-curricular' activity had a potential cost; it was not a cost-free indulgence. I did not have tenure at STC and was employed at the grace of the Head of Education and ultimately the Principal of the College. Not unexpectedly, in December 1973 Eric Pearson, the head of the STC Education department, citing Michael Matteson's invited lecture, and other matters, formally asked for my dismissal.

As Pearson was the President of the NSW Teachers Federation, this request became something of an industrial issue – 'union president seeks dismissal of union member' - and was debated in union meetings and publications. As some students were members of the Communist Party the issue was aired in the pages of the Communist Party's weekly paper *The Tribune*. Recognising that I was in the middle of completing my double-honours BA degree and MEd degree, and perhaps seeing other problems, the Principal Dunstan Kemp shelved the request. Sydney Teachers' College was an 'Exhibit A' for Louis Althusser's conceptualisation of 'Education as an Ideological State Apparatus' (Althusser 1971).

These were heady days which are now all gone. Foundation subjects – philosophy, psychology, sociology and perhaps history – had long been recognised as an essential part of the preparation of professional teachers or educators (Tozer, Anderson & Armbruster 1990). If teaching was to be a *profession* then teachers needed some awareness of these domains. But over the past 20-30 years, foundation subjects have been progressively eliminated from teacher education programmes; classroom management skills and what masquerades as 'learning theory' now dominant the programmes. It is hard to think of any student agitation around any education issue in the past 20-30 years. Around external issues – Climate Change, sexual identity and abuse – yes, but rarely around educational issues.

University of New South Wales (1975-present)

Thankfully, less than 200 meters from the STC, my philosophy, psychology and education classes continued. PESA state branch meetings were held each 6-8 weeks, with myself as secretary. At the end of 1974 my master's degree in philosophy of education and my double-honours BA were complete. In the middle of yet another screaming, yelling end-of-year STC staff assessment meeting, I slipped out for an interview at University of New South Wales for an advertised lectureship in philosophy of education.

The Vice-Principal of STC, Vic Couch, had graciously written a positive reference saying that I was ‘the leader of innovative education in the college’. The philosopher of education, Kevin Harris had moved to UNSW the year before, and I phoned him during the afternoon of the assessment meeting and was told that I had been offered the position. This did give me a nice secure base to let go with both barrels in the remainder of the STC staff meeting. Whatever inhibitions I might have felt were completely gone. At the end of the meeting I told the Principal that I was moving to UNSW, effective January 1, 1975. It is difficult to know whose feeling of relief was greater. Dunstan Kemp wrote (January 3rd, 1975) a fine note: ‘Once again please accept my congratulations on your fine university performance and on your new appointment in which I trust you will be successful’.

I stayed at UNSW, with an interlude as Foundation Professor of Science Education in Auckland (1992-93), until my retirement on 4th July 2008. Philosophers of education Jim Gribble and Martin Bibby joined the UNSW staff at the same time. The school then, in the mid-70s, had perhaps the largest group of philosophers of education in the world (seven), led by Professor Les Brown who was Head of School. Sadly, we as a group did not make the best of our commanding situation.

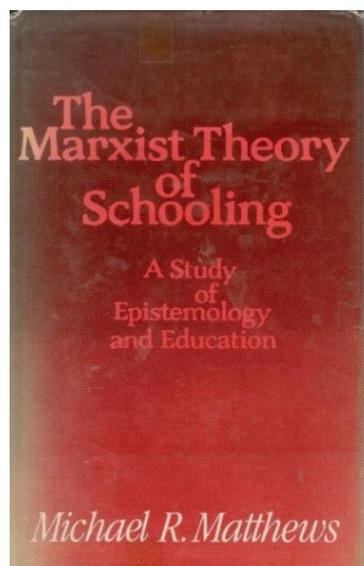


University of New South Wales

As each one of this original group retired, they were not replaced. In 2008 I was the last philosopher to retire and was not replaced.

This local picture of the demise of philosophy of education is a snapshot of the worldwide decline, not just of philosophy of education, but all the other foundation subjects (psychology, sociology, history). In teacher education programmes, theory has been replaced by practice; university courses by in-school apprenticeships.

Upon appointment at UNSW I put enormous time into preparing DipEd Philosophy of Education lectures. These were 36 detailed lectures, each of 12-15 typed pages, that I used to multiple-copy and mail to a group of perhaps 20-30 colleagues throughout Australia and overseas. Some lecture titles were: ‘Science and Observation’, ‘Karl Popper and Falsificationism Pt.1’, ‘Thomas Kuhn I: The Background’, ‘Thomas Kuhn II: Two Issues’, ‘Science and Society Pt.1’, ‘Ideology II: Althusser’s Theory’, ‘Marx’s Theory of Religion’, ‘Marxist Epistemology I: Early Marx’, ‘Marxist Epistemology IV: Lenin’, ‘Paul Hirst’s Epistemology III’, ‘Public Knowledge and Social Control’.



Marxist Theory of Schooling (1980)

Philosophy of science, epistemology and Marxist theory were the core of the lectures. They were way over the head of, and inappropriate for, DipEd students so what was prepared and what was delivered turned out to be different things. But when told that I needed a PhD for tenure, they provided a ready-made core for a thesis whose title was *Epistemology and Education: A Critique of Analytic Philosophy of Education*. It was examined and awarded in 1980. The same year a modified version was published by Harvester Press as *The Marxist Theory of Schooling*.

In retrospect it would have been better to have tried to improve and publish these lectures in science education journals. This could much earlier have connected me to the handful of scholars who had, up to the late-1970s, been publishing on HPS&ST questions (Cawthron & Rowell 1978, Connelly, 1969, 1974, Eger 1972, Elkana 1970, Ennis 1979, Holton 1975, 1978, Klopfer 1969, Koertge 1970, Phillips 1978, Siegel 1978). But this was in the time before there was pressure for new staff to publish; a time before staff could have an unpublished thought.

In Chapter Eight of the book, I used the 'IQ Controversy' to illustrate the differences between a Marxist and philosophy-of-science informed approach on the one hand, and the more orthodox analytic approach on other topics in philosophy of education. I first showed that little was gained by doing a conceptual analysis of 'intelligence' along the lines of analyses of 'indoctrination', 'learning', 'conditioning', 'teaching', 'autonomy' that were then common in the literature. Intelligence functioned as a theoretical term in psychology and had to be understood as such. For some theorists it was an intervening variable and thus had no ontological status, for other theorists it was a hypothetical construct and did have ontological status. Theoretical and problematic issues in psychology had to be addressed by the philosophers of education. But Marxism led one to look at the social functioning of IQ tests and consequently the history of such tests. For Marx there is no understanding of any significant subject without attention to its history. To understand social events, institutions, structures, ideologies – begin by looking at their history. Later this would inform my approach to study in the history and philosophy of science. Once the history of IQ tests was laid out, it became very clear that the science of intelligence was contaminated with ideology; ideological assumptions had gotten into the definition of theoretical terms.

The IQ chapter was taken up by NSW Teacher's Federation submissions to the State government on Selective Schools (government high schools restricted to supposedly talented or gifted students), and in 1985 was the subject of debates in the *Canadian Journal of Education*. James T. Sanders after surveying the contributions of such recognised scholars as Stephen J. Gould, Clarence Karier, Brian Simon and Richard Lewontin chose my writings to exemplify the Marxist case he was criticising:

I realise that I could be accused of unduly and arbitrarily narrowing the focus for discussion and debate on the issue by short-circuiting the voluminous literature on the IQ controversy. This is not my intent. There is to be sure, no small amount of literature on the controversy; if anything there is an overabundance. And considering the buzzing, blooming polemical confusion that characterises much of this discursive literature Matthews' circumscribed case against IQ does have certain virtues. It is current (or post-Burtian), sustained, and organised along the major technical issues that (to my mind) make up the core of the controversy. (Sanders 1985, p.403)

PESA meetings continued in 1975, with some of us trying to engage with the current of radical critiques of education, some continuing the programme of Analytic Philosophy of Education (regrettably they were labelled APEs). Paul Hirst's *Forms of Knowledge* thesis was one of the chief targets; and it was attacked from within (as being conceptually incoherent) and from without (as functioning as justificatory ideology for the current divisions in the school curriculum). In 1975 the PESA inaugural conference was held at Macquarie University.

Kevin Harris published his critique of the Peters-inspired analytic programme in his *Education and Knowledge* (Harris 1979). I contributed a chapter on Freire's epistemology to the anthology edited by Robert Mackie - *Literacy and Revolution: The Pedagogy of Paulo Freire* (Matthews 1980). This was my first academic publication and it argued that Freire's theory of knowledge was essentially that articulated by Marx in his 1845 [Theses on Feuerbach](#).

General and Disciplinary Philosophy of Education

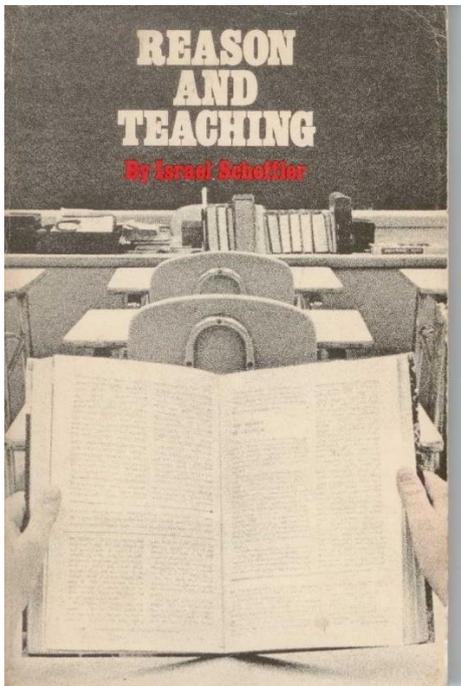
My professional concern with HPS&ST questions commenced because I was teaching philosophy of education to science graduates enrolled in the Diploma of Education. Two years before my appointment, Israel Scheffler published his essay '[Philosophy and the Curriculum](#)'. It was a convincing argument for the inclusion of courses in the philosophy of the discipline in programmes that are preparing people to teach that discipline. He maintained that: 'philosophies-of constitute a desirable additional input in teacher preparation beyond subject-matter competence, practice in teaching, and educational methodology' (Scheffler 1973, p.40). He summarised his argument as follows:

I have outlined four main efforts through which philosophies-of might contribute to education: (1) the analytic description of forms of thought represented by teaching subjects; (2) the evaluation and criticism of such forms of thought; (3) the analysis of specific materials so as to systematize and exhibit them as exemplifications of forms of thought; and (4) the interpretation of particular exemplifications in terms accessible to the novice. (Scheffler 1973, p.40)

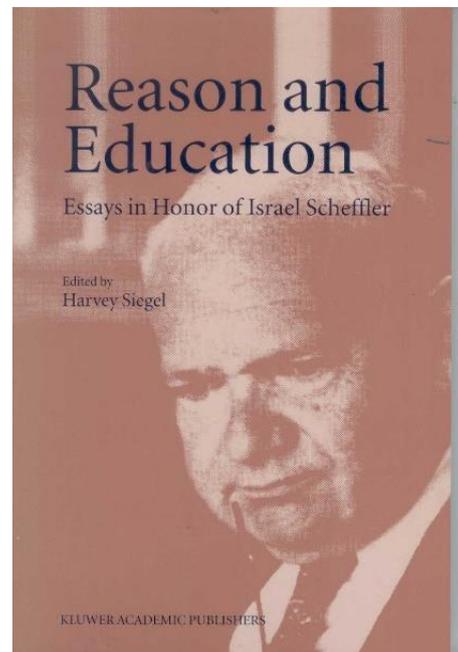
As I was teaching science graduates, and had been a science teacher, it was natural and easy to 'take on board' Scheffler's argument. Thereafter my philosophy of education courses had two components. First, *general* philosophy of education addressing the kinds of issues that all teachers need to address – aims of education, equality, indoctrination, affirmative action, teacher's freedoms and responsibilities, teachers stating or not stating their own positions on controversial ethical and political matters, what does *understanding* subject matter mean, and so on. Second, *disciplinary* philosophy of education addressing the kinds of substantive questions peculiar to the discipline being taught.

Putting my words into Scheffler's mouth, his argument amounted to saying a science teacher should know the meaning of the basic terms or vocabulary of their discipline – 'cause', 'law', 'explanation', 'observation', 'model', 'theory', 'fact', 'experiment', 'hypothesis', 'confirmation', 'falsification', and so on. They should know something about the people whose names occur throughout the textbooks – Galileo, Newton, Darwin, Mendel, Einstein and so on. They should have some knowledge and hopefully opinion about the conflicting objectives of their own discipline – to describe, to control, to understand. They should have some knowledge of the cultural and historical dimensions of science – the momentous issues

involved in Galileo's trial, the cultural impact of Darwin's theory, the transformation in the quality of life brought about by Pasteur's and Jenner's discoveries, the challenges of genetic engineering and so on.



Reason and Teaching (1973)



Reason and Education (1997)

The connection between Scheffler's argument and HPS was obvious: without HPS Scheffler's aspirations could not be met. He wrote:

The teacher of science ... needs to have a conception of the field of science as a whole, of its aims, methods, and standards; he needs to have principles for selecting materials and experiences suitable for inducting novices into the field, and he needs to be able to communicate both with novices and with scientific sophisticates ... But the scope of this requirement is, I suggest, virtually indistinguishable from that of the philosophy of science. (Scheffler 1973, pp.35, 36)

Importantly, for Scheffler these aspirations were not 'optional extras', were not 'icing on the cake', they were constitutive of the meaning of being a science teacher. And they applied equally to being a teacher of history, art, economics, mathematics, theology, or any other discipline: each had to know, and be able to explain, literally, what they were talking about.

These aspirations were independent of what might be required for any particular teaching situation; they were not limited to what a teacher's classes might need know. Teachers of a discipline had to have a grasp of the discipline they were teaching beyond what their students might be examined on; they had to see beyond the curriculum fence. Curricula change. A responsible or 'professional' teacher should have some appreciation of why they change and some ability to appraise disciplinary, educational and political principles motivating the change. They need to know something about science other than what might be in any particular curriculum.

General philosophy of education and disciplinary philosophy of education are not separate silos; especially for science teachers they often overlap. The teaching of evolution is a classic

case. It is *disciplinary* philosophy that elaborates the theory's history, structure, and evidential support. But it is *general* philosophy of education that elaborates and appraises the contentious arguments about whether and to whom it should be taught. This combination of disciplinary and general considerations arise when there are clashes between worldviews and claims of science and those of culture. In the USA, and elsewhere, the tension is exasperated by a legal framework: The US Constitution allows teaching *about* religion, but prohibits the teaching *of* religion in State schools, so the disciplinary question of whether Special Creation or Intelligent Design are truly science, is paramount. This is a philosophy of science question that is thrust upon science teachers. The philosophical, cultural, educational, and legal literature on this particular issue is extensive (Ruse 1988).

In these respects, there is a greater onus on teachers than on 'ordinary' scientists. The latter can satisfactorily do their job in industry or in a laboratory without knowing much about the 'big picture', methodology or much else of science; they just do their job. Hopefully they know more, but for doing their job, they do not need to. This was, and still is, the situation of hundreds of thousands of scientists in China, who had shockingly limited, narrow-focused training (Fang 1992). There were BSc (radio valves) degrees conferred. Students learnt about nothing other than radio valves, about which they became very competent. Although called scientists, they were technicians, and after William Shockley's 1947 invention of the transistor, and subsequent mass production of transistor radios, the hundreds of thousands of radio valve 'scientists' were deemed useless. But a teacher's 'job' is to explain to classes, minimally, the meaning of the terms and concepts used in the class: What is a law? What is a theory? Why is one theory preferred to another? What constitutes evidence for a law?. This involves acquaintance with the bigger historical and philosophical picture of science.

Years later, as editor of *Science & Education*, I reproduced [Scheffler's article](#) in the first volume. It was the journal's first 'Golden Oldie'. Subsequently, at the invitation of Harvey Siegel, I published [an article](#) appraising and elaborating Scheffler's position (Matthews 1997).

The division of general from disciplinary philosophy of education in my UNSW courses was the beginning of my more formal HPS&ST research. Although it was a small conceptual step from HPS for trainee science teachers to a full-blown HPS&ST research programme, the actual step would come a decade later. Initially my interests were purely local; my own UNSW classes; I was not thinking about any wider, much less international and institutionalised (societies, journals and books) picture.

Assessment Scandal in the School of Education (1977)

I thought that at UNSW the kind of battles that had been fought at Teachers College were behind me. This was a mistake. In 1977 the STC Green Frog case was replicated by the UNSW 'Idi Amin and his Dancing Girls' case. The School's educational psychologists told students that their compulsory final exam would have a multiple choice format. Students objected to this, saying that their knowledge of educational psychology could not be adequately assessed by such means and, in a series of meetings, they demanded prose-type exams.

Led by Professor Desmond Drinkwater, the psychologists dug in and would not change. There was much agitation. A leading group went on a deputation to Drinkwater who dismissed them as 'Idi Amin and his dancing girls' – the lead male student had a Lebanese

father and an Irish mother. The student was full of fight, having had industrial experience in the workforce prior to coming as a mature student into teacher education. The previous year, one of the 'dancing girls' had been Head of History at one of Sydney's most prestigious girls' private schools. After more deputations and meetings, the School of Education, in a school vote, asked the psychologists to offer two forms of exam - objective choice and prose. They refused. This was appealed to the Faculty of Professional Studies who directed the psychologists to do as asked. They had to comply.

At the end of the year the psychologists presented their results: 130 passed and 110 failed. At the School staff meeting Professor Drinkwater, head of the psychology group, was asked to identify which of the failures had opted for the prose exam. He refused to do so. Failure in the subject was serious as it meant students did not obtain a DipEd, and thus could have no teaching career. Nearly 50% of the university's teacher-education cohort were being failed!

All the philosophers, and some other staff members, fought this matter through meeting after meeting. After we contacted by phone maybe fifty of the failed students and found that all of them had opted for the prose exam (including the lead 'dancing girl' who had high distinctions in each of her other subjects, and who would shortly be appointed Headmistress of one of Sydney's major Anglican girls' schools) it was clear how vindictive, and frankly short-sighted, Drinkwater and his psychology colleagues were. How could they ever imagine, even in a pre-Facebook era, getting away with this travesty?

The furore got into newspapers and appeared in the Australian-wide *National Times*. With the scandal going public, on the radio, and about to hit television screens, the university authorities finally stepped in and passed every student enrolled in the 1977 DipEd, including some who had dropped out of the programme mid-year and had not even completed practice teaching. This truly jaw-dropping, incomprehensible episode, just like the Teachers College 'Green Frog' case, invites the question: How could adult, well-educated people, most having PhDs, make such abominable decisions and stand by them?

Thereafter my time at UNSW went easily and productively enough right through to my retirement at age 60 in 2008. I taught undergraduate and graduate courses in philosophy of education, and a [graduate course](#) in 'HPS&ST'. The content of my HPS&ST courses changed as my own research and writing moved along. But around me, as elsewhere in the world, foundation subjects were progressively taken out of the programme. History went very early, then sociology was removed, and as philosophers retired, they were not replaced. It was the same situation in England (Hirst 2008). I was the last left standing. Psychology, more specifically learning theory, flourished. As discussed below, there was a two-year break (1992-93) when I moved to New Zealand as the Foundation Professor of Science Education. Since 2008 I have been an honorary staff member with no teaching or administrative responsibility.

The Rise and Fall of History and Philosophy of Science at UNSW

The UNSW library has a huge book and journal HPS collection largely because, when the university was established in 1949 out of a former Technical College, it had a visionary, C.P. Snow-inspired 'Two Cultures', Vice-Chancellor (Philip Baxter) who decreed that an HPS course was to be compulsory for all students. Consequently, the first-year HPS class had 1,000 students and it was, by all accounts, marvellously taught by John Thornton, Robert Gascoigne, Bill Leatherdale and others. This course had very popular 'naked eye' astronomy

exercises and other ‘hands-on’ experiential components. Forty and fifty years later students spoke glowingly of this HPS course experience. Of particular interest to me, the library had subscriptions to *The Modern Schoolman*, *The Thomist* and *New Scholasticism*, journals not oft found in Australian universities. As will be mentioned below, in 2000 I published my first pendulum motion book which had 1,300 references, nearly all of which were in the UNSW library.

Unfortunately, the history and philosophy dimensions of the foundation School were progressively diminished in favour of sociology, science policy and Science-Technology-Studies (STS). Despite a line of stellar philosophy of science candidates, successive new professorships went to other parts of the HPS domain. Philosophy was allowed to die off, with just my friend and colleague Peter Slezak, who was appointed in 1981 after completing his PhD at Columbia University, remaining to hold the philosophy fort. The school name was changed from ‘HPS’ to ‘STS’ but when this ‘new direction’ ran out of steam, the name was changed back, but sadly too late. The UNSW HPS School was closed in 2008.

Progressively all other HPS schools in Australia have closed except for University of Sydney. So it is a moot point where Australian students can learn about the achievements of Galen, Buridan, Copernicus, Kepler, Galileo, Huygens, Newton, Boyle, Priestley, Lavoisier, Dalton, Darwin, Mendel, Einstein, Bohr and the diverse revolutions and intellectual and cultural upheavals with which they were associated. All indications are that the bulk of students studying in Australia – science students, humanities students, and even the new Ramsay-funded ‘Western Civilization’ students – will learn nothing of the scientific tradition that so powerfully shaped the modern world.

A Watershed Year: Boston University Sabbatical (1978)

The year after the School of Education psychology assessment battles, 1978, was a watershed year for me. It was the year of my first university sabbatical leave during which, on Wal Suchting’s recommendation, I went to the Boston University Centre for the History and Philosophy of Science. The BU School of Philosophy, and the Centre, were, arguably, at their peak. The marvellous [Boston Studies in HPS](#) series that began in 1961 co-edited by Robert Cohen and Marx Wartofsky was regularly appearing. The Centre Colloquium was held each 6 weeks or so with stellar scholars presenting papers. The staff were outstanding and ranged over a wide spectrum of philosophical schools – Christians, Marxists, Idealists, Phenomenologists, Personalists, Analysts, Whiteheadians, Existentialists, Logical Empiricists, Critical Theorists, and perhaps others. Indeed, Alasdair McIntyre had himself consecutively represented many of these positions.

[Michael Martin](#) was a staff member. His *Concepts of Science Education* (1972) was one of the first full-scale philosophical treatments of science education questions. Michael, and his wife Jane Roland Martin, have been good friends of mine from that time (Michael died in 2015). At BU everyone respected each other; there was an obvious sense of civility and collegiality in relationships. The contrast with the Sydney Philosophy Department and the UNSW School of Education of the time was palpable.

I did one graduate course on Marxism taught jointly by Robert Cohen and Marx Wartofsky. The course text was Robert Tucker *The Marx-Engels Reader* (1969). We worked our way through a selection of the major texts, with Cohen and Wartofsky providing historical and

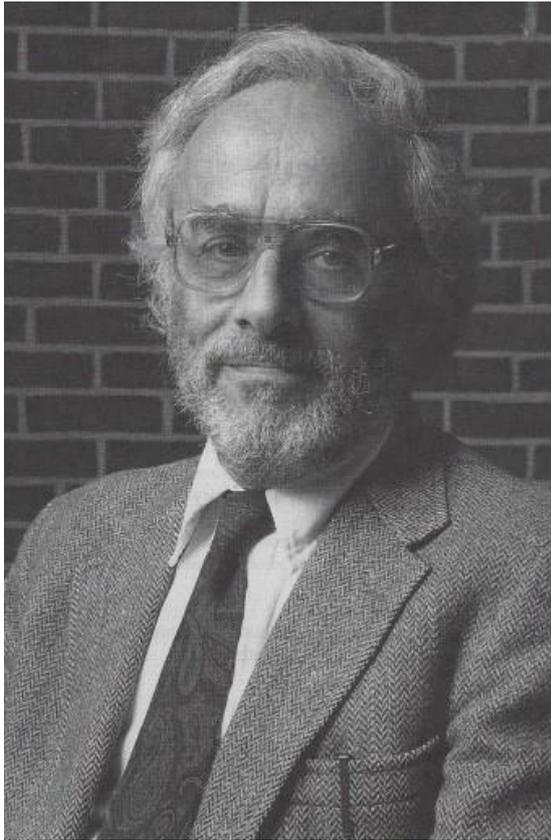
philosophical commentary and elaboration. Their command of philosophy and of Marx's work was impressive, as was their good humour.

[Robert Cohen](#) (1923-2017) was a joint appointment in physics and philosophy; and beginning in the late 1940s was secretary of the 'Vienna Circle' group in the US, whose members included Gerald Holton and Philip Frank. In 1955 he had published a chapter 'On the Marxist Philosophy of Education' in the prestigious *National Society for the Study of Education Yearbook* (Cohen 1955). This was not a good career move for a young academic in McCarthy-era USA, but his Methodist university, Wesleyan, stood by him when many big-name, public and private universities rolled over and fired 'suspect' or 'subversive' staff. Boston University, founded by the Methodist Church, was his next, and final, academic home. Cohen never forgot that he, as a Marxist and Communist, had been supported by a Christian institution.

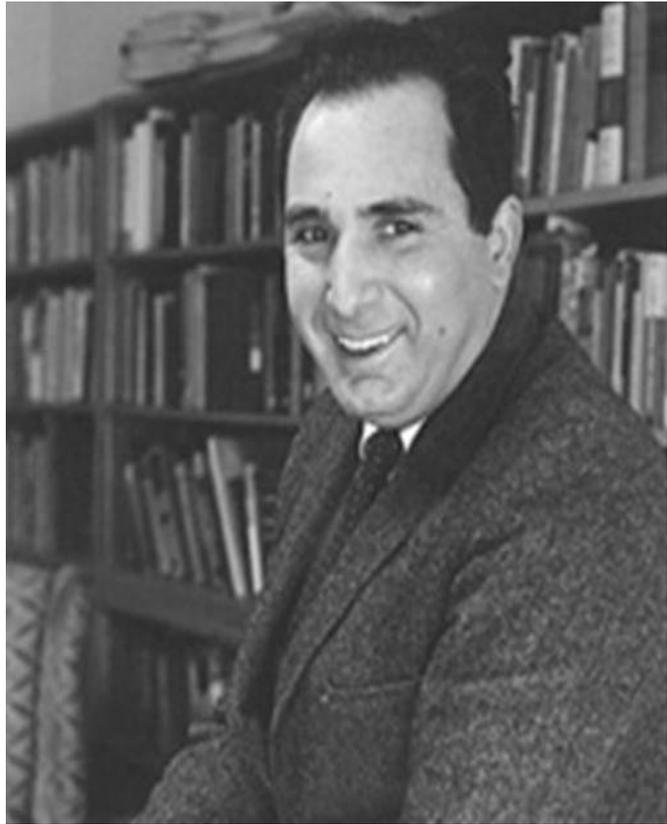
In 1978 Cohen gave me an off-print of a paper '[Individuality and Common Purpose: The Philosophy of Science](#)' that he had delivered as a plenary address to the annual conference of the US Science Teachers Association – 'The largest audience I have ever addressed'. Twenty-five years later, as editor of *Science & Education* I published the lecture as the journal's third 'Golden Oldie' (Cohen 1964/1994). He worked closely with Gerald Holton, also a Wesleyan alumnus, on the creation of *Harvard Project Physics* and wrote a university Physical Science text that embodied his philosophy of science and philosophy of education (Cohen 1975).

[Marx Wartofsky](#) (1928-1997) was one of the luminaries of North-American philosophy. At Columbia he was a student of John Herman Randall Jr., a world-class historian of philosophy, and of Ernest Nagel, the noted philosopher of science whose major work was the text in my 1967 University of Sydney philosophy of science course. He graduated from Columbia in 1952 but on account of his public socialist views could not secure an academic appointment until 1957 when he was employed as a philosophy professor by the Methodist, Boston University. Wartofsky's masterful study *Feuerbach* had been published the year before I arrived. Unfortunately, his *Conceptual Foundations of Scientific Thought* (1968) had not been mentioned in Sydney University philosophy of science programmes, nor indeed it seems in many other philosophy programmes.

The professional neglect of *Conceptual Foundations* is a pity as the book exhibits most of the features of good philosophy of science: it was wide-ranging in its historical sweep, it was informed by scientific practice, it connected philosophy of science to general philosophy and metaphysics, it recognised the place of ethical and social values in science, and it was clearly written. In some crucial respects, the book was decades ahead of its time. What did, however, receive rightful and wide attention was his paper 'Metaphysics as Heuristic for Science' (Wartofsky 1968).



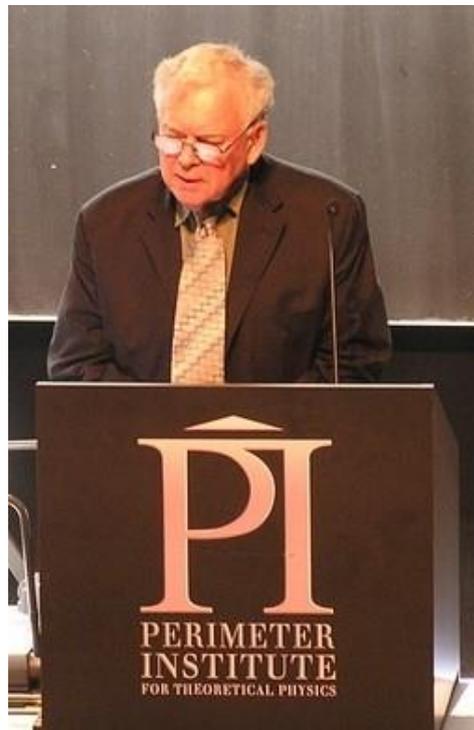
Robert S. Cohen



Marx W. Wartofsky

My other graduate course was on Galileo taught by [Abner Shimony](#) (1928-2015), who like Cohen, was a joint appointment in the Departments of Philosophy and of Physics. Shimony had a PhD in physics and contributed original work to experimental quantum mechanics, specifically a monumental piece on the experimental test of Bell's Theorem. He had a second PhD in philosophy from Yale, supervised by Rudolf Carnap.

Shimony published original, highly-technical and significant pieces on many foundational questions in physics and in philosophy (Shimony 1993a, b). The twenty-four contributions to his [Festschrift](#) are witness to this (Myrvold & Christian 2009). Additionally, he wrote poems, plays and a children's book about a child whose birthday was 'wiped out' by the Gregorian calendar reform.



Abner Shimony

It is noteworthy that his semester graduate philosophy of science course was simply a reading from front to back of Galileo's *Dialogue Concerning the Two Chief World Systems* (Galileo 1633/1953), with his philosophical commentary on Galileo's developing argument. He did not try to impress or intimidate students with his own immense erudition. Galileo, and understanding Galileo, was the focus; as that was done, the philosophical 'lessons' were drawn.

To my shame, and perhaps also to the discredit of my Sydney University education, I had never to that time read a page of Galileo: we read about Galileo, and quotes in support of some philosopher's argument, but did not read Galileo's text. This signifies, in part, the difference between philosophy making use of history, cherry-picking history, and taking history seriously.

Shimony's course was a head-turner; it set me on a path of historical-philosophical investigation that I have followed to the present. The semester course manifested the value of wedding philosophy of science to history of science. This was the pattern of 'BU Integration', so clearly displayed in volume after volume of the *Boston Studies* series. The Sydney Philosophy Department certainly defended science, but they did so as informed spectators, as readers of *Scientific American* or *Nature*; the philosophers of science at Boston University were both defenders of and participants in science. The university had the admirable practice of joint appointments, so that a number of philosophy professors were also professors of sociology, history, education, physics, biology, divinity, and so on.

In reading the *Dialogue* I was particularly taken by Galileo's pendulum experiments and their fecundity for elaboration of fundamental epistemological issues. They so well embodied and manifested the difference between the old Aristotelian, perceptually-anchored science, and the new experimentally-anchored Galilean/Newtonian science. Additionally, they had tremendous pedagogical utility. I gave some papers on these topics at PESA and PES conferences (Matthews 1998, 2001). As I will later relate, I wrote a book on the subject *Time for Science Education: How Teaching the History and Philosophy of Pendulum Motion can Contribute to Science Literacy* (2000), and edited, with Colin Gauld and Art Stinner, a pendulum-studies anthology (2005).

Another important 'takeaway' from Shimony's course was the role of thought experiment, *Gedankenexperiment*, in Galileo's new science, and subsequently in modern science. This led me to the rich world of Ernst Mach studies (Matthews 1989, 1990). A subject I returned to thirty years later (Matthews 2019).

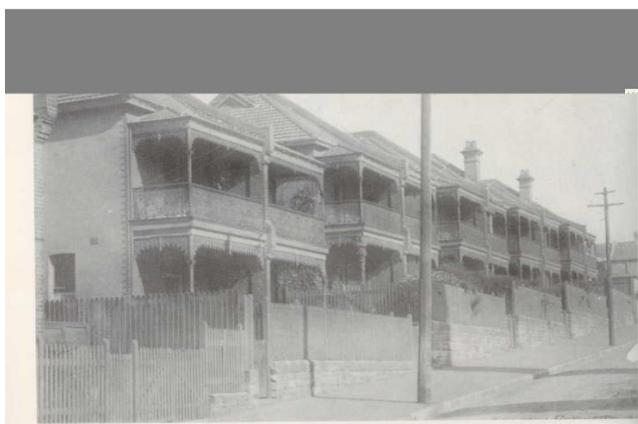
Alderman, Sydney City Council (1980-85)

Returning from Boston at the end of 1978, local Sydney politics unexpectedly loomed large in my life. It would be nice to think that this was a 'philosopher takes on City Hall' story, but the reality was more prosaic. In 1975 I had moved to Ultimo, a run-down tiny suburb literally in the shadow of Sydney's Central Business District. There, large 4-bedroom houses sold for almost nothing, so I could afford to buy one. In 1980 I attended a small neighbourhood protest meeting over a clearly obnoxious development and being the only person attending with no legitimate excuse not to take the protest to a council meeting, I became spokesperson for the group. The same year a long-sitting Australian Labor Party (ALP) alderman (who had never lived in the area) was retiring and he organised for his son

(who also had never lived in the area) and his son's girlfriend (who, needless to say, had never lived in, and perhaps had never even visited the area) to be the Labor candidates for this inner-city ward in the 1980 election.

People were prepared to accept the son. Nepotism was how inner-city politics worked at the time; they were less prepared to accept the free-loading girlfriend. There was general agitation for an alternative, and as better known and credentialed locals stepped back, I became the candidate of the Active Residents Campaign.

Phillip Ward was a collection of mostly poor inner-city suburbs – Pymont, Ultimo, Chippendale, North Newtown, Camperdown, Haymarket and Sydney University, plus half of the Central Business District of Sydney. The ward had a voting population of about 10,000. Pymont and Ultimo were called 'Sydney's Sink': whatever developments were not wanted by better suburbs went into Pymont and Ultimo.



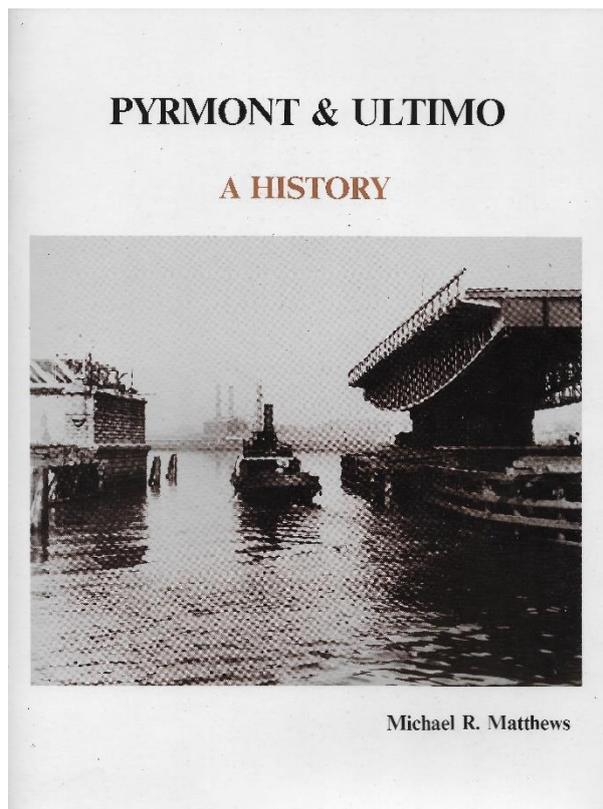
Pymont houses demolished for car park (1980)



Ultimo abandoned light industry (1980)

Traditionally Phillip Ward returned two Labor and one Civic Reform (Liberal Party, conservative) aldermen. I gained the votes of many on the left of the ALP, so splitting the total Labor vote thus denying election of the girlfriend. In September 1980 I was thus elected to Sydney City Council as the first independent alderman since the First World War. When I was elected, 365 votes were cast in the Pymont sector of the ward, and not many more in the Ultimo sector; now 15,000 people live in Pymont and 10,000 in Ultimo. As with all inner cities around the world, gentrification and development of abandoned industrial sites have exploded the population. In 1980, as with a number of other moments in my life, I happened to be in the right place at the right time.

Many early struggles were about needless demolition of occupied and unoccupied houses and factories. In 1980 a row of splendid terrace houses in Pymont were demolished for a carpark of the adjacent Colonial Sugar Refinery, which ten years later itself was to close. I led campaigns against this. When the *Sydney Morning Herald* published a letter from the Pymont Catholic priest supporting my stand and refuting the Labor Party's claims, the Party at the very next council meeting cut off funding to the Pymont 'Mission to Seamen', a charitable work that the council had been funding for 50+ years. In Ultimo abandoned industrial sites were demolished for a road that was never built. City politics was played hard. With a stream of letters to the *Herald* and radio interviews I was able to publicise the 'underbelly' of council business.



Pyrmont & Ultimo: A History (1982)

**THERE IS AN ALTERNATIVE
ON MARCH 24th**

1 ALD. MICHAEL R. MATTHEWS

INNER CITY RESIDENTS NEED NOT SETTLE FOR CORRUPTION
ON THE ONE HAND OR NEGLECT ON THE OTHER. THERE IS AN
ALTERNATIVE — CITY COUNCIL, ALDERMAN
MICHAEL R. MATTHEWS.
INDEPENDENT

For decades **both** political parties have turned their back on the inner city. Labor thinks it cannot lose the state seat of Elizabeth; Liberals think they cannot win it. Make it an independent seat and force both parties to pay attention to our problems.

The two state independents —
Ted Mack in North Sydney and John
Hatton on the South Coast — have
clearly demonstrated the worth of
energy, integrity and independence in
Parliament.

In this needless state election tell
Macquarie Street that you want attention
and action not party hum-bug.

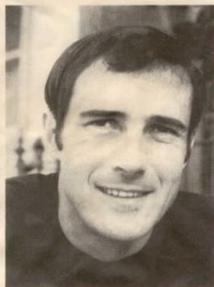
**The Labor candidate has occupied the
seat for 30 years and has done
nothing. The party's retirement rules
were set aside so he could serve still
another term.**

**ELECTORS AND THE CITY
DESERVE BETTER.**

ALD. MATTHEWS LIVES IN NOISY, TRAFFIC CONGESTED ULTIMO. THE LABOR
CANDIDATE HAS FOR YEARS LIVED OUTSIDE THE ELECTORATE IN LEAFY
CENTENNIAL PARK. ALD. MATTHEWS KNOWS THE PROBLEMS OF INNER
CITY LIFE.

VOTE FOR THE LOCAL CANDIDATE
VOTE FOR THE INDEPENDENT CANDIDATE

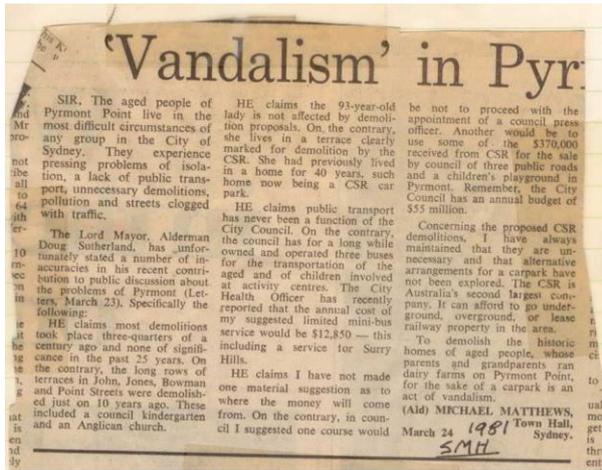
You can assist in the campaign.
Donations and offers of help to —
"Active Independent Campaign"
80 Macarthur Street, Ultimo 2007.
Elizabeth 27 8740 h.h.



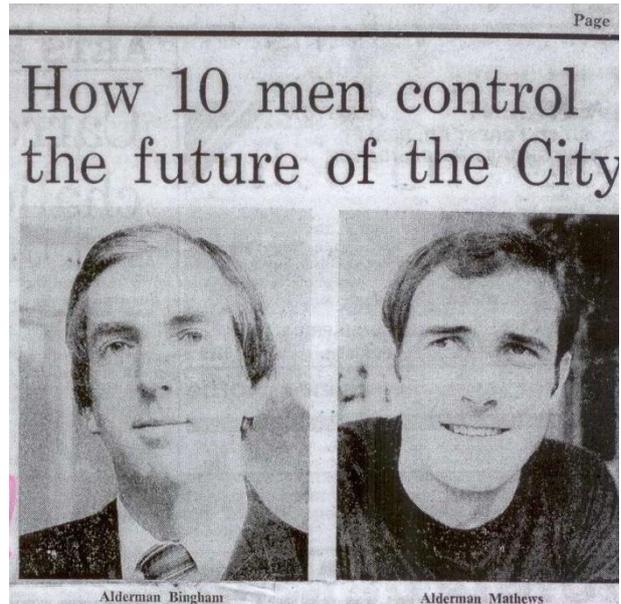
City Council Campaign (1984)

My unexpected election was one of those little things that had wide unintended consequences. With the girlfriend not elected, the left wing took power over the right wing within the ruling Labor Party group of the City Council by one vote (4:3). This was intolerable to the right-wing leadership of the state Labor Party who controlled NSW parliament. The state party had to be able to deliver Sydney Central Business District (CBD) zoning, development and other 'favours' to its financial backers and friends. Without control of City Council, it could not do this. The answer was for the State in 1982 to amalgamate City Council with the adjacent right-wing dominated South Sydney Council. This sounded like a good, and routine, idea at the time – the City Council boundaries always took the shape of the last state government's foot that trod upon them. But it spectacularly backfired when at the following 1984 election, independent candidates won seats in all the old South Sydney wards, and the Labor party lost control of the expanded City Council.

I served two terms on Council. The time commitment was immense – fortnightly Council meetings interspersed with fortnightly committee meetings, site inspections, constituent meetings, newsletter editing, writing letters and articles for Sydney newspapers, and so on. During this period, and utilising the Council resources that were freely available to me, I wrote a local history book (*Pyrmont and Ultimo: A History*, 1982), which became at the time, and might still be, the largest selling 'local history' book published in Australia.

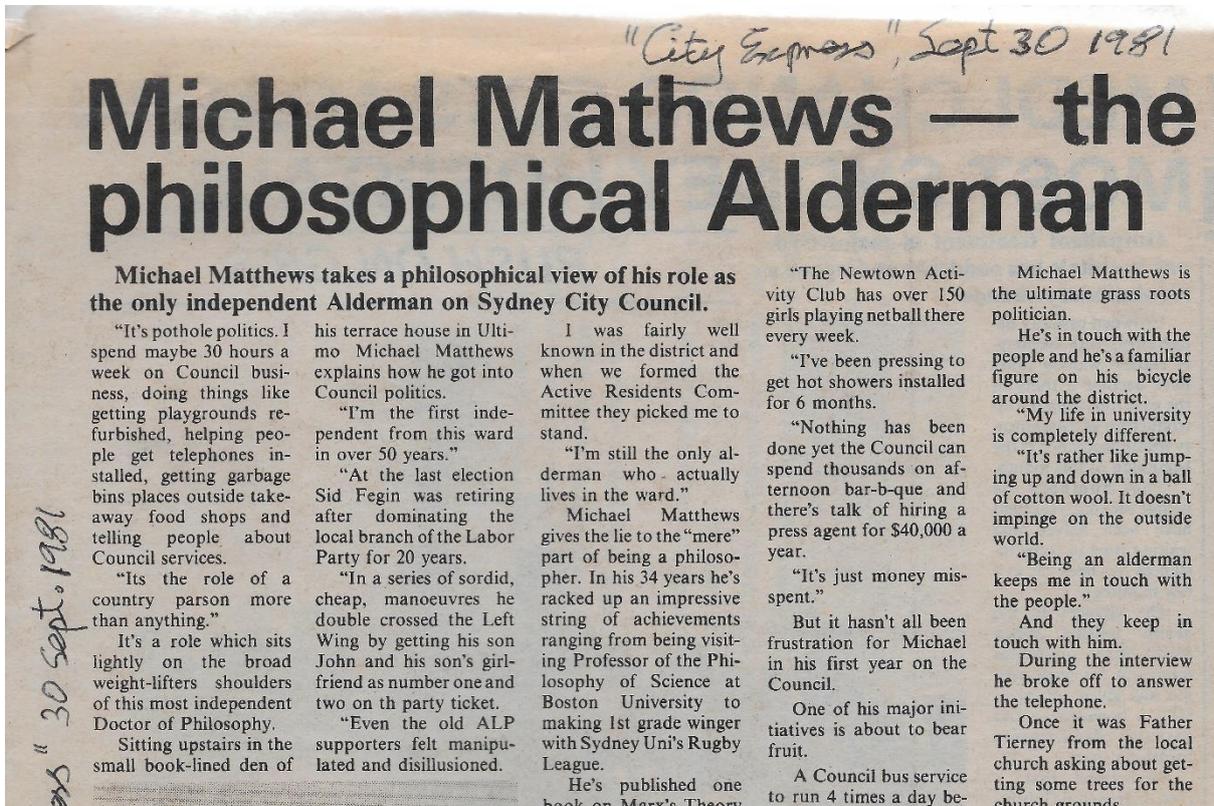


Sydney Morning Herald (1981)



Sydney Morning Herald (1982)

My six years in local government were valuable and formative. Council dealt with millions and millions of dollars of development applications every second week. Weighing up development, against conservation, against city planning rules and regulations, against resident opinion, state demands, and so on, was an exhausting but formative regime. In-between weeks there were committee meetings. I was chair of the House Committee. Additionally, there were troves of other business that needed attention and decisions.



City Express 30.9.1981

After the 1984 'boil-over' election I failed by one vote on the expanded 27-member council to be elected Deputy Lord Mayor of Sydney. I had support of the independents and the conservative Civic Reform group, but [Jack Munday](#), a prominent and successful independent candidate was offered, and took, chairmanship of the Planning Committee in return for supporting the Labor candidate.

After my retirement in 1985, independents did take control of Council and have, on and off, kept it to this day. I must have done something right in my trail-blazing two terms. The two independents who worked with me and followed me into Council – Clover Moore and Frank Sartor – both went on to be progressive and notable Lord Mayors of Sydney. Both became members of State parliament. Frank, who joined the Labor Party, missed out by two internal party votes on becoming Premier of NSW. Doubtless I could have extended my sojourn in local government and maybe risen higher, but it would have meant a complete break with academic life which I was not prepared to accept.

It is perhaps worth relating that in the 1984 Council election campaign I used to doorknock lonely streets on weekends with Frank Sartor, him taking one side and me the other. At the end of the street he would ask for the house numbers of those who were not at home so we could go back another time! I kept no such list; I was inwardly relieved when a door was not opened. Later when elected Frank would phone at 11pm or later to discuss an amendment to a following day's motion that eight times out of ten could have been suitably sorted out on the floor of the meeting. But 8/10 was not good enough. Frank's drive was indicative of the sort of focus that is needed to go to the top of politics. Clearly, I had that drive in part or I would not have been elected to City Council, but I did not have it in full. Further, during my brief political life I had other things to do, namely university teaching and writing of my MA (Hons) thesis on Galileo.



Frank Sartor (1984)



Clover Moore (1984)

If there was any ‘philosophical’ perspective evident in my Council activity, it was my commitment to judging matters on their merits. This might be a simple and obvious point. But, in a situation where Council votes were determined by prior caucus decisions made by both major parties, or by the financial interests of the political parties (and their donors), or by how aldermen had voted on some previous motion (‘if you vote for my park, I will vote for your rezoning’), to argue that matters be considered on their merits, was revolutionary, or at least unheard of.

What constituted ‘merit’ was not always obvious, and it was an evolving idea. Some things had obvious merit – conservation of historic buildings and precincts, support for the underdog, elimination of cronyism in Council grants and housing allocation, support for residents against through traffic, provision of pedestrian malls, height limits to avoid gross shadow effects, provision of council recreation facilities, favouring public transport over private car use, transparency in decision making, and so on. These were a political platform.

But the City of Sydney was not just some ordinary local town or suburb. It was the transport hub of NSW, it was the financial hub of the state if not of Australia, perhaps a quarter of a million commuters daily came to the city to work in establishments that paid the bulk of the city’s rates. So, council deliberations were not just be about local resident affairs; ‘merit’ had a wider purview. Making a local connecting street a peak-hour clearway greatly benefited thousands of commuters, and adversely affected a hundred residents. What is the outcome of a merit analysis?

Transparency was an early issue for me. The salaries of the Prime Minister of Australia and the Vice-Chancellor of UNSW were public but not that of the council's Town Clerk. In State government, business, and universities, senior positions were publicly advertised, for City Council they were only advertised internally. Council had a rightly lauded 'public housing' policy and owned hundreds of flats, apartments and houses. These were for deserving members of the public. As an election candidate, then as an alderman, I had occasion to visit many. What became clear was that predominately the tenants were council employees. Council was running an employee housing scheme under the name 'public housing'. This extended to the highly-paid head of the Parks Department living in the two-story ranger's house in one large harbourside park. The policy was defended on the grounds that 'the tenants can never avoid paying rent, it comes out of their salaries'. These arrangements had been the status quo for decades; both political parties benefiting from it. I set about, with some success, publicising and ending these arrangements. Being a serious liberal was revolutionary enough in local government, one did not have to be a radical to stand out or make headlines.

MA Thesis on Galileo (1979-85)

In 1979 I enrolled in an honours MA degree in history and philosophy of science at the University of Sydney. I did this in order to write up in a more systematic and disciplined way the Galileo interests I had developed during the previous-year's Boston University sabbatical. The thesis topic was *The Natural/Violent Motion Distinction in Galilean Mechanics*. Writing time competed with council commitments and UNSW teaching.

I benefited from writings on the subject by Thomist philosophers of science, in particular William Wallace *Prelude to Galileo* (1981) and James Weisheipl *Nature and Motion in the Middle Ages* (1985). The six chapter-headings indicate its contents: Introduction; Aristotle on Motion; the Medieval Inheritance; the *De Motu* period; Nature, Natural Motion and Gravity in Galileo's Mature Works; Post-Galilean Developments. There were 160 references, nearly all of which, most conveniently, were in the UNSW library.

Aristotle's treatment of motion, or more generally of movement, had both physical and metaphysical dimensions. Most discussion in philosophy, and in education where there is any, concentrates on the former usually identifying the erroneous Aristotelian 'law' of motion: an object's speed equals force applied divided by resistance of the medium through which the object moves. Erroneous, but it corresponds with a good deal of common sense and everyday experience. It is the common naive assumption brought to school by students that then has to be unlearned (diSessa 1982); and frequently it is not, students learn a formula, but they do not internalise the physics (Ebison 1993).

The sense of motion discussed here is an object's change of place, what Aristotle calls 'local motion', and what now is basically just called 'movement'. But objects do not just change position, they themselves change, they undergo change of substance and quantity. But for Aristotle, understanding change necessarily led to metaphysics. And famously, in Thomism, the Aristotelian understanding of change led to theology, and on to God. Aquinas utilised Aristotle's account of motion in his fundamental proof for the existence of a 'Prime Mover, who all call God' (Buckley 1971, Pt.1).

This leads to Aristotle's realism about potentiality and its actualisation. The Anglican Thomist, E.L. Mascall, defended this fundamental Aristotelian tenet:

For unless we are prepared to say that, if X changes into Y, Y was potentially in X before the change, we shall not be recognizing that X *has changed* at all. We shall, instead, be assuming that X has been annihilated and that Y has been created to take its place, and we shall be substituting for the rich complexity of a universe which, with all its processes of generation and corruption, of life and death, persists through time a succession of discrete states without any real continuity. (Mascall 1943, p.43)

The idea of real potentiality is not without problems, nevertheless it was accepted by non-Thomist philosophers such as Whitehead and Shimony. Whitehead somewhere wrote: ‘The present is pregnant with the future’. The topic of potentiality has had a considerable revival in contemporary philosophy, with a Springer *Handbook* devoted to the subject (Engelhard & Quante 2019) and one chapter being on ‘Potentiality in Aristotle’s *Metaphysics*’ (Marmodoro 2029). More generally, Aristotelian metaphysics has had a revival in contemporary philosophy of science (Lamont 2009).

Rom Harré and Edward Madden advanced arguments in their *Causal Powers* book (Harré & Madden 1975) that are explicitly Aristotelian, indeed Thomist. They talk of internal powers rather than potentials; and say that ‘we would assent in all essentials to Aquinas’ theory, as interpreted by Anscombe and Geach’ (Harré & Madden 1975, p.100). Against the Humean and widespread empiricist understanding of causality, they echo Mascall’s foregoing argument:

It is our contention that the Humean event-ontology is unable to make sense of the material identity and continuity involved in the rational explanation of change we have been examining. ... On our view, ‘event’ is to be understood in terms of an ontology of enduring things, while on the Humean view enduring things are conceived to be constructions of events. (Harré & Madden 1975, p.109).

Education authorities and teachers constantly invoke real potentials when they speak of ‘students realising their potential’. Literally they are saying that there is something there to be realised; they are Aristotelian realists about potential. Perhaps when pulled up, their realism might dissolve into instrumentalism: there is nothing there, the expression simply refers to a possible future state-of-affairs. This desiccated account of potential hardly captures the educational realities with which teachers, parents, and administrators deal. Israel Scheffler has well written on the subject (Scheffler 1985).

Aside from historical background, the fundamental epistemological distinction that I articulated was between real objects and the theorised objects of science. I saw this distinction in Galileo’s work (Matthews 1988). The distinction sat comfortably with Althusser’s anti-empiricist, Marxist, distinction of real and theoretical objects. History of science and Marxist epistemology fitted well together. The distinction is fairly basic and not especially sophisticated: real objects, events and processes are always ‘messy’, they are mostly imperfect, and subject to multiple influences.

Galileo acknowledged that events do not always correspond to his theory. The material world and his so-called ‘world on paper’, the theoretical world, did not correspond. In his *Two Chief World Systems*, concerning his inclined plane experiment, he instructs Simplicio:

Remember that I said a perfectly round ball and a highly polished surface, in order to remove all external and accidental impediments. Similarly, I want you to take away any impediment of the air. (Galileo 1633/1953, p.146)

In his *Two New Sciences*, after mathematically establishing his famous law for the parabolic motion of projectiles, he writes:

I grant that these conclusions proved in the abstract will be different when applied in the concrete and will be fallacious to this extent, that neither will the horizontal motion be uniform nor the natural acceleration be in the ratio assumed, nor the path of the projectile a parabola. (Galileo 1638/1954, p.251)

Science both *abstracts* from and *idealizes* the natural world; it does not deal with the world as given in experience. Science simplifies reality; it describes idealized objects and processes: the reaction of pure substances, frictionless movements, idealized genetic transmission, elliptical planetary orbits, and so on. This is why Nancy Cartwright titled her well-received book *How the Laws of Physics Lie* (Cartwright 1983). They lie because physics and the laws of physics are not immediately about everyday objects and processes, much less our experience of those objects and experiences. Galileo approached the law of falling bodies by rolling them down inclined planes, not by dealing with them directly, not by looking at a naturally falling body. Kant remarked that:

When Galileo caused balls, the weights of which he had himself previously determined, to roll down an inclined plane; when Torricelli made the air carry a weight which he had calculated beforehand to be equal to that of a definite volume of water . . . a light broke upon all students of nature. They learned that reason has insight only into that which it produces after a plan of its own, and that it must not allow itself to be kept, as it were, in nature's leading-strings (Kant 1787/1933, p.20)

For this reason, the Romantic criticism of science – science does not deal with the full complexity of nature – misses the point. Science advances precisely by *not* dealing with the full complexity. Aldous Huxley correctly observed:

The scientific picture of the world is inadequate, for the simple reason that science does not even profess to deal with experience as a whole, but only with certain aspects of it in certain contexts. All of this is quite clearly understood by the more philosophically minded men of science. . . . [Unfortunately] our times contains a large element of what may be called 'nothing but' thinking. (Huxley 1947, p.28)

Bill Rozeboom, my philosophy honours advisor, had made the same point:

. . . the natural sciences have long since learned to appreciate the power of idealized approximations ('models') which highlight the essentials of phenomena too intricate to be grasped at the outset with errorless accuracy, and the importance of 'robust' conclusions which are largely indifferent to the particular details of simplifying assumptions. (Rozeboom 1970, p.196)

What connects the scientific picture to the world is experiment, not experience.

The MA degree was awarded, with second-class honours, in 1985. There were still some Sydney PESA meetings, and one in the early 1980s at Newcastle that I attended. I also began attending US PES meetings, presenting some of my Galileo studies (Matthews 1988), and

profitably engaging with science-interested PES members – Harvey Siegel, Denis Phillips, Jim Garrison, Robert Ennis and Stephen Norris.

Education versus Publication Pressure in Universities

In Australia, through to the 1990s, there was no great pressure on academics to publish. I was appointed to UNSW in 1975 without a PhD. The expectation was that one *learnt* things, became better educated, mastered one's discipline, and aspired to a scholarly life. Publications were the outgrowth of this, not the measure of it. Suchting used to publish about three articles each two years. This was the Sydney Philosophy standard. My first publication was five years after appointment to UNSW; it was in 1980, the year I was elected to City Council. At Teachers College I was encouraged to complete my honours degrees in philosophy and psychology and my MEd degree in philosophy of education. At UNSW I was encouraged to complete my honours HPS degree on Galileo and my PhD degree. Nowadays when a university's reputation and income is tied directly to publication output, such further studies by staff are seen as a distraction from publishing, as diminishing the income stream, and fatal to one's tenure case. One obvious consequence is that university staff have a greatly narrowed field of disciplinary vision; they are more and more specialised; knowing more and more about less and less.

Overwhelmingly the standard 'preparation' pattern for university science education faculty is for the staff member to have completed an undergraduate or graduate science degree, completed teacher education, taught school science for some years, then complete course work and thesis for a PhD in education. Then be appointed to a university position. Unfortunately, this employment trajectory results in widespread shallowness, amateurism, faddism and 'sloganeering'. Education faculty have to teach about and supervise in psychological areas (e.g. learning theory), sociological areas (e.g. classroom dynamics, school funding, resources and participation), historical areas (e.g. curriculum change and politics), and philosophical areas (e.g. nature of science, social responsibility of teachers) with little if any formal training in these disciplinary fields. The situation has been made worse as such 'foundation' courses which were once a part of doctoral coursework requirements have been progressively abandoned.

Peter Fensham in his important book on the discipline of science education (*Defining an Identity* 2004) recognises this malaise and says that 'science educators borrow psychological theories of learning ... for example Bruner, Gagne and Piaget', and that: 'The influence of these borrowings is better described as the lifting of slogan-like ideas from these theories' (p.105).

He could have mentioned that the situation is even worse when it comes to philosophical borrowings. So, for instance, instead of the thoughtful and informed examination of Kuhn's work, a review by Cathleen Loving and Bill Cobern of his impact on the field concluded that 'science educators had become a cheer squad for Kuhn' (Loving & Cobern 2000). Instead of appraisal, there was cheering. I tried to address the problem by advertising for contributions for a double issue of *Science & Education* on '[Thomas Kuhn and Science Education](#)' that was published in 2000. In 2004 I published a long piece on the topic - '[Thomas Kuhn's Impact on Science Education: What Lessons can be Learned](#)' - that documented both the trove of mistaken interpretations of Kuhn held in the science education community, and the community's endorsement of his seemingly idealist and relativist positions. On account of Kuhn not being overly careful about his philosophical asides, and the fact that his own

positions changed over time, there is debate about just how much of an idealist and relativist he was (Massimi 2015, Hoyningen-Huene 2015). My paper was informed by the previously mentioned 1975 Sydney University honours' seminar on Kuhn. I concluded:

the science education community should more effectively engage with on-going debates and analyses in the history and philosophy of science; and although members of the education community should be lauded for taking and arguing positions in the history and philosophy of science, these positions should be held with full acknowledgement that most of them are disputed. (Matthews 2004, p.112)

It is not the individual faculty member's fault. It is a systematic fault; one that pleasingly did not infect Australia until well after my appointment at UNSW. I used to say to newly appointed faculty in the USA when I met them at conferences: 'Terrific that you have a position, now you can go to the library and read some of the classics in the field that you have never read'. Their reply was always: 'Michael, we do not have time to read, there is a progress review coming up at the 3-year mark, and I have to have conducted some piece of research and submitted something for publication'.

Established staff are not without these pressures. In the late 1990s, I met a senior science education academic in the UK and asked something about a widely publicised and topical book. The reply was: 'Michael, we barely have time to read articles, let alone read books'. He was specifically referring to the UK pressures on accountability, fund-chasing, and general 'administrivia' that was taking up so much time of academics. If senior scholars are not reading books, then the university education is in serious trouble.

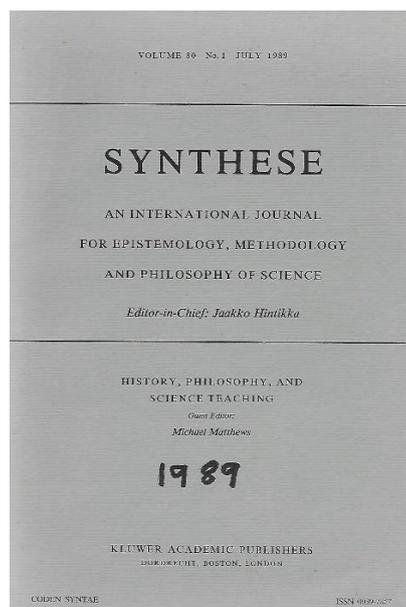
So instead of reading Aristotle, Galileo, Newton, Maxwell, Darwin, Faraday, Dewey, Piaget, Bruner, and related secondary literature, new staff spend their time video-taping lessons, transcribing student interviews, and producing limited, local, uncontrolled and unscientific research that few people will read, and that notoriously has little impact on science teaching or on anything else. All of this 'busyness' just gets in the way of junior faculty's own education and learning. Far better for everyone if new staff read and study for 3-5 years then publish something substantial that will have a long shelf-life.

Florida State University, Tallahassee Conference & Founding of IHPST Group (1987-89)

My three decades of engagement with the [IHPST Group](#) (International History, Philosophy and Science Teaching Group) has shaped and defined whatever long-term contribution to academic life that I have made. In 1987, after six years of political activity in which university work was barely ticking over, I took sabbatical leave in the Philosophy Department at Florida State University, Tallahassee. It was from here that my subsequent three decades engagement in History, Philosophy and Science Teaching (HPS&ST) research was launched. I went to Tallahassee because David Gruender, who had written on Galileo was there, and because there were some capable philosophers - Jim McMillan and Manny Shargel - in the Education Department. In addition, FSU had the national champion college women's rugby union team that had been written up in the Australian press. In 1979 I had played my last game of rugby league for Sydney University so in 1987 at FSU I enjoyed coaching both the women's team and the men's team, with the women being ever more serious and diligent about training than the men.

My HPS&ST work, and subsequently the IHPST Group, was launched when I returned in April 1987 from a large Washington AAAS conference to mark the tri-centenary of publication of Newton's *Principia* (1687).

I remarked over coffee to [Jaakko Hintikka](#), the FSU philosopher who was the editor of Springer's prestigious *Synthese* journal, that it was a great pity that science teachers do not attend such HPS conferences as there was so much presented that would interest them, and inform their teaching. He suggested I guest edit a special issue of *Synthese* on the topic of 'History, Philosophy and Science Teaching' as a means of ascertaining interest in the area. I jumped at the opportunity.



Anchor journal *Synthese* (1989)

It is perhaps noteworthy that from something very casual and unplanned, a substantial scholarly and institutionalised research field grew.

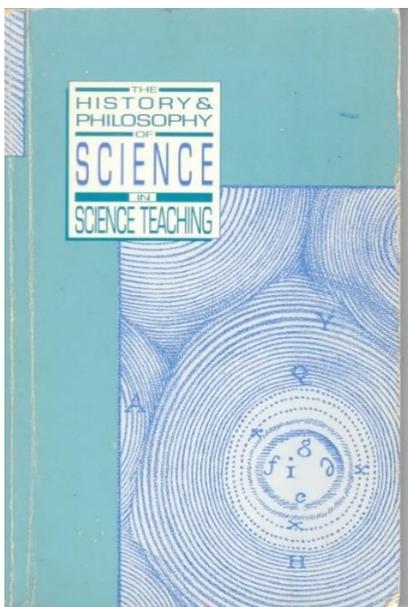
I began writing to a dozen individuals who I knew would be interested in contributing. They in turn recommended others, who recommended still others. In the end I had about 60 excellent manuscripts from scholars all over the world. About ten could appear in *Synthese*, so rather than return the others I contacted journal editors I knew to see if they were interested in special issues of their journals on the topic. Among those responding positively was James Kaminsky, the editor of PESA's *Educational Philosophy and Theory* journal. As it turned out, this was the first of the six special issues to be published ([Vol.20 No.2, 1988](#)). Others were *Interchange* ([Vol.20 No.2, 1989](#), [Vol.24 Nos.1-2, 1993](#)), *Studies in Philosophy and Education* ([Vol.10 No.1, 1990](#)), *Science Education* ([Vol.75 No.1, 1991](#)), *Journal of Research in Science Teaching* ([Vol.29, No.4, 1992](#)) and of course the flag-ship *Synthese* ([Vol.80 No.1, 1989](#)).

Among scholars published in these seminal issues were: Harvey Siegel, Mark Silverman, Martin Eger, Nancy Nersessian, James Cushing, Ian Winchester, Stephen Brush, George Kauffman, Joseph Pitt, James Garrison, Michael Ruse, Fritz Rohrlich, Arnold Arons, Charles Birch, Joan Solomon, Roger Bybee, Jim Stewart, Dimitri Ginev, Norman Lederman, James Wandersee, Zoubeida Dagher, George Cossman and Derek Hodson.

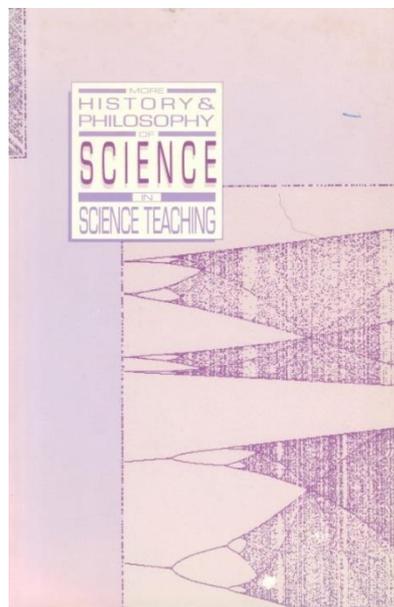
The time was ripe for a concerted international effort to bring the worlds of HPS and science teaching together; something hitherto done only spasmodically, for instance around creation of the *Harvard Project Physics* course and the Biological Sciences Curriculum Study (BSCS) *Web of Life* course. David Gruender, the wonderfully supportive FSU philosopher, suggested seeking National Science Foundation funding to bring all contributors, and others, together for a conference on the subject at Florida State University. After a good deal of his effort, and use of his many contacts, this application was successful. Both of us worked with Kenneth Tobin, an Australian newly appointed to a professorship of Science Education at FSU, to organise the first HPS&ST conference which was held in Tallahassee in November 1989.

Fortunately, in the process of ‘networking’ for the conference, contact was made with Fabio Bevilacqua from the University of Pavia who was chairman of the Interdivisional Group on History of Physics of the European Physical Society. The European group had already held education conferences in Pavia (1983), Munich (1986) and Paris (1988). Subsequently it would hold conferences in Cambridge (1990), Madrid (1992), Szombathely (1994), and Bratislava (1996) with printed Proceedings being produced for each of these meetings. Bevilacqua, an historian of physics in the Pavia University Physics Department, had completed a PhD in the History and Philosophy of Science at Cambridge University, with a thesis supervised by Mary Hesse and Gerd Buchdahl.

About 200 researchers from 30 countries attended the Tallahassee conference. It marked the beginning of the International History, Philosophy and Science Teaching Group ([IHPST](#)), of which I was foundation secretary and Newsletter editor. In its different forms, I have retained the [latter position](#) to the present time.



Tallahassee 1989 Conf. Proceedings vol.1



Tallahassee 1989 Conf. Proceedings vol.2

There are many things that can be said about the background and deliberations of the Tallahassee meeting. The first is that although the bulk of the conference was concerned with the traditional liberal education agenda of how HPS can enhance and improve the teaching of science, it did occur at the same time as the ‘Science Wars’ (Brown 2001, Gross, Levitt & Lewis 1997, Koertge 1998) were erupting in the HPS and Science Studies communities; it was an intellectually exciting and polarising time. The wars erupted on many fronts - in sociology of science, the Edinburgh ‘Strong Programme’ was gaining academic traction fuelled in part by relativist and constructivist interpretations of Thomas Kuhn; many feminist and multicultural critiques of science and of orthodox philosophy of science had been published; postmodernist agendas were being pursued in many departments.

By the time of the conference, the work of Jean-François Lyotard, Michel Foucault, Michael Mulkay, Bruno Latour, Harry Collins, Sandra Harding, Evelyn Fox Keller, Andrew Pickering, David Bloor, Michael Lynch, Steve Woolgar, Donna Haraway, Sal Restivo, Mary Belenky and Jacques Derrida had been published and had some influence in education

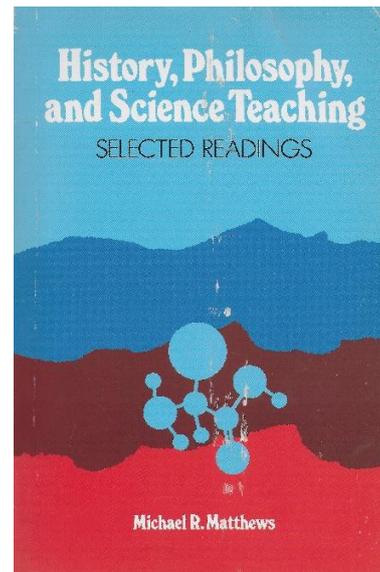
circles. Ernst von Glasersfeld, the self-styled ‘radical constructivist’, was an energetic participant at the conference, and a contributor to the *Synthese* special issue.

Inevitably, but in subdued way, the Science Wars, Postmodernism, and Realist versus Constructivist debates were played out at the conference. A plenary session was devoted to the Constructivist debate. It was chaired by Ken Tobin and contributed to by Jaques Désautels, Ernst von Glasersfeld and David Gruender. Gruender’s paper was titled: ‘Some Philosophical Reflections on Constructivism’, and he wrote: ‘It is impossible to look at current literature dealing with the education of teachers, especially in science and mathematics, without noticing the galvanizing effects of the newly introduced theory of “constructivism”’. He went on to caution that: ‘this whole approach of defining knowledge in terms of environmental feedback leading to constructs which better enable the knower to survive in the environment raises serious theoretical issues of its own. And this is so whether one prefers the version offered by Piaget or by Dewey’.

There were divisions at the conference about the epistemological, ontological and pedagogical merits of constructivism, a division between two intellectual tendencies, loosely labelled Realism and Constructivism, yet very pleasingly the conference was marked by convivial and congenial exchanges on the subject. There was wide agreement about the benefit of constructivist pedagogy, but disagreement about its commonly related epistemological and ontological claims. This tension has carried through the subsequent history of the group and its soon-to-be-founded journal *Science & Education*. For the journal, debate began with Wallis Suchting’s critical paper ‘Constructivism Deconstructed’ and Ernst von Glasersfeld’s ‘Reply’ both in the first volume (1992), and continued through a special double-issue on the subject in the sixth volume (1997) that was published as a book [*Constructivism in Science Education: A Philosophical Examination*](#) (Matthews 1998).

For everyone at the conference, the value of scientists, and science and mathematics educators working with philosophers, historians, and cognitive psychologists was immediately obvious. The IHPST group’s distinctiveness has always been bringing historians, philosophers, philosophers of education, cognitive scientists, science education researchers and science teachers together to investigate how historical and philosophical scholarship can inform theoretical, curricular and pedagogical problems that engage science teachers and administrators. Since the beginning, the educative dimension of the conferences has been emphasised. For instance, great effort was made to have bound printed copies of the talks distributed at the conference so that presenters could speak to a text that the audience had in front of them. Effort was made to ensure that presentation and discussion was conducted in a convivial and collegial manner. Some groups have conviviality and little scholarship, others have scholarship and little conviviality, the IHPST group has succeeded in having both.

At Ian Winchester's invitation I chose seventeen of the special-issue journal papers for publication in a Teachers College Press book *History, Philosophy and Science Teaching: Selected Readings* (1991). In a pre-web age, the book made the early HPS&ST papers widely available.



Teachers College Press (1991)

Deserving of special mention is the exchange in the book between physicists Martin Eger and Abner Shimony on the demarcation (Shimony) or otherwise (Eger) of ethics and science. Shimony expressed his realist conviction as:

It should be clear why I resist Eger's attempt to narrow the gulf between the natural sciences and ethics. With regard to the former, I have argued, albeit briefly, that there is a domain of entities independent of human experience which is endowed with definite properties, and a scientific proposition is objectively true if it correctly characterizes this domain. Whatever the difficulties may be for human beings to discover on the basis of their limited experience the objective truth, it is, so to speak, 'there' to be found out. (Shimony 1991, p.98)

Shimony is both an ontological realist (there is a human-independent world out there), and an epistemological realist (aspects of that world can, with whatever difficulty, be known, and evidence-based evaluation can be made between competing claims to such knowledge). Both claims have been contested in the HPS&ST community, and of course, beyond. Whole domains of postmodernist, constructivist, multiculturalist, feminist, liberationist and other such educational theory and practice hinge upon the truth or falsehood of epistemological realism. If the position is rejected then, for instance, Graham Smith's claim of three decades ago is easier to defend:

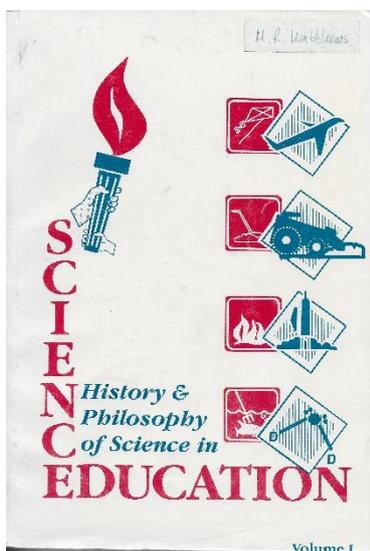
There is a need to struggle to assert the equal validity of Maori knowledge and frameworks and conversely to critically engage ideologies which reify Western knowledge (science) as being superior, more scientific, and therefore more legitimate. (Smith 1992, p.7)

This position has, since 2005, become official government policy in New Zealand. Researchers seeking funding, for example to the Royal Society Marsden Fund, must state how they will include Mātauranga Māori in their research. There are Australian and Canadian equivalents of this policy. A 2020 advertisement for a lecturer in Zoology at Otago University requires *advancing Mātauranga Māori/Te Ao Māori perspectives in the study of Zoology with the position affording an exciting opportunity for an emerging scholar to research and teach from a kaupapa Māori perspective* (Corballis, Rata & Nola 2020). The position is defensible if epistemological realism is rejected, but its rejection is not the outcome of any rigorous argument, it is mostly assumed, it is the default epistemology; the

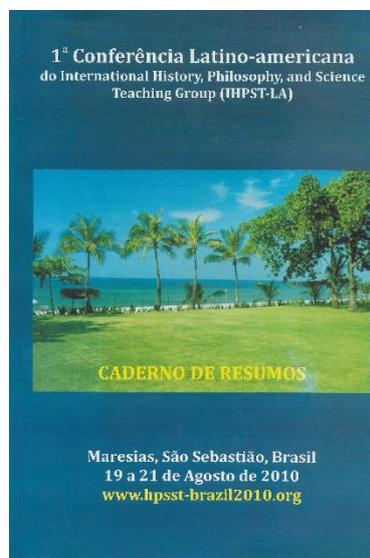
names of Kuhn, Feyerabend, Latour and others are simply invoked if argument is required. The names substitute for argument.

The profound philosophical differences between the two philosophical physicists - Eger defended a hermeneutical-constructivist account of science - did not impede their mutual respect and valuation. After Eger's death in 2004 Shimony edited a 540-page collection of Eger's scientific, philosophical and educational papers (Eger 2006).

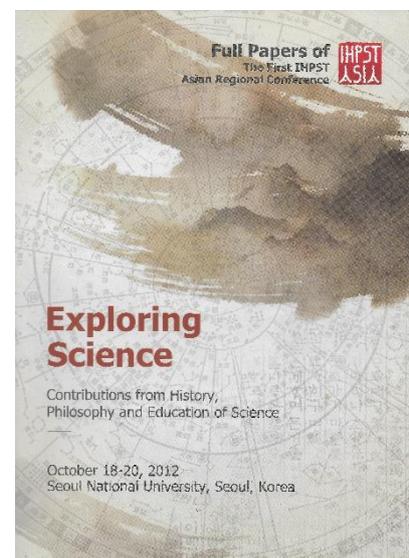
Since the first 1989 meeting, [biennial IHPST conferences](#) have been well attended and successful in bringing philosophers, historians and educators together to address theoretical, curricular and pedagogical issues in science teaching. Regional meetings have been held in South America, Asia and Europe. Apart from, on doctor's orders missing a couple, I have contributed to all these conferences. They have been a happy and productive constant in my scholarly and personal life.



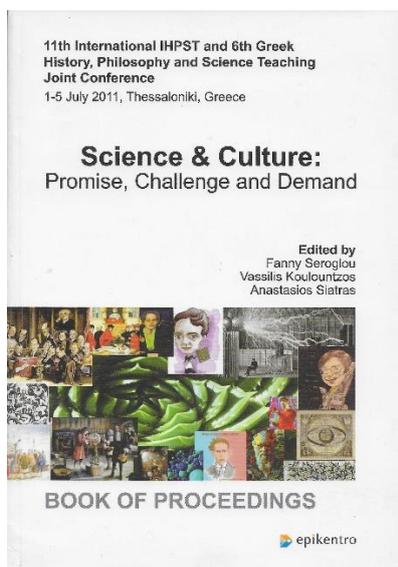
IHPST 1992 Kingston



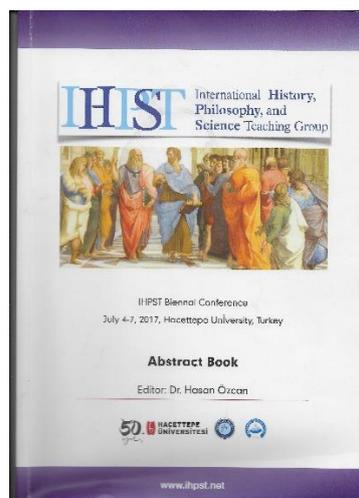
IHPST 2010 Brazil



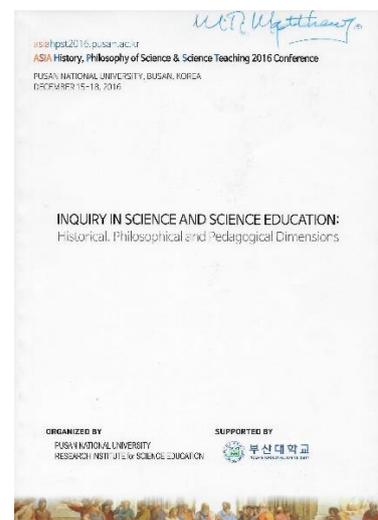
IHPST 2012 Seoul



IHPST 2011 Thessaloniki



IHPST 2017 Ankara

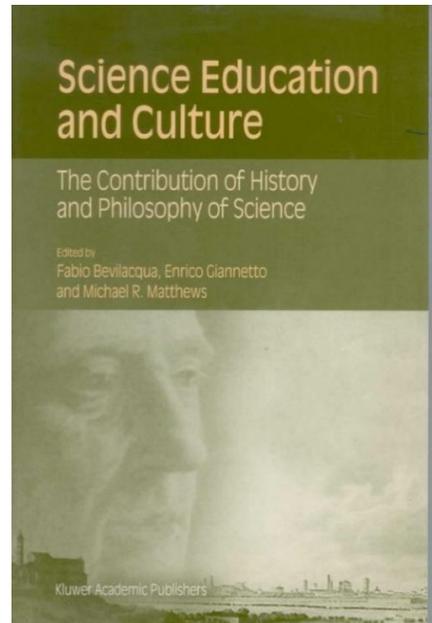


IHPST 2016 Pusan

The 1999 conference on ‘Science Education and Culture’ was held at Pavia University and Lake Como. It was jointly organised with the Interdivisional Group on History of Physics of the European Physical Society and chaired by Fabio Bevilacqua and Enrico Giannetto who was also a physics professor with a higher degree in philosophy.

Among contributors to the Pavia conference were Alberto Cordero, Robert Carson, Peter Machamer, James Donnelly, Ron Good, Norm Lederman, Edgar Jenkins, Sibel Erduran, Robert Nola, Olivia Levrini, Cibelle Celestino, Art Stinner, Fanny Seroglou and Panagiotis Koumaras.

In 2001, select and reviewed papers presented at the conference were published in a 21-chapter Springer book ([Bevilacqua, Giannetto & Matthews 2001](#)).



IHPST 1999 Pavia

After twenty years of productive but informal existence without office bearers, the IHPST Group was formalised at its 2007 Calgary conference. I was honoured to be founding president of the newly formalised group. The following aims were adopted:

- (a) The utilization of historical, philosophical and sociological scholarship to clarify and deal with the many curricular, pedagogical and theoretical issues facing contemporary science education. Among the latter are serious educational questions raised by Religion, Multiculturalism, Worldviews, Feminism, and teaching the Nature of Science.
- (b) Collaboration between the communities of scientists, historians, philosophers, cognitive psychologists, sociologists, and science educators, and school and college teachers.
- (c) The inclusion of appropriate history, philosophy, and sociology of science courses in science teacher-education programmes.
- (d) The dissemination of accounts of lessons, units of work, and programmes in science, at all levels, that have successfully utilized history, philosophy, and sociology.
- (e) Discussion of the philosophy and purposes of science education, and its contribution to the intellectual and ethical development of individuals and cultures.

The pros and cons of formalisation were apparent. Before formalisation, little if any time was spent on internal administrative matters, all group time was spent on the ‘mission’ of the group (research, publishing, conference organizing, preparation of classroom materials, etc.). After formalisation, time had to be spent on internal administrative matters (holding elections, maintaining membership rolls, etc).

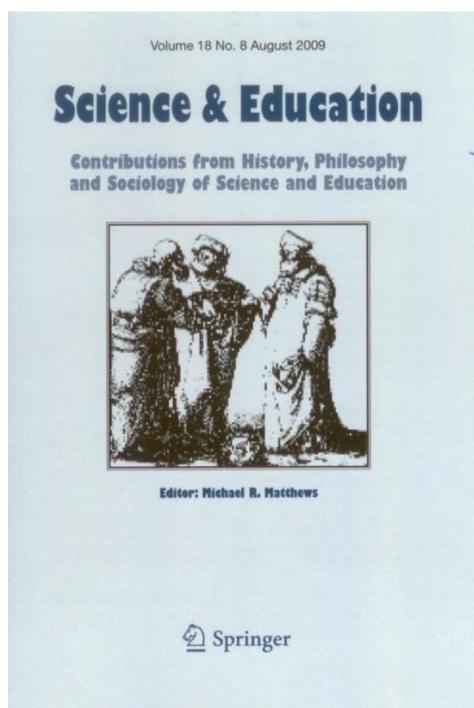
Editorship of *Science & Education Journal* (1992-2015)

Perhaps the most significant and lasting consequence of the creation of the IHPST Group was the launching of *Science & Education: The Contributions of History, Philosophy and Sociology of Science and Education*. It was the first ever international journal devoted to HPS&ST research.

In 1990, or thereabouts, I met the Kluwer Education Editor, Peter de Liefde, at an American PES conference. Over beers he suggested turning the IHPST newsletter that I had been editing into a Kluwer journal with myself as Foundation Editor. Starting an academic journal was a big step, but I was happy to take it. I was buoyed by the range and competence of the authors already published in the above-mentioned seminal special issues on HPS&ST. By writing, phoning and travelling, I was able to find a group of 40 outstanding individuals to constitute the initial editorial committee. They included a number of past presidents of the US Philosophy of Science Association, the US History of Science Society, the US Philosophy of Education Society, and many presidents of national science teaching associations. There were also editors of major educational and philosophy journals on the committee. This was perhaps the most illustrious editorial board ever of any science education journal.

The journal first appeared in 1992, with four numbers per year. It was the first research journal dedicated to this particular niche – the application of historical and philosophical scholarship to theoretical, curricular and pedagogical problems in the teaching of science. The journal has been, on all measures, very successful.

Contributors include a long list of major contemporary philosophers and historians; as well as philosophers of education, cognitive scientists and science educators. Due to the quantity and quality of manuscripts submitted, it has progressively grown to ten numbers per volume.



Science & Education journal (1992-)

A feature of the journal since its inception has been the publication of thematic special issues that bring together substantial research articles on topics such as: ‘Science and Culture’ (1994), ‘Hermeneutics and Science Education’ (1995), ‘Religion and Science Education’ (1996), ‘Philosophy and Constructivism in Science Education’ (1997), ‘The Nature of Science and Science Education’ (1997), ‘Galileo and Science Education’ (1999), ‘Children’s Theories and Scientific Theories’ (1999), ‘Thomas Kuhn and Science Education’ (2000), ‘Constructivism and Science Education’ (2000), ‘History, Philosophy and the Teaching of Quantum Theory’ (2003), ‘Science Education and Positivism: A Re-evaluation’ (2004), ‘Science Education in Early Modern Europe’ (2005), ‘Models in Science and in Science

Education' (2007), 'Social and Ethical Issues in Science Education' (2008), 'Feminism and Science Education' (2008), 'Teaching and Assessing the Nature of Science' (2008), 'Worldviews in Science and in Science Education' (2009), 'Historical and Philosophical Perspectives on Darwin and Darwinism in Education' (2009), 'Mendel, Mendelism and Education' (2015) and 'Physics and Mathematics: Historical, Philosophical and Pedagogical Considerations' (2015).

The range of thematic issues underscores the fundamental point that research in science education needs to be broader than merely research on pedagogy, on effective teaching and learning, on characteristics of the teaching profession, and other such routine topics. These are all important matters, but there are other important questions that research needs to address.

Prior to publication of *Science & Education* journal it was rare for philosophically informed and sophisticated work to appear in science education journals; some was published but not much. One of the great successes of the journal has been the regular appearance of such work. Among philosophers who have published in the journal are: Robert S. Cohen, Richard Kitchner, Gerd Buchdahl, Harvey Siegel, Israel Scheffler, Alberto Cordero, John Worrall, Alan Musgrave, Hasok Chang, Peter Machamer, Peter Slezak, Michael Martin, James Garrison, Noretta Koertge, Robert Crease, Patrick Heelan, James Cushing, Richard Grandy, Robert Nola, Alan Chalmers, Mario Bunge, Robert Pennock, Jane Roland Martin, Howard Sankey, Demetris Portides, Michael Ruse, Paul Thagard, Hugh Lacey, Gürol Irzik, Cassandra Pinnick, Thomas Reydon and Peter Kosso.

Among historians are: Helge Kragh, John Heilbron, Lewis Pyenson, I. Bernard Cohen, Zev Bechler, Fabio Bevilacqua, Roger Stuewer, William Carroll, Stephen Brush, Roberto de Andrade Martins, Lesley Cormack, Antonio Clericuzio, Bernadette Bensaude-Vincent, Anders Lundgren, Olival Freire Jr., Kathryn Olesko, David Depew, Ana Barahona, Yves Gingras and Irina Gouzevitch.

Prominent science educators also contributed to the journal: Derek Hodson, Nancy Brickhouse, Kevin de Berg, Mike Smith, Jack Rowell, William Cobern, Norm Lederman, Eduardo Mortimer, Douglas Allchin, William McComas, Michael Clough, Mick Nott, Cathleen Loving, Jerry Wellington, Edgar Jenkins, George DeBoer, Igal Galili, Peter Heering, Art Stinner, Richard Duschl, Fritz Kubli, Mansoor Niaz, Nahum Kipnis, Robert Carson, James Garrison, Ismo Koponen, Lisa Martin, William Cobern, David Rudge and many others.

These scholars have made an important contribution to raising the quality of educational research, discussion and debate. They set an example of how good philosophy and good history is done in addressing theoretical, curricular and pedagogical issues in science education. Additionally, their papers show that the local classroom teaching of science occurs on a much broader historical, philosophical, and cultural stage. This is something important for the professional identity of teachers.

It was not all plain sailing. In 1995 I coordinated a thematic issue of *Science & Education* on '[Hermeneutics and Science Education](#)' that focused on the earlier Martin Eger articles that had been published in the journal (Eger 1993a, b). The issue was contributed to by Robert Crease, Fabio Bevilacqua, Enrico Giannetto, Patrick Heelan, James Cushing, Dimitri Ginev and Wallis Suchting.

Suchting had published two substantial papers in early volumes of the journal: one on ‘The Cultural Significance of Science’ ([Suchting 1994](#)), the other on ‘The Nature of Scientific Thought’ ([Suchting 1995](#)). And a detailed critical review of Zev Bechler’s *Newton’s Physics and the Conceptual Structure of the Scientific Revolution* ([Suchting 1993](#)). These pieces displayed his immense learning in the history of philosophy and of science, his command of classical and contemporary languages, and his commitment to clear and careful writing - all of which marked his teaching at the University of Sydney.

But Suchting was unsparing in his withering [assessment](#) of just what hermeneutics as a methodology contributed to understanding the practice of science. For Suchting, interpreting a text makes perfect sense, and hermeneutics is the science of such interpretation. And scientists wrote, read, and argued about texts. Crucially, Eger went further saying that ‘natural things like trees, molecules or stars could have meaning’ and equally be illuminated by hermeneutics. But to talk of interpreting nature, objects, or processes is nonsensical; it is a misuse of the word, a category mistake. Suchting wrote at the end of his typical pages of detailed line-by-line analysis:

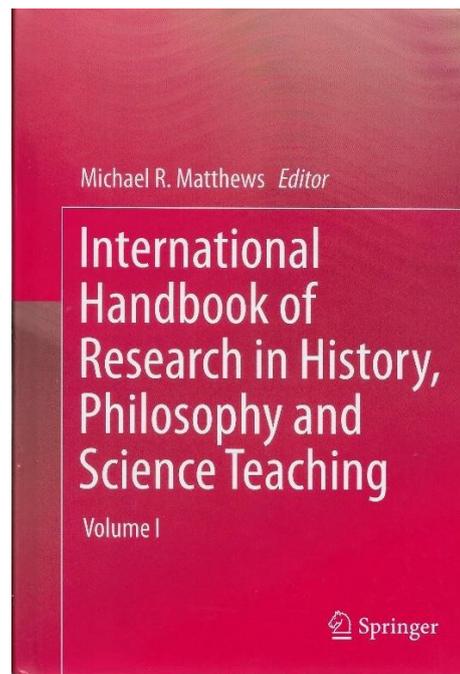
I believe that Eger’s pieces lack serious substance. ...[they are] characterised by devices like the pumping up of platitudes into apparently deep truths by the hot air of jargon; conversely, the use of ordinary words as Trojan horses concealing subjectivistic absurdities; and tools of evasion like scare-quotes and clauses that qualify that to which they refer to every degree not short of vacuity. Unfortunately, these devices are increasingly common in academic circles. (Suchting 1995, pp.167-68)

As editor, publishing such an assessment by one good friend of another close friend was not without some anguish. Suchting’s conclusion was harsh, but arrived at, as with all of his work, after pages of patient, line-by-line analysis. It is the responsibility of an editor to see that an argument is sustained and not ambiguous, and that the conclusion does not overstep the evidence. I judged this to be the case with Suchting’s paper and so published it. There were significant personal repercussions of this editorial decision. Both authors had their own complaints. Every editor has such experiences, but that does not make them easier.

In 2009, there were 65,000 article-downloads from the publisher’s web site with, interestingly, 21% of the downloads being from China (23% from USA). By the end of my editorship in 2015, the downloads were edging towards 100,000 pa. In 2019, at the end of my successor’s (Kostas Kampourakis) editorship there were 162,000 article-downloads pa. With Asia-Pacific having 27%, Europe 27% and North America 26%. The download figures are testament to the impact and importance internationally of HPS on science education research. The journal is now in the capable editing hands of Sibel Erduran at Oxford University. Creating and sustaining the journal for 25 years was a satisfying career accomplishment. I have written at length some [reflections on the subject](#).

To celebrate the 25th ‘birthday’ of the journal Springer asked me to edit an [International Handbook of Research in History, Philosophy and Science Teaching](#). This was prepared over a three-year period and published in 2014. There were 3 volumes, 76 chapters, 2,544 pages, and 125 authors from 30 countries contributed. The Subject Index had 2,000 entries, the Name Index had 3,600 entries, and there were 10,200 References. A truly comprehensive work.

It was the first handbook to be published covering the field of historical and philosophical research in science education. Given that science through its long history has always been engaged with philosophy, and that for over a century it has been recognised that science curriculum development, teaching, assessment and learning give rise to so



HPS&ST Handbook (2014)

many historical and philosophical questions, it is surprising that such a handbook took so long to appear. But more the reason to celebrate its appearance. There were 20 chapters on how HPS contributes to better classroom teaching and learning.

In the first five years, to 2018, of the book’s life on the Springer website, there were almost a quarter of a million chapter-downloads (242,292). This is very tangible evidence of the impact and usefulness of HPS&ST research both for the science education and the HPS communities.

The IHPST Group, and the journal *Science & Education* with which it is associated, were a constant in my scholarly and personal life for 30 years. The group existed informally from 1989 to 2007, during which time I was secretary. In 2007 it was formalised, and I had the great honour to be elected its Foundation President. Through these connections, I have had the good fortune to visit perhaps 30 countries, and give maybe 200 lectures in various education, physics and philosophy departments. Over this time a number of my papers have been translated and published in Portuguese, Spanish and Italian journals; and different books have appeared in Greek, Korean, Chinese, Spanish and Turkish editions. Many of the international scholarly contacts have grown into significant personal friendships, something for which I am very happy indeed.

My decades-long editorship of the monthly [HPS&ST Newsletter](#) which now goes direct to about 8,500 emails, and to many science education lists and HPS lists, is a small way of returning something to the international network from which I have directly and indirectly gained so much. Paulo Maurício in Lisbon and Nathan Oseroff-Spicer in London contribute a great deal to this task.

The Scientific Background of Modern Philosophy (1989)

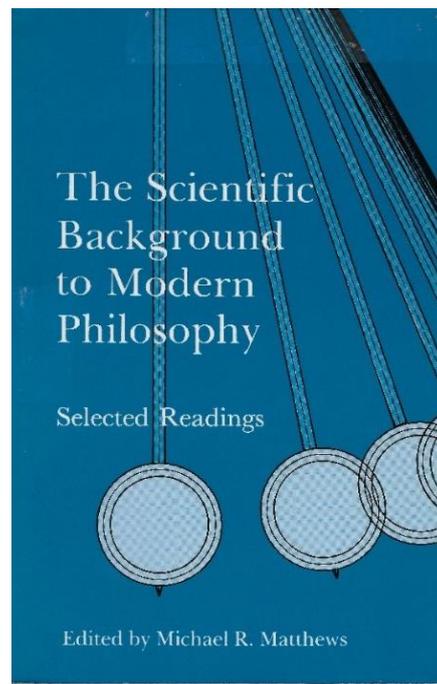
During my 1987 sabbatical leave I had conversations in Boston with Jay Hullett, the owner of Hackett Publishing Company and a former Boston University philosopher, about the contribution of Galileo and Newton and others of the ‘new’ science to early modern

philosophy. He invited me to compile, with commentary, a selection of writings of the ‘scientists’ of the Scientific Revolution who had a formative impact on the origins of modern European philosophy. The result was the anthology [*The Scientific Background to Modern Philosophy*](#) (Matthews 1989b).

I had learned during my 1978 stay in Boston, and subsequently, that the history of philosophy and the history of science go hand-in-hand; one should not be studied without the other. The early modern philosophers – Descartes, Locke, Berkeley, Hume and many others – were in dialogue with the new science of their time. They examined the philosophical implications of the method and spectacular results of the natural scientists. But philosophy students for the most part are not taught the history of philosophy as a dialogue between philosophy and science; it is taught as a soliloquy with itself.

Unfortunately, the philosophically important texts of the scientists (‘natural philosophers’) – Copernicus, Galileo, Newton, Boyle, Huygens, Descartes - were not readily available to philosophy students. The anthology was put together whilst housesitting the lovely home of Richard Burian in delightful Blacksburg Virginia and published in 1989.

The book has now sold 50,000+ copies which indicates that a good many philosophy lecturers agree that the teaching of early modern philosophy needs to recognise its intimate connection with early modern science. The book contributes a little to enabling humanities students to appreciate the central role of science in the formation of modern thought and worldviews.



Scientific Background (1989)

John Herman Randall Jr., one of Marx Wartofsky’s teachers, well captured the symbiotic relationship between science and philosophy when he wrote:

...it will be apparent that modern philosophy is here seen as primarily the response to challenging new scientific ideas – to Galileo, Newton, Darwin, Einstein, Freud, Franz Boas, and the like. During the modern period, it has been chiefly science that has driven men to the searching thought that is philosophy. This is true even of those philosophers who have tried to escape from science, like the romantic idealists and the present-day existentialists; they are heavily colored by what they are trying to emancipate themselves from. (Randall 1962, p.viii)

The same connection holds between the philosophy of science and the history of science. Imre Lakatos memorably wrote: ‘Philosophy of science without history of science is empty; history of science without philosophy of science is blind’ (Lakatos 1978, p.102). The case has been argued for by many (McMullin 1970, Wartofsky 1976, Shapere 1977, Mauskopf & Schmaltz 2012). This is a particularly important insight for science teachers for whom, just on pedagogical grounds, the history and philosophy of any topic or subject needs to go hand-in-hand for the benefit of students’ learning and education.

First Engagement with Science Education Research and Constructivism (1988)

For the first fifteen years of my academic career I attended and contributed to national and international philosophy of education and HPS conferences, and, as related earlier, I prepared HPS&ST lectures and materials for my own UNSW teacher education and graduate classes. It was only in 1988, thirteen years after being appointed to UNSW, that I began attending science education research conferences, first in Australia (ASERA) and then the USA (NARST). My first science education conference was a National Association for Research in Science Teaching (NARST) conference in 1989. Although aged 40, I was a ‘new boy’ in the conferences. They were unexpected and eye-opening events. I was familiar with the Science Wars, whose opening shots were fired by the Edinburgh Sociology of Scientific Knowledge group, that were raging through HPS schools and tearing some apart; but I was unaware that the wars had flowed over into science education. At the 1989 NARST conference I found myself in the trenches.

The conference was awash with philosophically doubtful if not plain silly, relativist and idealist constructivist ideas. Amid the cheering and foot-stomping for a plenary constructivist address by Ernst von Glasersfeld, I recall saying to the chap alongside me: ‘This is pure Bishop Berkeley. Why are people clapping?’.

This initial estimation was confirmed when I later read von Glasersfeld’s autobiographical essay where he says that the Bishop of Dublin was the first philosopher he read, and that 1710 (the year of publication of Berkeley’s *Principles of Human Knowledge*) was one of the greatest years in the history of philosophy. At the NARST meeting, this warmed-over Berkeleyan philosophy, with its idealism about the world and in-principle rejection of knowledge claims about Nature – ‘we only have access to our perceptions’ - received rapturous applause. I was dismayed.

Berkeley’s idealism, his opposition to Newtonian science, his theory of perception and ideas, are standard topics in introductory or second year philosophy. David Stove used comment that: ‘An undergraduate philosophy course without Berkeley is like a zoo without elephants’. Berkeley’s arguments do not warrant cheering, but rather attention to their details, and ultimately to their fundamental weakness. And for science educators especially, attention to the roots of his opposition to Newtonian science. If you have not studied philosophy, then Berkeley is certainly a novel and enticing figure. Countless senior, and not so senior, science educators along with graduate students, followed the von Glasersfeld path into constructivism, idealism and scepticism. For example, Wolff-Michael Roth, a senior figure in science education and enthusiast for von Glasersfeld’s work, maintains:

according to radical constructivism, we live forever in our own, self-constructed worlds; the world cannot ever be described apart from our frames of experience. This understanding is consistent with the view that there are as many worlds as there are knowers. (Roth 1995, p.13)

He goes on to assert:

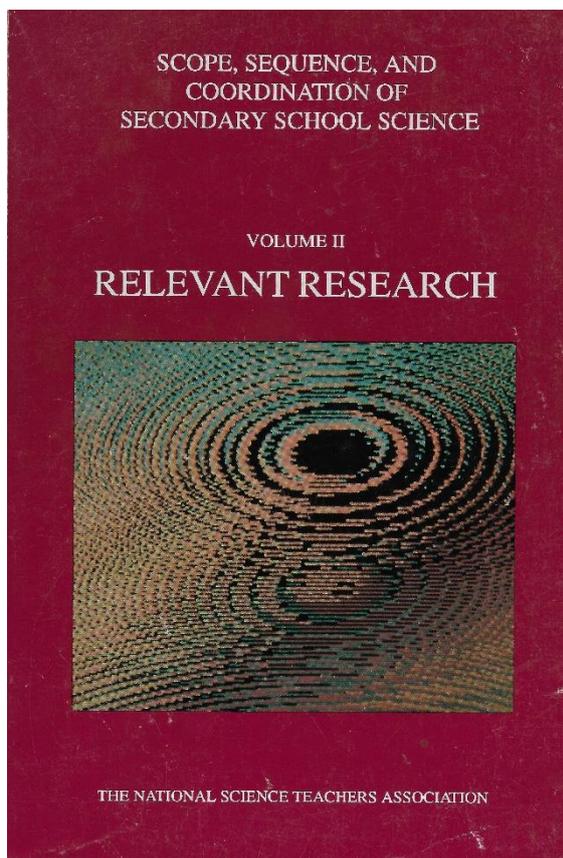
Through this research [sociology of science], we have come to realize that scientific rationality and special problem-solving-skills are parts of a myth. (Roth 1995, p.31)

I felt such views had to be contested.

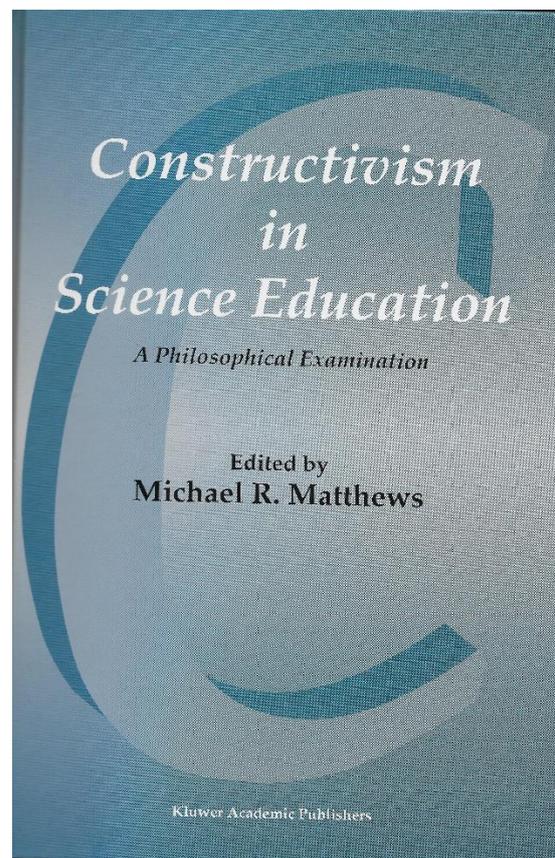
I gave my first anti-constructivist paper at the USA PES conference in 1992, modestly titled ‘Old Wine in New Bottles: A Problem with Constructivist Epistemology’ (Matthews 1993). Denis Phillips, an Australian biology teacher and philosopher of education who moved to Stanford University in the early 70s, in his commentary on the paper said:

Mike Matthews has been too gentle on the constructivists. He recognizes that they commit philosophical blunders, but nevertheless he charitably treats them as informed, competent, well-trained people who happen to hold a venerable philosophical position – classic empiricism. ... My own interpretation is less charitable. (Phillips 1993, p.312)

I repeated the paper at a meeting in Washington attended by Bill Aldridge, the Executive Secretary of the huge, 50,000-member US National Science Teachers Association. He was anxious to publish the paper in the NSTA *Scope, Sequence and Coordination: Relevant Research* book as a counterweight to constructivist pieces that had been commissioned. His words were: ‘We need your view’. I was happy to give it (Matthews 1992).



US National Science Teachers Assoc. (1992)



Constructivism in Science Education (1998)

For many, I became the *bête noire* of constructivism. This reputation was enhanced with publication of my edited anthology *Constructivism in Science Education: A Philosophical Examination* (1998) to which, among others, critics such as Wallis Suchting, Denis Phillips, Robert Nola and Peter Slezak contributed. And further enhanced with publication of a critical article in the Denis Phillips edited, *National Society for the Study of Education* 2000

Yearbook (Matthews 2000). Constructivism had taken the science education world, and indeed most educational worlds, by storm. Its appraisal was timely.

In the first volume of *Science & Education* Wallis Suchting published '[Constructivism deconstructed](#)', the most sophisticated and detailed philosophical critique of radical constructivism published in education, and probably beyond education. It is worth quoting here his conclusion:

First, much of the doctrine known as 'constructivism' ... is simply unintelligible. Second, to the extent that it is intelligible ... it is simply confused. Third, there is a complete absence of any argument for whatever positions can be made out. ... In general, far from being what it is claimed to be, namely, the New Age in philosophy of science, an even slightly perceptive ear can detect the familiar voice of a really quite primitive, traditional subjectivistic empiricism with some overtones of diverse provenance like Piaget and Kuhn. (Suchting, 1992, p. 247)

Initially my concern was with the theory or philosophy of constructivism, I did not attend to constructivist pedagogy or its effectiveness when employed to inform teaching practice. I shared the common response to criticism of constructivist theory, namely that although the theory might be poorly articulated and philosophically problematic, nevertheless constructivist pedagogy can be supported. This position is understandable, but it rests on a moot point: How effective is constructivist pedagogy in teaching science, or indeed any other discipline?

The efficacy side of constructivism abruptly presented itself in the primary schooling of my own daughters. They attended a middle-class State primary-school whose principal and teachers had been instructed in, and became committed to, constructivism. Our girls were, as with everyone else, having maths classes, but they were not learning maths. They came home with random pieces of paper with random problems that they had to work out. There was nothing systematic. And there was no textbook, so parents could not easily assist their children. When my wife and I went to the principal to present our concerns, he told us that he did not 'believe in the tyranny of textbooks'. This presented no problem for us as we went to the web and bought the entire suite of the excellent [Singapore Primary Maths](#) books and worked through each book topic by topic. Our girls did well in school maths; one graduating in maths, and is now a mathematics teacher. None of this achievement owed anything to constructivism; it was achievement despite constructivism. Nevertheless our daughters' success would be listed as a success of the school when it came to tabling education outcomes.

The daughters of an American friend had the same experience. My friend had graduated in physics and mathematics from the very best US and UK universities; had published maths textbooks; had lectured in physics, mathematics, and engineering; and had worked with international organisations including PISA. Along with other parents he ran the Mathematics Club at his daughters' Boston-area Elementary school. In 2018, the eldest daughter was beginning 6th grade when the school adopted the constructivist-aligned *Illustrative Mathematics* programme. Appalled at what he saw, he sent the following note to the principal:

Thus, with apologies for being blunt but recognizing that everyone's time is short and that I have beat around the bush long enough, the new *Illustrative Mathematics* "Open Up" curriculum is complete rubbish. It is classic progressive non-education. It never teaches, i.e. explains, mathematics. Instead, the units follow an awful pattern. First, students get vague

chit-chat and a series of vaguer problems, from which they must intuit a general idea not stated explicitly. This mystery idea is then used in further problems. Finally, the "Summary" section has the chutzpah to list the mystery idea as if it had been taught. And the idea is often expressed in a confusing and mathematically incompetent way.

He went on:

As I mentioned, the curriculum attempts to compensate for its superficiality by attaching "be prepared to explain your reasoning" to most problems, thereby forcing students to fill the class period writing long explanations to ill-defined and mostly pointless problems. In a typical class period, students will solve two or three problems - all trivial. I dread the thought that my daughter, and the other students, will spend so much time in math class and learn so little.

And:

Even a great teacher cannot overcome the obstacles set by this awful curriculum. Please, save the [...] students from it. It will make the parents with enough time and money arrange tutoring for their own children, often using Singapore Math, while leaving the poorer children adrift. That is not fair or just.

Constructivism is not just a hinderance to the learning of mathematics, it is also, in the guise of the internationally adopted 'Whole Language' literacy instruction, a barrier to children's reading and literacy. My friend said of his daughters' school that the reading teaching is almost completely whole language, where students are taught every strategy possible: They are taught to use pictures, to use neighbouring words, to use the first letter, the last letter, etc. He added: 'The only strategy not taught is what I learnt as reading: decoding a word from left to right to produce one phoneme at a time and blending it into a word (or doing so one syllable at a time)'. And related that:

As a result, in my older daughter's grade (5th grade, ages 10/11), all the students who read well (fluently, rapidly, and correctly) were taught to read by their parents. The rest got the school nonsense, reinforced by the Harvard Graduate School of Education, and are unskilled readers, reading slowly and/or guessing at multisyllable words.

My experience, and that of my US friend, provides anecdotal evidence against constructivism, the kind of evidence of which there is too much in education. But the supposed efficacy of constructivist, or minimally-guided, pedagogy has now been challenged by educational researchers. Richard Mayer, a past-President of the Division of Educational Psychology of the American Psychological Association, a former editor of the *Educational Psychologist* and a former co-editor of *Instructional Science*, reviewed an extensive body of research on constructivist pedagogy and concluded that it did not work, and where it did work, it worked in virtue of departing from constructivist principles (Mayer 2004, 2009). His analysis was confirmed by Kirschner, Sweller and Clark who, in another review article, argued that:

... the past half century of research on this issue has provided overwhelming and unambiguous evidence that unguided or minimally guided learning is significantly less effective and efficient than guidance that is specifically designed to support the cognitive processing necessary for learning. Not only is minimally-guided learning ineffective for most learners, it may even be harmful for some ... (Kirschner, Sweller & Clark 2006, p.75)

And it is a very large ‘some’, including: slow learners, students from poor or otherwise stressed families, students from homes where education is either not valued or not evident, and so on. Notwithstanding the philosophical and pedagogical problems documented by so many, the constructivist caravan rolled on across the international educational landscape, being adopted by country after country, province after province, as the ‘official’ or endorsed educational theory.

University of Auckland, and New Zealand Constructivism (1992-93)

In 1992 I applied for and was appointed to the Foundation Chair of Science Education at the University of Auckland. This brought me into immediate contact with New Zealand PESA colleagues Jim Marshall, Michael Peters, Ivan Snook, Colin Lankshear and others. It also brought me into contact with the Auckland philosopher Robert Nola. Robert has ever since been an enduring friend and a valuable source of informed philosophical good sense (Nola 1997, 2000, 2003).

I could not engage with the postmodern, Foucault-Derrida-Rorty inspired philosophising of philosopher colleagues Marshall and Peters. They were friends, and welcoming colleagues, but we just agreed to differ on the philosophical merit of what they were pursuing in numerous books and articles. To my simple, or jaundiced, eye, it was mostly unintelligible and would not reward the effort of trying to discern its ‘deep’ meaning.

For good or bad, nothing in my philosophical background prepared me to understand, much less engage with, for instance, the conclusion of one of Michael Peters’ *Educational Philosophy and Theory* (the journal of PESA) articles where, after multiple pages explicating Heidegger and Derrida, two of the foremost obscurantists of the modern age, he wrote:

It might be argued that the prospect of a critical pedagogy of difference, of a genuinely multicultural and internationalist pedagogy suitable for the future, is located at the interstices and in the interplay between a ‘democracy to come’ and a ‘subject to come’, a global subject whose critical function it is to both initiate and interrogate the new International. (Peters, M. 2003, p.327)

Much less was I prepared for an evaluation of his earlier claim in the same article that: ‘Heidegger’s thought is guided by the double motif of being as presence and of the proximity of being to the essence of man’ (p.315). Perhaps this means something, but I do not know what, and I doubt whether the effort of finding out would be worth it.

Such discourse has now come to dominate PES and PESA conferences and publications. Writers of such sentences rise to be senior professors, authors and editors of scores of books and handbooks. A significant educational problem is that such obscure, if not unintelligible, writing has become the norm in education programmes. Incomprehensibility is the new normal.

The ill-effects on students’ minds who are subject to one, two, three or more years of it, is inestimable. If that is the academic norm, if that is how you are supposed to learn to write, then what possible chance is there that university education can contribute to people writing clearly, being able to judge sense from nonsense, good advice from gobbledegook, and appreciate the difference between sound and unsound arguments? Minimal chance.

Steven Shapin, the Harvard historian of science, wrote of this academic curse:

But the problem to which it is worth drawing attention is the particular species of bad writing that is, so to speak, institutionally intentional. Initiates learn to write badly as a badge of professionalism; they resist using the vernacular because it doesn't sound smart enough; they infer from obscurity to profundity. Some things are indeed hard to say in ordinary English, but not nearly so many as academics pretend. (Shapin 2005)

In the philosophy of education community, there had been a marked turn away from engagement with science and philosophy of science. For instance, I arrived a day late for the 1999 US Philosophy of Education Society (PES) New Orleans conference. It was revealing that the only two books out of perhaps 200 not 'ticketed' for later collection on the free publishers' display table were Alexander Bird's *Philosophy of Science* (Bird 1998) and Mario Bunge's anthology *The Critical Approach: Essays in Honour of Karl Popper* (Bunge 1964). I rescued both from their dumper-bin fate, and they now sit happily in my library. Twenty years earlier at PES such books would have been the first taken; perhaps now they would not even get onto the 'give away' table.

It was only after arriving in New Zealand that I realised that the country's science education establishment – curriculum writing, examinations, graduate student programmes – had been taken over lock-stock-and-barrel by constructivists. The University of Waikato was the beating heart of the constructivist operation. Academics there, notably Beverley Bell, had been mesmerised by the then powerful Leeds University Science Education Department, headed by the late Rosalind Driver. The Waikato group had brought the true religion back to New Zealand and, as it is a small country, they just needed to fill maybe four or five key positions in universities and the government Education Unit, in order to have control over the nation's science education. This they did.

The basic problem was that the Leeds group, as with many other constructivist groups around the world, were saying things that were philosophically doubtful, to put not too fine a point on it, but to folk with no knowledge of the history of philosophy, or no time to think philosophically, these contentious things sounded profound and seemingly had great intellectual *gravitas*. For example, the Leeds group maintained that 'the criterion for truth lies in each of us'. Just a moment's reflection should show that there are serious problems with this formulation; yet it was repeated mantra-like by the Waikato group. Elsewhere the Leeds group asserted that, because theoretical entities postulated by science are human constructions, they can have no existential reference. This question-begging, and clearly silly, assertion was also widely repeated; as was the sceptical mantra that 'we can have no access to reality'.

Also widely repeated by constructivists was the idealist slogan that there is no independent reality: objects and events are all human dependent - if you do not recognise or name a tsunami, then there will not be one. John Staver, a prominent US science educator, stated the ontological idealist position as follows:

...For constructivists, observations, objects, events, data, laws, and theory do not exist independently of observers. The lawful and certain nature of natural phenomena are properties of us, those who describe, not of nature, that is described. (Staver 1998, p.503)

Charitably, this is just lazy writing; Staver does not mean what he says. Clearly there are no observations, data or theories without observers. This need not be said. But on the coat tails

of a mundane, undisputed claim, comes the disputed and false claim that objects and events do not exist without observers (leaving aside laws for the current argument).

Steve Woolgar says of his own version of constructivism that it:

is consistent with the position of the idealist wing of ethnomethodology that there is no reality independent of the words (texts, signs, documents, and so on) used to apprehend it. In other words, reality is constituted in and through discourse'. (Woolgar 1986, p.312)

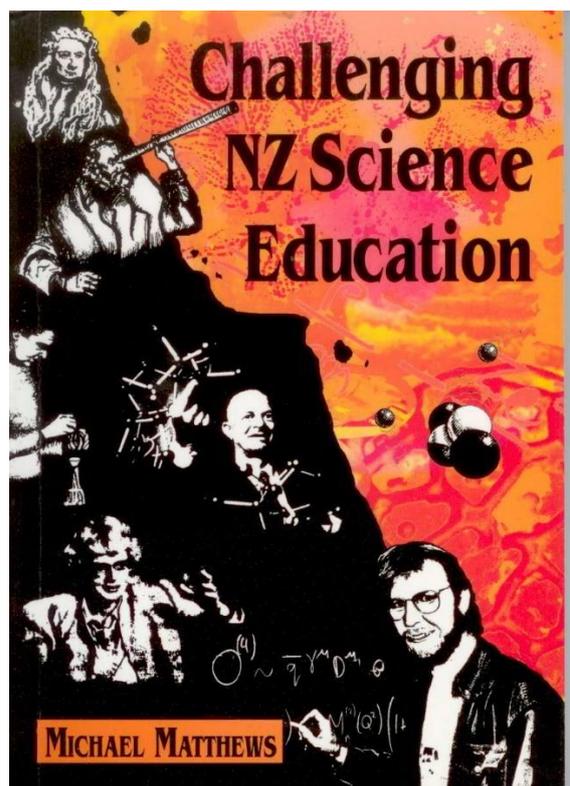
This is a startling narcissistic, idealist and false claim. Does the world really contain devils because people speak of them? Are all recovered memory claims to be recognised because people talk about them? Was there phlogiston in the 18th century world because people were talking about it? Was Donald Trump's inauguration crowd the biggest in history because he said it was? Do Sudanese women become witches because the village talk of them as such? This 'discourse makes the world' claim, is not just philosophical folly, it is political folly.

In 1993 the rift between the constructivists on the one hand and myself on the other burst onto the NZ national stage. The debate was over the new constructivist-inspired National Science Curriculum, and was sparked by two articles in Auckland's *New Zealand Herald* newspaper, written by school teachers and complaining first about the introduction of Achievement Based Assessment (ABA), and second, about the 'Dumbing Down of the Curriculum'. The debate went national when I supported the teachers by contributing an article titled 'Curriculum Reform Degrades Sciences' (*NZH*, 26 August 1993). This article was reproduced the same year in Christchurch's *The Press* (27 September), and Wellington's *The Dominion* (12 October).

My newspaper Opinion Piece was in the tradition of Sydney Philosophy Department argument: namely direct. I did not pull punches. I pointed out that 'Science in the National Curriculum identifies scientific thinking as: being curious, being creative, having hunches, clarifying ideas and feelings, thinking about your own thinking. All of these traits are laudable, but they are not uniquely scientific. The national curriculum document holds that scientific thinking is anything but knowing science, anything but mastering the special conceptual tools of science'. These and another 1,000 words were inflammatory. The controversy – 'Professors Divided' - was picked up in radio interviews, and many newspaper feature-writers up and down the country contributed their bit.

I wrote the New Zealand episode up as a book, *Challenging NZ Science Education* (1995), and tried to draw out some systematic lessons from the experience. In the Introduction I wrote:

This book will attempt to defend a liberal, rationalist approach, to science pedagogy against its detractors from both the soft left and the conservative right. It proposes a liberal theory of education and pedagogy, not a liberal theory of schooling. The former is a normative theory about what should happen in schools; the latter, as with all theories of schooling, are factual or social scientific theories that attempt to understand and explain schools as elements in the reproduction of society. ... The liberal approach to science teaching attempts to teach the content of science (facts, concepts, definitions, laws, formulae, technique and methodology) and also an appreciation and knowledge of science as an important component of our intellectual history and cultural world.



New Zealand Science Education (1995)

Routledge *HPS and Science Teaching* Book (1994, 2015)

A milestone for me, and ultimately an important enough contribution to the HPS&ST programme, was a contract offered in 1989 by Israel Scheffler to write a book for his Routledge 'Philosophy of Education Research Library' series. I met Scheffler, and we finalised the contract, at Harvard in 1989 in the process of organising the Tallahassee conference where the IHPST Group would be founded.

The book's title was *Science Teaching: The Role of History and Philosophy of Science*. I spent four years researching and writing the manuscript, and it was published in 1994. It was the first monograph whose title conjoined 'science teaching' with 'history and philosophy of science' (the Teachers College Press anthology with that title had been published in 1991). The book gave a brief history of efforts to engage HPS in science teaching; it pointed to contemporary theoretical issues engaging science teachers and that required HPS for their illumination (constructivism, multiculturalism and religion); it indicated how curriculum and pedagogy in certain areas (air pressure and pendulum motion) might be better served by attention to the relevant history and philosophy of the topics. It had 700 references, which reflected the 'read things, get on top of subject matter, do not overly bother with publication' ethos of Australian universities at the time.

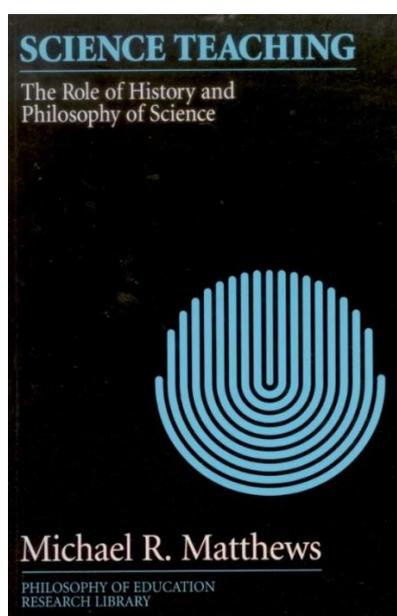
In the Preface I wrote:

For all its faults, the scientific tradition has promoted rationality, critical thinking and objectivity. It instils a concern for evidence, and for having ideas judged not by personal or social interest, but by how the world is; a sense of 'Cosmic Piety', as Bertrand Russell called it. These values are under attack both inside and outside the academy. Some educationally-

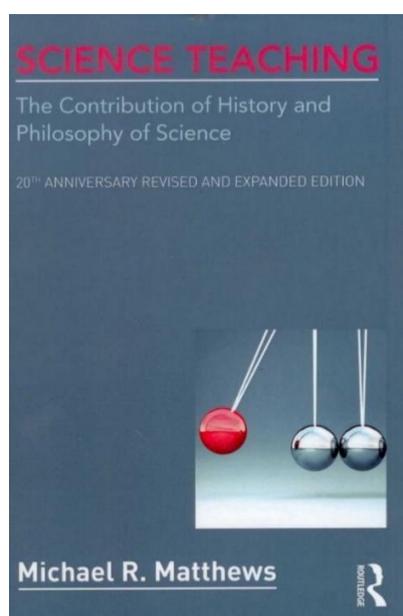
influential versions of postmodernism and constructivism turn their back on rationality and objectivity, saying that their pursuit is Quixotic. This is indeed a serious challenge to the profession of science teaching.

The vitality of the scientific tradition, and its positive impact on society, depends upon children being successfully introduced to its achievements, methods and thought processes, by teachers who understand and value science. The history and philosophy of science contributes to this understanding and valuation.

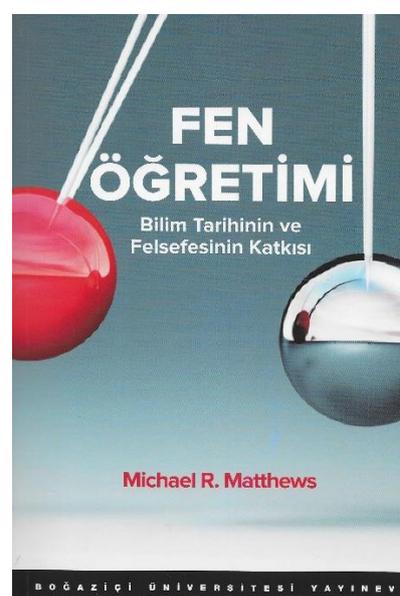
This conviction has not changed. Pleasingly the book was well received, being regularly listed in Google Scholar among the most-cited books in science education research. [A second revised and expanded edition](#) was published in 2015 and translated into Korean, Chinese, Turkish, Greek and Spanish. The book contributed to the internationalising of HPS&ST research.



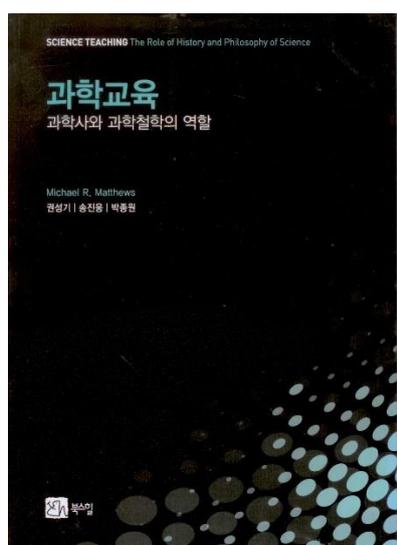
Science Teaching (1994)



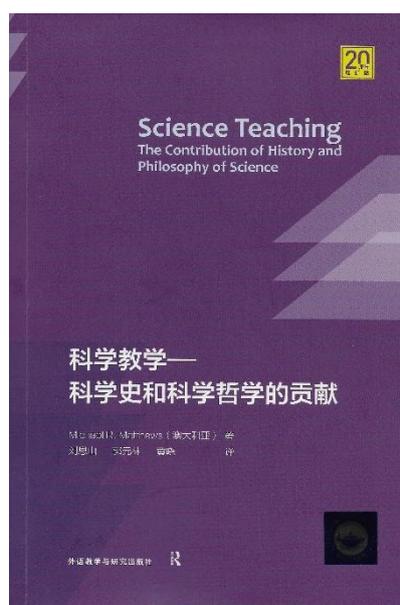
Science Teaching (2015)



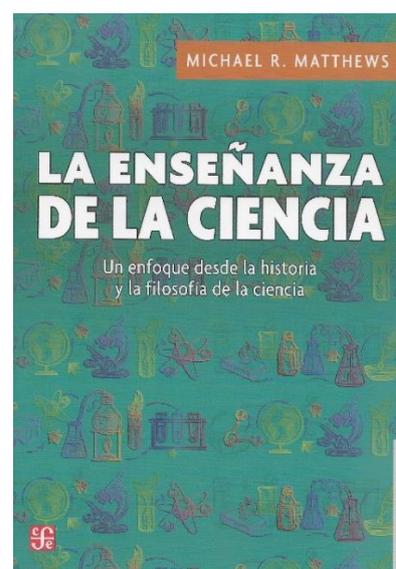
Turkish edition (2017)



Korean edition (2014)



Chinese edition (2017)



Spanish edition (2017)

Pendulum Studies (1995-2005)

In 1994, returning to UNSW, I was able to turn back to my Shimony-inspired pendulum studies. Utilising the wonderful resources of the library (in the days before everything was available on-line), I wrote a fairly comprehensive book on the history, philosophy and pedagogy of pendulum motion. The book had 1,300 references and was published in 2000 - [*Time for Science Education: How the History and Philosophy of Pendulum Motion can Contribute to Science Literacy*](#). All references were available in the wonderful UNSW library, and without the relentless pressure to publish, I was able to read them all. Now of course students do not need access to a wonderful library with photocopy machines. They just need to access a cell phone.

The pendulum had a major impact on the development of science and thereby on society and culture. The pendulum was central to the studies of Galileo, Huygens, Newton, Hooke and all the leading figures of the Scientific Revolution. The study and manipulation of the pendulum established many things: an accurate method of timekeeping and hence solving the longitude problem; discovering the conservation and collision laws; ascertaining the value of the acceleration due to gravity g , and the variation of g from equatorial to polar regions, and hence the oblate shape of the earth; provided crucial evidence for Newton's synthesis of terrestrial and celestial mechanics, showing that fundamental laws are universal in the solar system; a dynamical proof for the rotation of the earth on its axis; the equivalence of inertial and gravitational mass; an accurate measurement of the density and hence mass of the earth; and much more.

Pendulum motion was central to the argument between Aristotelians and Galileo over the role of experience in settling conflicting claims about the world. And it figured in Newton's major metaphysical dispute with the Cartesians, namely the dispute concerning the existence of the aether. The pendulum provided a very clear and accessible window into the methodological innovation of the Scientific Revolution, of the methodological difference between the old Aristotelian and the new Galilean/Newtonian science. Domenico Bertoloni Meli observed that:

Starting with Galileo, the pendulum was taking a prominent place in the study of motion and mechanics, both as a time-measuring device and as a tool for studying motion, force, gravity, and collision. (Meli 2006, p.206)

With good reason the historian Bertrand Hall attested:

In the history of physics the pendulum plays a role of singular importance. From the early years of the seventeenth century, when Galileo announced his formulation of the laws governing pendular motion, to the early years of this century, when it was displaced by devices of superior accuracy, the pendulum was either an object of study or a means to study questions in astronomy, gravitation and mechanics. (Hall, 1978, p.441)

The importance of the pendulum in science and philosophy was exceeded only by its importance to commerce, navigation, exploration and European expansion. A convenient and accurate measure of the passage of time was crucial for the pressing commercial and military problem of determining longitude at sea, as well as for everyday economic and social affairs. The pendulum answered these problems.

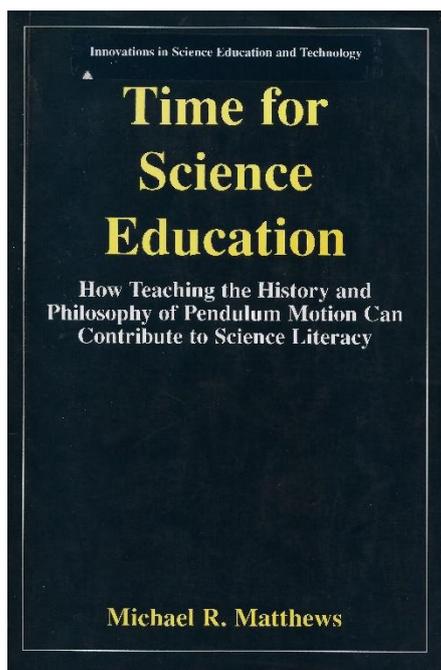
Unfortunately the centrality and importance of the pendulum for the development of modern science is not reflected in textbooks and school curricula where it appears as an ‘exceedingly arid’ subject and is mostly, even in the best classes, dismissed with a formula [$T=2\pi\sqrt{l/g}$], some routine mathematical exercises, and perhaps some practical classes. It is frequently mentioned as the ‘most boring subject in the physics programme’, and folk are not surprised to see the swinging pendulum used as a hypnosis-inducing artefact in comedies.

In the Introduction of *Time for Science Education* I wrote:

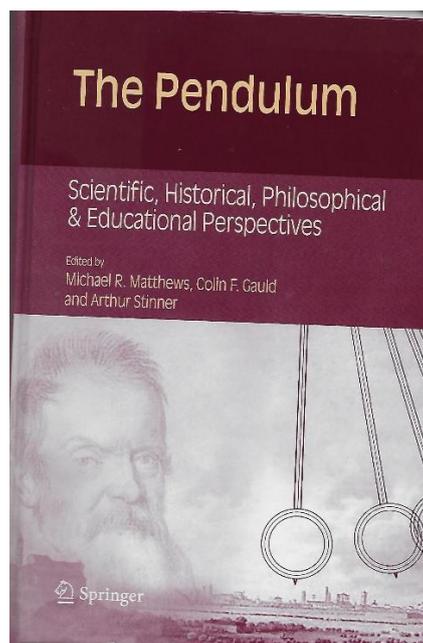
This book outlines something of the pendulum story and its scientific, philosophical, and cultural ramifications. It also tries to indicate how understanding that story can assist teachers to improve science education by suggesting pendulum-related curricular content, experimental and project work, and points of connection with other parts of science and other school subjects. Although the pendulum is a minor topic in most curricula, it is argued that the richer approach to its treatment can result in enhanced science literacy, and enhanced appreciation of the part played by science in the development of society and culture. (Matthews 2000, p.xx)

A reviewer of the *Time* book wrote that: ‘Matthews should spend more time in classrooms and less in libraries’. I can appreciate the point, but the pendulum has been well taught in classrooms for 100+ years and has figured in textbooks for the same period. My claim was that neither the classrooms nor the textbooks were capturing, or doing justice to, the incredible philosophical, technical, social and cultural reality of the pendulum. Only time in libraries, or the equivalent, reveals that rich history. I became aware of it by doing a graduate philosophy of science course at Boston University in 1978, not by doing a physics course or an education course.

With the pendulum book published, I moved on to coordinate a large International Pendulum Project. This was grounded on a number of special issues of *Science & Education*, and on two conferences held at UNSW (2002, 2005). All of this resulted in a 31-chapter anthology co-edited with Colin Gauld and Art Stinner ([*The Pendulum: Historical, Philosophical and Pedagogical Dimensions*](#), 2005). Colin Gauld and [Art Stinner](#) had themselves for decades been making substantial contributions to HPS&ST research and practice.



Time for Science Education (2000)



The Pendulum (2005)

It is worth relating that it was a graduate philosophy of science course on Galileo that opened my eyes to the incredible richness and wide-ranging impact of the pendulum, not a course in physics or in science education. Much research on children's learning of pendulum laws has been done in science education, but this is a tiny slice of the cultural, social, philosophical, technological and mathematical worlds to which the pendulum opens access. The same point about the enriching, expanding, deepening effects of adding HPS can, and have been, made for all topics in the science programme.

Similarly, the benefit of science educators studying and researching outside the science education field and bringing what they learnt back to science education should be obvious. Outside studies in disciplines such as cognitive science, psychology, philosophy, child development, sociology, STS should be encouraged and surely would enrich the educator's and colleagues' understanding of their own research and enrich their own teaching.

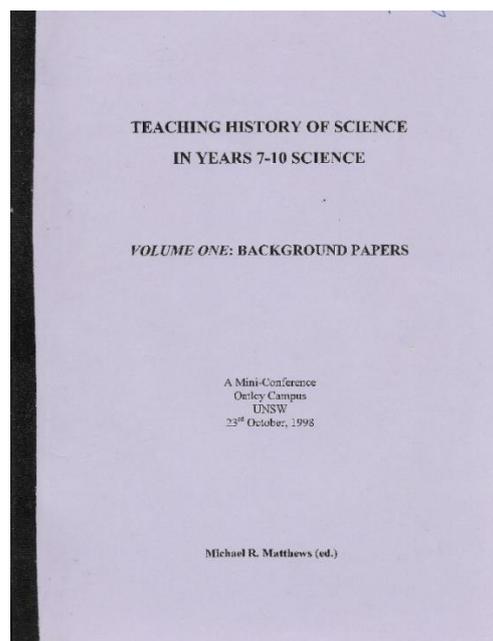
In-Service Courses for Science Teachers (1996-2003)

On my return to Sydney from Auckland, along with the pendulum book and pendulum project, I became involved with the State Board of Studies in processes to regenerate the secondary school science curriculum. I wrote papers for BOS meetings and conferences for the years 7-10 curriculum (1996) and then the years 11-12 curriculum (1997). The results were new curricula that incorporated HPS into the different science topics being taught. Parallel with this curriculum involvement, I organised annual one-day teacher conferences on 'HPS and Science Teaching'. These were required because, like everywhere else in the world, local science teachers had no training in HPS and yet were being asked to teach about it in their science programmes.

The first such conference, held in 1998, drew about 250-300 science teachers, which at the time was the largest ever gathering of New South Wales science teachers. It may still be so. 'Background Papers' were written (by Colin Gauld, Gordon Brown and myself) and distributed in advance to all teachers.

Parallel one-hour workshops were held throughout the day, with full text and materials printed and available to participants upon arrival. Historians, philosophers, scientists, and educators from most of the state's universities contributed.

Teachers' evaluations were overwhelming positive: 'We are hungry for this knowledge', one wrote.



First NSW HPS&ST Conference (1998)

The same pattern was followed for the following five years, with usually about 20-25 hour-long workshops on the programme. In the end it all got too much; both I and teachers had more pressing priorities. Nevertheless, these meetings were the sort of discipline-based philosopher's engagement with teachers that I have come to see as being the most productive kind for philosophers of education.

My UNSW colleague and friend, Peter Slezak, was a contributor to these meetings. He trained in sociology at UNSW, took his PhD in philosophy at Columbia University, and was appointed to UNSW School of HPS in 1981. There he founded and directed the university's cognitive science programme. His enthusiasm for science, philosophy of science, and liberal education had a great impact on students, teachers and colleagues. Pleasingly he has been a contributor to all UNSW HPS&ST teachers' conferences, to IHPST conferences, and *Science & Education* journal during my editorship (Slezak 1994a,b, 2014).



Peter Slezak

HPS&ST Projects (2000-20)

For the past twenty years, from about 2000, I have been involved in a number of parallel yet overlapping and connected HPS&ST research projects. These have been: Science Education and Worldviews, Joseph Priestley, Ernst Mach, Cultural Studies, Feng Shui as Pseudoscience, Mario Bunge, and Science Teacher Education.

I Science Education and Worldviews

The relationship between the theory and practice of science and cultural worldviews is an issue that ticks away, sometimes softly at other times loudly, for students, parents, science teachers, curriculum writers, examiners, and many others. At issue is whether science assumes some set of worldview commitments about matters of:

Ontology: what sorts of things exist and do not exist in the world; is the world really out there and independent of consciousness?

Epistemology: how is knowledge about the world achieved and justified; are there extra-scientific authorities that can inform us about the world and its processes?

Ethics: are moral laws part of the universal fabric of the world or are they culture-bound conventions; is goodness and a moral life connected to how the world is?

Anthropology: are humans especially distinctive and apart from all other species in nature; do humans alone have souls, reason, conscience, feelings?

Teleology: is the world purposeful or goal directed, and do natural processes occur so as to satisfy internal or external ends?

Cosmogony: how and when did the world begin?

The issue ticks away softly when the worldview of science and culture align, it ticks loudly when they do not.

In all cultures, from the very beginning of scientific inquiry about nature, these worldview questions have arisen because they are a part and parcel of the unavoidable question: What is the Nature of Science?

In the West, the Atomism of the new 17th century Galilean/Newtonian science, what has been labelled ‘the mechanical worldview’, brought them into clear relief; as did Darwin’s evolutionary theory of the 19th century, with its all-encompassing naturalism; and in the early 20th century the new quantum, non-deterministic theory. In every case, philosophers, theologians, poets and literary figures engaged with the supposed new scientific worldview – adopting it, accommodating to it, rejecting it, denying that science is committed to any worldview but rather affirming that it is merely a metaphysics-free way of manipulating the world.

The Islamic tradition frequently renounced the new scientific worldview, and its Enlightenment champions. A representative Islamic reaction to the Scientific Revolution can be seen when one contemporary scholar writes that the new science of Galileo and Newton had tragic consequences for the West because it marked:

The first occasion in human history when a human collectivity completely replaced the religious understanding of the order of nature for one that was not only nonreligious but that also challenged some of the most basic tenets of the religious perspective. (Nasr 1996, p.130)

Nasr repeats Western religious and romantic laments about the new science when he writes:

Henceforth as long as only the quantitative face of nature was considered as real, and the new science was seen as the only science of nature, the religious meaning of the order of nature was irrelevant, at best an emotional and poetic response to ‘matter in motion’. (Nasr 1996, p.143)

In a comparable manner, Darwin's theory provided not just a novel account of the origin of species by natural selection, but it initiated a transformation of modern worldviews and a new understanding of the place of human beings in the natural world. At a popular level the worldview dimension of Darwinism was captured at the time by the British Prime Minister Benjamin Disraeli who famously proclaimed in 1864 at the Oxford Diocesan Society: 'Is man an ape or an angel? My Lord, I am on the side of the angels.' (Desmond & Moore 1991, p.527).

Versions of Darwin's evolutionary naturalism have become commonplace in most, but not all, modern worldviews. The Spanish Government introduced legislation in June 2008 to grant a limited number of traditional human rights (life, liberty and freedom from physical and psychological torture) to the great apes (gorillas, chimpanzees, and orangutans). The Spanish Catholic Church has spoken against the legislation saying it erodes the Biblical injunction that gives humans dominion over the earth, and it diminishes the unique and primary place of human beings in the order of things; a uniqueness coming from the possession of an immortal soul that gives intelligibility to the central Christian doctrines of Redemption, Salvation and Judgement.

Reasonably, school science programmes have long been asked to elaborate upon aspects of the science/society/worldview connection. The Duke of Argyll in his 1856 Presidential Address to the British Association for the Advancement of Science challenged the meeting with the claim that:

What we want in the teaching of the young, is, not so much the mere results, as the methods and, above all, the history of science ... that is what we ought to teach, if we desire to see education, well-conducted to the great ends in view.

The influential UK government report of 1918 - *Natural Science in Education* (Thompson, 1918) - maintained that in science teaching:

It is desirable . . . to introduce into the teaching some account of the main achievements of science and of the methods by which they have been obtained. There should be more of the spirit, and less of the valley of dry bones . . . One way of doing this is by lessons on the history of science. (Brock 1989, p.31)

Thirty years ago the American Association for the Advancement of Science in its *Project 2061* restated the point in stronger terms:

Becoming aware of the impact of scientific and technological developments on human beliefs and feelings should be part of everyone's science education. (AAAS 1989, p.173)

And elaborated the point a year later in its *The Liberal Art of Science*:

The teaching of science must explore the interplay between science and the intellectual and cultural traditions in which it is firmly embedded. Science has a history that can demonstrate the relationship between science and the wider world of ideas and can illuminate contemporary issues. (AAAS 1990, p.xiv)

These expectations pleasingly were carried into the 1996 US [National Science Education Standards](#) which had a separate strand on 'History and Nature of Science Standards' (NRC 1996) whose contents were to be reflected throughout the K-12 curriculum. The NRC said:

Students should develop an understanding of what science is, what science is not, what science can and cannot do, and how science contributes to culture. (NRC 1996, p.2)

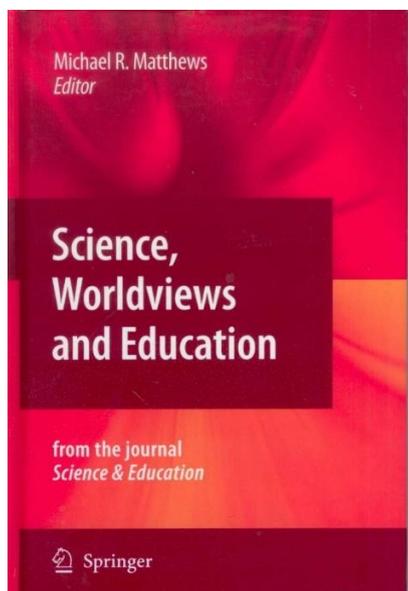
And,

The standards for the history and nature of science recommend the use of history in school science programs to clarify different aspects of scientific inquiry, the human aspects of science, and the role that science has played in the development of various cultures. (NRC 1996, p.107)

It was less explicit, but still there, in the 2013 [Next Generation Science Standards](#) (NRC 2013). Nature of Science (NOS) competence, in part, meant students had to have some appreciation and understanding of the interplay of science and culture. The same objective was part of the OECD's [Programme for International Student Assessment](#) (PISA). In all cases, the expectations held for students applied to teachers, and so required attention to how teachers were going to acquire such NOS or, the same thing, HPS interest and competence.

The connection of science and worldviews was the subject of my own research and writing in my final years at UNSW. As editor of *Science & Education*, I oversaw the publication in 2009 of a substantial 320-page, 14-article thematic [double-issue on the topic](#) (Vol.18 Nos.6-7), which was contributed to by biologists, physicists, philosophers, theologians and educators.

My own views on the subject of science and worldviews, and on how and why the issue can be broached in science classes, are elaborated in the [Introduction](#) I wrote for the volume and in the contributed essay '[Teaching the Philosophical and Worldview Components of Science](#)'.



Science, Worldviews and Education (2009)

The double issue was published by Springer as a book – [Science, Worldviews and Education](#). By 2017, there were 10,025 chapter-downloads from the book's Springer website, and an unknown number from the original journal site. This is evidence that the 'wider view' of science education is shared by many.

These issues concerning 'Science, Worldviews and Education' were continuous with the preoccupations I had back in University of Sydney Newman Society days and that were developed with my further undergraduate studies in philosophy. For millions of Catholics in the 1960s it was the Church's prohibition of contraception, something made so public when the contraceptive pill arrived in all pharmacies, that brought to their attention the connection of worldviews, science and philosophy.

Subsequent to Pope Paul VI's 1968 *Humanae Vitae* encyclical that reaffirmed the traditional condemnation of contraception, hundreds attended Sydney University Newman Society

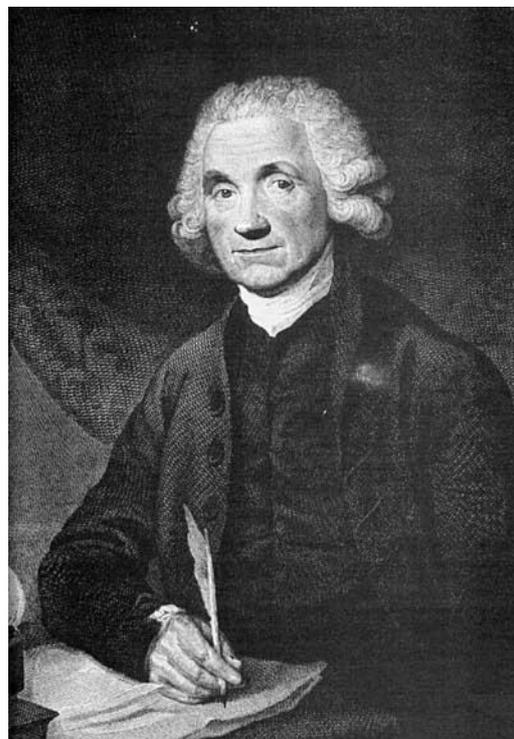
debates on the subject. The debates were not merely about Church authority, they were also about the whole intellectual scheme, ‘paradigm’, from which the Church’s position came and within which it was justified.

The Church’s moral teaching was based on an Aristotelian/Thomist account of natural law wherein the reproductive process had certain intrinsic, natural ends or goals that should not be frustrated; to do so was ‘contrary to natural law’ and, for the Church, was sinful (Noonan 1965). Taking the pill put one outside the sacramental life of the Church. Reconciling the worldview of science and the worldview of the Church was not a idle matter.

II Joseph Priestley

In the early 2000 years I was engaged with reading of the life and work of [Joseph Priestley](#) (1733-1804). It began as part of my work on science and worldviews but took on a life of its own. Priestley was a fascinating and rewarding subject. Additionally, his work on combustion and [photosynthesis](#) well-fitted my programme of showing how the history and philosophy of science can illuminate everyday teaching of science (Matthews 2009).

Priestley was one of the foremost scientists (natural philosophers) of the eighteenth century, a life-long devout Christian minister, and an energetic exponent of Enlightenment principles, in particular the necessity of applying the methodology of Newtonian science to all fields of inquiry – historical, theological, educational, psychological, and ethical. Priestley advocated the separation of Church and State, freedom of speech, freedom of religion, de-criminalisation of heterodox religious beliefs especially non-Trinitarian belief (in his time, rejection of the Trinity led to imprisonment in England and hanging in Scotland), and the freedom of science (including historical studies of religious scripture) from political and religious control. In addition, as with all Enlightenment philosophers, he was a ceaseless advocate of education.



Joseph Priestley

Priestley was a polymath with staggeringly wide interests. Along with maintaining an active clerical life as a Dissenting minister, Priestley published an enormous number of authoritative works across a wide range of fields: these included over two hundred books, pamphlets and articles in history of science (specifically of electricity and optics), political theory, theology, biblical criticism, church history, theory of language, philosophy of education, rhetoric, as well as chemistry for which he is now best known.

But more than this, Priestley sought coherence and intellectual unity in his scholarly, personal, religious and political activity. Newton had established that the single law of attraction applied on earth and in the heavens. Priestley thought the same simplicity of law

would apply through the social and mental (psychological) realms as well; this in part because there was only a single substance, matter, throughout all realms. He was a forceful advocate of the materialist tradition in the Enlightenment. He was an ontological monist; rejecting all dualisms in natural philosophy, psychology and religion.

Priestley was a forceful critic of the hylomorphism, the matter/form metaphysics of Aristotelianism that was then, and still is, embedded in the philosophy and doctrine of the Catholic Church. In 1778 he wrote to the Jesuit philosopher/physicist [Roger Boscovich](#) saying that:

the vulgar hypothesis [Aristotelian matter theory], which I combat, has been the foundation of the grossest corruptions of true Christianity; and especially [those] of the church of Rome, of which you are a member; but which I consider as properly *antichristian*, and a system of abominations little better than heathenism. (Schofield 1966, p.167)

Modern appreciation of Priestley has been significantly influenced by the harsh judgement of Thomas Kuhn in his best-selling *Structure of Scientific Revolutions* (Kuhn 1970). In a famous (that should be seen as infamous) passage Kuhn writes of the irrationality of paradigm change and of old paradigms just dying out until ‘at last only a few elderly hold-outs remain’. He then singularly names Priestley as an example ‘of the man who continues to resist after his whole profession has been converted’ and adds that such a man ‘has *ipso facto* ceased to be a scientist’ (Kuhn 1970, p.159). Kuhn essentially ‘blackened’ Priestley’s reputation in the academic world and beyond. His has become the widely-accepted obituary for Priestley – the stubborn old man who held on to belief in a peculiar phlogiston substance and who resisted the dawning light of Lavoisierian chemistry. Pleasingly, some historians and philosophers – Robert Schofield (1997, 2004), John McEvoy (1990) and William Brock (2008) - have provided extensive studies that refute Kuhn’s caricature of Priestley. Kuhn wrote many insightful things; but also many that were not, including his assessment of Priestley.

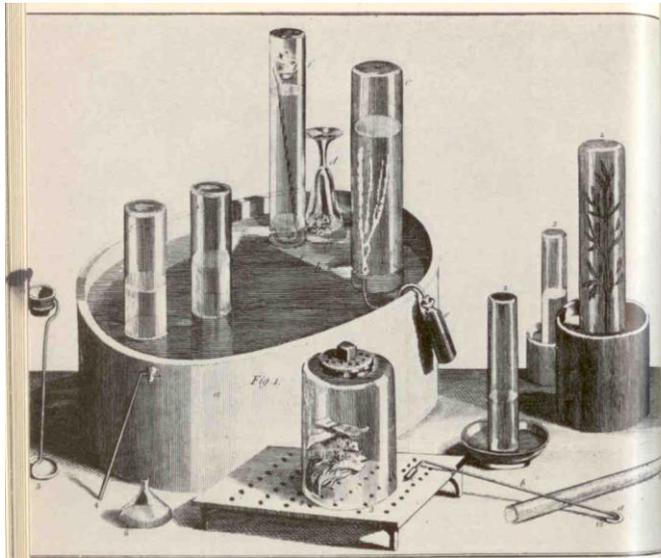
A more generous and accurate assessment of Priestley was given by Frederic Harrison in his Introduction of a nineteenth-century edition of Priestley’s *Scientific Correspondence*:

If we choose one man as a type of the intellectual energy of the eighteenth century, we could hardly find a better than Joseph Priestley, though his was not the greatest mind of the century. His versatility, eagerness, activity, and humanity; the immense range of his curiosity in all things, physical, moral, or social; his place in science, in theology, in philosophy, and in politics; his peculiar relation to the [French] Revolution, and the pathetic story of his unmerited sufferings, may make him the hero of the eighteenth century. (Bolton 1892, Introduction)

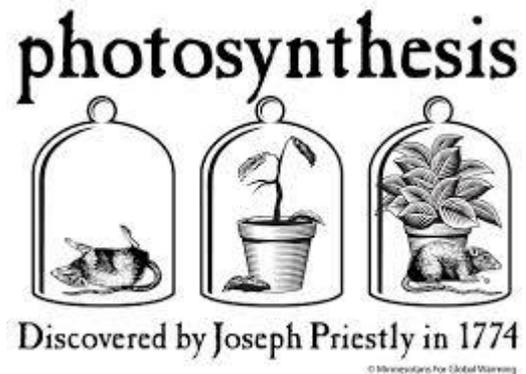
Priestley is an under-utilised figure in science education. Although his contribution to the discovery of oxygen is recognised, it is usually glossed by a Kuhnianesque comment that he was an obscurantist concerning Lavoisier’s new chemistry and a dogmatist concerning his own adherence to the phlogiston account of combustion and respiration.

Unfortunately, Priestley’s contribution to the modern understanding of photosynthesis is seldom mentioned in school curricula. This is a pity as his role was pivotal, and students can very easily be led through many of the same experimental steps that he took - the materials and equipment are all very basic. Green leaves and brown leaves can be put in an inverted test tube in water and left in the sun; after not very long an ‘air’ bubble appears above the

green leaves, nothing above the brown. The experiment can be done at night and no air appears over either. And so on. Because he wrote so well and clearly, reading his texts is easy for students. There is the opportunity for students to ‘walk in the footsteps’ of a great scientist and thereby not only learn scientific content, method and methodology, but also to get a sense of participation in a tradition of thought and analysis that is at the core of the modern world. Priestley’s work is readymade for ‘Historical-Investigative’ teaching.



Priestley's Apparatus



Priestley's Photosynthesis Experiment

Such Priestley-guided participation allows students to appreciate and understand key elements of the scientific tradition: hard work, experimentation, independence of mind, a respect for evidence, a preparedness to bring scientific modes of thought to the analysis and understanding of more general social and cultural problems, a deep suspicion of authoritarianism and dogmatism, and the concern for promotion of an open society as the condition for the advance of knowledge.

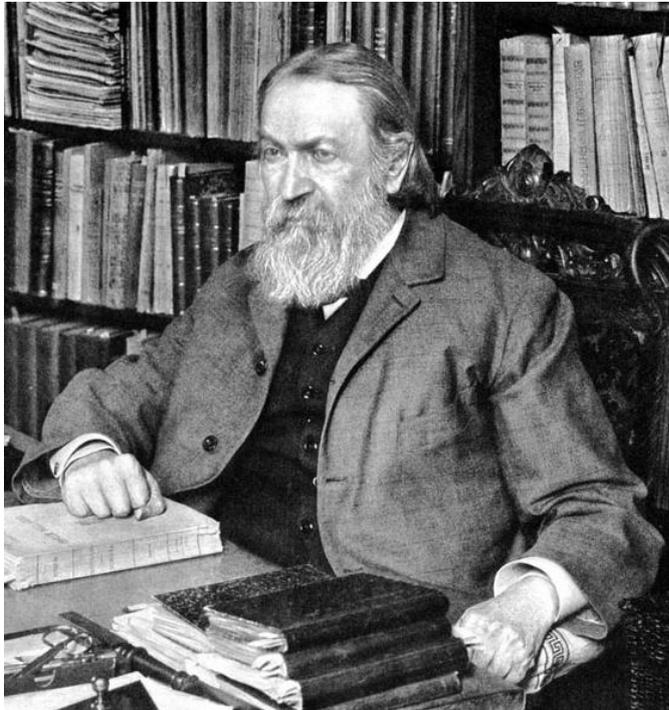
The education of science students can only be enriched by learning something of Priestley's life, times and achievements. Bringing Priestley into education allows light to be shed upon the mutual interaction of worldviews and science; it allows the scientific sources of the European Enlightenment to be investigated; and it allows the evaluation of the special Enlightenment *niche* occupied by Priestley, namely the theistic, albeit dissenting, strand of the Enlightenment. Understanding and appreciating this connection between science and the Enlightenment; and having the opportunity to examine what is dead and what is living in that tradition can be a major contribution of science classes to the cultural education of students in the modern world.

III Ernst Mach

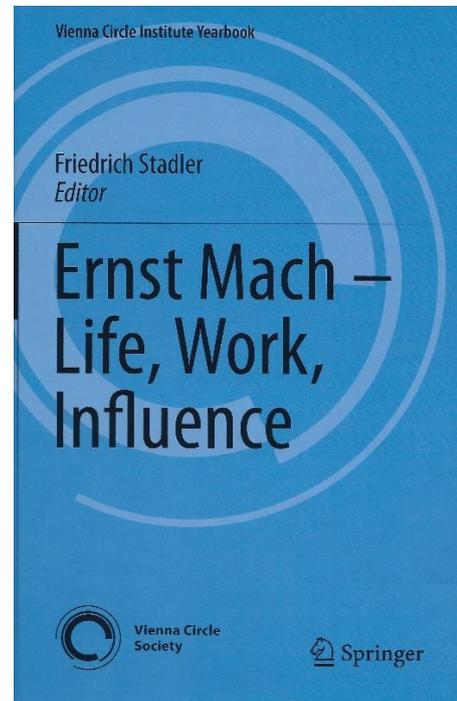
Abner Shimony's 1978 Galileo course at Boston University led to two research interests: first, pendulum studies which have been mentioned above; and second, reading and writing on Ernst Mach. The connection to Mach was through the elaboration of Galileo's thought experiments, something from which Mach drew both epistemological and educational lessons. Karl Popper said of Galileo's 'imaginary' experiment refuting Aristotle's supposed 'speed of fall varies as weight' law, that it was:

One of the most important imaginary experiments in the history of natural philosophy, and one of the simplest and most ingenious arguments in the history of rational thought about our universe. (Popper 1934/1959, p.442)

Mach maintained that: ‘Experimenting in thought is important not only for the professional inquirer, but also for mental development as such’, not only the student but ‘the teacher gains immeasurably by this method’ (Mach 1896/1976, p.143).



Ernst Mach



Vienna Centenary Conference 2016

In Boston I was given, and worked through, volume six of the Boston Studies series - *Ernst Mach: Physicist and Philosopher* (Cohen & Seeger, 1970). It is a wonderful collection of papers by, among others, Robert Cohen, Gerald Holton, Peter Bergmann, Erwin Hiebert and Otto Blüh.

Ernst Mach was a major contributor to the European Enlightenment tradition, and one of the great philosopher-scientists of the late-nineteenth and early-twentieth centuries. He had immediate and continuing influence in European and more generally international physics, philosophy, biology, physiology, psychology, economics, sociology, and much else, including mathematics and literature. The first of Mach's five hundred publications appeared in 1859, the year of Darwin's *The Origin of Species*. The last appeared in 1921, five years after his death.

Einstein said of Mach's *The Science of Mechanics* that: ‘This book exercised a profound influence upon me while I was a student. I see Mach's greatness in his incorruptible skepticism and independence’ (Einstein 1951, p.21). Einstein wrote in a letter to Mach that all the physicists of his generation had ‘imbibed Mach with their mother's milk’. He repeated this in his obituary for Mach. Of particular impact on Einstein was Mach's historical sensibility; his awareness that human cognition is historically influenced and contingent. In the *The Science of Mechanics* Mach writes:

The historical investigation of the development of a science is most needful, lest the principles treasured up in it become a system of half-understood prescripts, or worse, a system of *prejudices*. Historical investigation not only promotes the understanding of that which now is, but also brings new possibilities before us, by showing that which exists to be in great measure *conventional* and *accidental*. (Mach 1893/1974, p.316)

Einstein said that this recognition gave him the freedom to think outside of the categories of Newtonian science. Cardinal Newman called on the same sensibility to better understand or legitimise the development of religious doctrine (Newman 1846/1960). Mach's position is contrary to fundamentalisms of all kinds – political, religious, scientific, or any others.

William James (1842-1910), the US philosopher and psychologist, in an 1882 letter to his wife written after visiting Mach in Prague, said:

Mach came to my hotel and I spent four hours walking and supping with him at his club, an unforgettable conversation. I don't think anyone ever gave me so strong an impression of pure intellectual genius. He apparently has read everything and thought about everything, and has an absolute simplicity of manner and a winningness of smile, when his face lights up, that are charming. (Frank 1950, p.79)

As with most champions of the Enlightenment, Mach was deeply involved with education. He published numerous school and college textbooks; he addressed a multitude of teachers' meetings; in 1884, he co-founded and edited the first ever research journal for science education - *Zeitschrift für den physikalischen und chemischen Unterricht* (*Journal of Instruction in Physics and Chemistry*); he taught what might have been the first ever university teacher-education course; he had an on-going engagement with the reform and restructuring of Austrian high school education, especially on breaking the stranglehold that Classics had at the expense of Science on university admission; he wrote a number of detailed studies on learning and concept development; he argued for the need to synchronise teaching to how children learn and form their concepts; and as a member of the Upper House of the Austrian parliament he made speeches and interventions on education policy.

Mach explicitly addressed pedagogical issues in three famous papers. One was his most systematic treatment of education in general and science education in particular – 'On Instruction in the Classics and the Mathematico-Physical Sciences' (Mach 1886/1986), translated in his *Popular Scientific Lectures*. Two others were 'On Instruction in Heat Theory' (1887), and 'About the Psychological and Logical Moment in Scientific Instruction' (1890). The first English translation of the latter was done by Hayo Siemsen and published in *History, Philosophy and Science Teaching: New Perspectives* (Mach 1890/2018).

Despite being an extraordinary scholar who read and knew so much, Mach was appalled at overfilled German and Austrian curricula. For him, the principal aims of education were to develop understanding, strengthen reason, and promote imagination. A bloated curriculum counteracted these aims:

I know nothing more terrible than the poor creatures who have learned too much. What they have acquired is a spider's web of thoughts too weak to furnish sure supports, but complicated enough to produce confusion. (Mach 1895/1986, p.367)

He believed in presenting science historically, or as he put it, teaching should follow the genetic approach:

every young student could come into living contact with and pursue to their ultimate logical consequences merely a *few* mathematical or scientific discoveries. Such selections would be mainly and naturally associated with selections from the great scientific classics. A few powerful and lucid ideas could thus be made to take root in the mind and receive thorough elaboration. (Mach 1895/1986, p.368).

Mach's educational ideas are fairly simple and uncontroversial; the HPS&ST programme can easily embrace them:

- Begin instruction with concrete materials and thoroughly familiarize students with the phenomena discussed.
- Aim for understanding and comprehension of the subject matter.
- Teach a little, but teach it well.
- Follow the historical order of development of a subject.
- Tailor teaching to the intellectual level and capacity of students.
- Address the philosophical questions that science entails and which gave rise to science.
- Show that just as individual ideas can be improved, so also scientific ideas have constantly been, and will continue to be, overhauled and improved.
- Engage the mind of the learner.

In brief, Mach made important contributions to both the *theory* and the *practice* of education. It is a great pity that his work is not better known in the Anglo-American science education community. It is telling that Mach's name does not appear in the Index of the popular and scholarly *A History of Ideas in Science Education* (DeBoer 1991).

Two of my papers on Mach were published in the 1989 Tallahassee conference journals (Matthews 1989, 1990). After that, along with other pursuits, research and publications that have been mentioned above, I kept up my Mach interests and acquired a considerable Mach library. For the three-volume Springer *Handbook of Research in History, Philosophy and Science Teaching* I commissioned a chapter on Mach (Siemsen 2014) and another chapter on 'Thought Experiments in Science and in Science Education' (Asikainen & Hirvonen 2014).

In 2014 I was invited to give a plenary lecture on 'Mach and Education' to the 2016 Mach Centenary Conference being staged by the Vienna Circle Studies Centre at University of Vienna. This was an opportunity to gather together a good deal of my reading and accumulated writing on Mach; pleasingly, [the lecture](#) was subsequently published in the 50-chapter select conference proceedings (Matthews 2019).

IV Cultural Studies in Science Education

In 2018 Springer published the 12-chapter [History, Philosophy and Science Teaching: New Perspectives](#) (Matthews 2018). It was conceived as a follow-up, 4th volume, to the 2014 *HPS&ST Handbook*. Its chapters documented and appraised research on topics not included in the original handbook. Of particular note were chapters on The Enlightenment, Indoctrination, and Cultural Studies.

Cultural Studies is a growing but contested field. Its growth is directly linked to the decline of the constructivist research and pedagogical programme. After sustained philosophical

criticism, and more recently refutation of its claims to be a guide for successful pedagogy (Kirschner, Sweller, & Clark, 2006), constructivism has waned. Thirty years ago there were hundreds of constructivist presentations at the US annual NARST and AERA conferences. In recent years only a handful of papers with “constructivism” in their title could be found on the programme. The Constructivist SIG at AERA has basically closed shop, having just four papers on the programme at the 2015 annual meeting.

As constructivism waned in science education, many former advocates re-branded themselves as critical theorists or cultural theorists. In 2006 Kenneth Tobin and Wolff-Michael Roth founded the journal *Cultural Studies of Science Education*. Tobin had been a joint-chair of the 1989 Tallahassee conference at which the IHPST group was founded. He was a contributor to early meetings. Both had been highly published and prize-winning champions of constructivism who then rejected and disowned the position. Roth announced his apostasy saying that constructivism ‘turned out to be plagued with considerable contradictions’ (Roth 2006, p.326). Something that many philosophers, including Wallis Suchting quoted earlier, had said from the outset. Kenneth Tobin had ‘Moved on’ from constructivism and elsewhere stated his [new position](#) as:

In contrast to the mainstream of research in science education, I advocate a multilogical methodology that embraces incommensurability, polysemia, subjectivity, and polyphonia as a means of preserving the integrity and potential of knowledge systems to generate and maintain disparate perspectives, outcomes, and implications for practice. In such a multilogical model, power discourses such as Western medicine carry no greater weight than complementary knowledge systems that may have been marginalized in a social world in which monosemia is dominant. (Tobin 2015, p.3)

Who knows what this means? The claim, as with so many other cultural studies assertions, minimally cries out for a word-by-word, phrase-by-phrase, sentence-by-sentence application of the standard philosopher’s question: What do you mean by?

Cultural Studies and Critical Theory have morphed. Henry Giroux, a stellar figure in critical theory who is oft-quoted by cultural-studies aligned science educators, managed to write, and have published, the following 80-word sentence:

In this case, the notion of voice is developed around a politics of difference and community that is not rooted in simply a celebration of plurality, but rather in a particular form of human community that encourages and dignifies plurality as part of an ongoing effort to develop social relations in which all voices in their differences become unified in their efforts to identify and recall moments of human suffering and the need to overcome the conditions that perpetuate such suffering. (Giroux 1987, p.119)

What can one say? Giroux presumably is trying to say something, but he is not succeeding. Critical theory abounds in such sentences – as stunningly revealed by the Sokal hoax where hundreds of such sentences were randomly strung together and published to acclaim in a leading Critical Theory journal (Sokal & Bricmont 1998). The great pity is that it is from such sources that science educators are filling in the ‘big picture’ of science in their teaching. The mangling of language and the inability to write clearly should be an embarrassment, it should be struck out by editors, but it is not. Such writing is a ticket to the top.

The obvious question for educators is: To what degree does the new cultural studies programme embody the philosophical and pedagogical weaknesses (errors) of its constructivist parent? The brief answer is: 'A lot'.

For example, consider the foundational claim made by Wolff-Michael Roth, Kenneth Tobin and Stephen Ritchie, three major cultural theorists and journal editors:

Science is viewed as a discourse that is a relatively recent activity of humankind, the goal being to make sense of a universe of phenomena in terms of knowledge that is viable. (Roth, Tobin & Richie 2001, p.218)

This is simply false. That science is viewed as a discourse and not an activity is revealing. Science requires discourse and communication, but many human occupations, including knowledge seeking ones, require that. What science requires is experimental intervention in the world and the harnessing of technologies, minimally measurement technologies. Marx in his *Theses on Feuerbach* had a much better feel for the practical, interventionist, experimental character of science. The *praxis* of science.

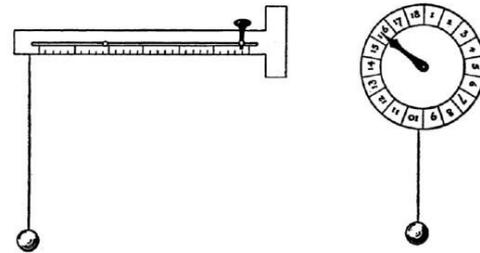
The goal of science is not to 'make sense' of the world, but to explain the world and its processes; to identify lawful behaviours and causal relations in a world that exists independently of us. Poets, artists, novelists, theologians, and everyone else can, and do, make sense of things about them, but making sense is not making science. Every major step forward in science has defied the common sense of the time. Galileo memorably commented on those few who were promoting the Copernican helio-centric, rotating Earth account of the solar system:

Nor can I ever sufficiently admire the outstanding acumen of those who have taken hold of this opinion and accepted it as true; they have through sheer force of intellect done such violence to their own senses as to prefer what reason told them over that which sensible experience plainly showed them to the contrary ... , there is no limit to my astonishment when I reflect that Aristarchus and Copernicus were able to make reason so conquer sense that, in defiance of the latter, the former became mistress of their belief. (Galileo 1633/1953, p. 328)

Thus, the title of Lewis Wolpert's book *The Unnatural Nature of Science* (Wolpert 1992).

Further, if phenomena are understood as experiences of the world, then science is not concerned with the universe of phenomena, the realm of experience, it is concerned with the universe that gives rise to phenomena. There are countless arrays of different experiences or 'phenomena' occasioned by planetary motion. Novelists, poets and anyone else can interpret that array; sociologists, psychologists, anthropologists and others can scientifically study the array; but scientists study the planetary motion that exists independently of any phenomena or experience.

The history of measuring instruments in science is testament to the replacement of subjective experience and feelings with objective measures. Galileo's pulsilogium, that measured pulse rate by the length of a swinging pendulum beating in time with the pulse, replaced 'it feels fast to me' with a length of string that could be objectively measured. Thermometers replaced 'it feels hot to me', scales replaced 'it feels heavy to me', tape measures replaced 'it looks long to me', ammeters replaced 'there must be a lot of current in the wire' and so on.



Galileo's Medical Pulsilogium

Identifying, accounting for, or eliminating subjectivity is at the heart of scientific progress.

Many constructivists, critical theorists, and cultural theorists reach out to quantum mechanics to show that the observer's experience, the phenomenon, is necessarily tied to, and a part of, scientific observation and measurement. So Wolff-Michael Roth confidently asserts that:

The doctrine that the world is made up of objects whose existence is independent of human consciousness turns out to be in conflict with quantum mechanics and with facts established by experiments. (Roth 1993, p.673)

This is the subjectivist interpretation of the formalism of quantum mechanics and Heisenberg's Uncertainty Principle. It is oft labelled the *Copenhagen* interpretation. For these, quantum measurement (something in the macro phenomenal world) changes the objective micro-world. As often expressed, the wave-packet collapses when measurement occurs, when measurement is registered in consciousness. Everybody knows that measurement can affect what is being measured – think of the problems of participant observation in sociology or anthropology – and these effects need to be identified and accounted for. But this is different from saying that measurement creates the object; that our measuring creates the quantum world knowledge of which is given in quantum mechanics.

Abner Shimony (1963/1993), Art Hobson (2019) and Mario Bunge (1977, [2003](#)) are just three of many philosophically-competent physicists, who reject this common subjectivist view. Each point out that there is simply no 'observer term' in formalised quantum mechanics; the observer is not in the QM equation; observers and their experiences (phenomena) are not part of quantum mechanics. Observers (scientists) are needed to create quantum mechanics, and they bring with them culture, personal experience and many other things. This is a truism. But scientists are not part of the science they create. Religion was of greatest importance *for* Newton, and *for* his science; but it is not *in* his science.

Finally, the goal of scientific knowledge is to be correct, not to be viable. Superstitions are viable, ideologies are viable, racism is viable, any belief or commitment can be viable, but that has no bearing at all on whether it is scientific much less true. The Aristotelian world picture, along with its science, made perfect sense to everyone for two thousand years. The stationary earth around which the sun rotated, fitted in with everyone's experience or the 'phenomena'. It was viable. Copernicus, Kepler, Galileo did not study people's experiences,

they studied the movement of planets. In Stalin's USSR, belief in Lysenkoism was most viable, whereas belief in Mendelian hereditary was not viable, it was a prison sentence or a death sentence.

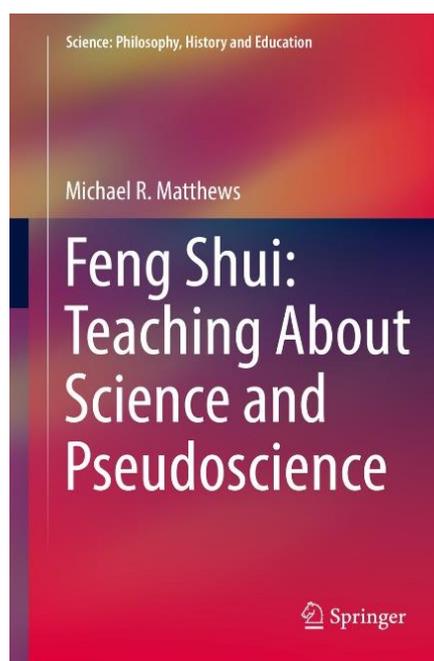
To pursue viability in science, rather than correctness, is to go down the wrong philosophical, and ultimately educational, track. There is little evidence that cultural theorists recognise this; indeed, on the contrary, they have gone full-steam down those rocky tracks.

In the depths of the 2020 international COVID-19 crisis it is noteworthy that no complementary knowledge system has contributed to the identification and understanding of the coronavirus, its vectors, its mutation, or its discriminatory impact on those infected. Such understanding as we have is provided by the 'Western' medicine that Tobin and cultural theorists say has no greater epistemological weight than any other, and by social-scientific epidemiological studies of the disease's harrowing spread. How do cultural theorists appraise, much less criticize, China's National Health Commission that in March 2020 recommended that those critically ill with COVID-19 take a traditional Chinese remedy containing bear bile and goat horn?

V Feng Shui as Pseudoscience

Since my early university Catholic days and interests in Thomism, I have been taken with questions about science and worldviews. As mentioned above, I have written papers and edited anthologies on the subject. In recent years this has flowed over to writing and lecturing on Feng Shui. I see this as an example of where science teaching might contribute to the appraisal of important cultural commitments and social movements.

In 2019 Springer published my book [Feng Shui: Teaching About Science and Pseudoscience](#). It is wide-ranging having 340 pages, 14 chapters, and 830 references.



Feng Shui (2019)

The book takes up a challenge made 20 years ago by Mario Bunge:

Given the intrinsic interest and the cultural importance of pseudoscience and anti-science, it is surprising that they should receive so little attention on the part of philosophers, particularly in our times of crisis of public confidence in science. (Bunge 2001, p.189)

As there is almost no extant discussion of the educational opportunities and responsibilities afforded by feng shui for science teachers, the book is a modest beginning to both the philosophical and educational tasks.

Although feng shui practices and worldview have their origin in East Asia, both have an increasing international presence. Feng shui medical practices, under the title of ‘complementary’ or ‘alternative’ medicine, are routinely taught in Western medical schools; feng shui architecture is likewise taught in many Western architecture faculties and China hosts international conferences on the subject.

The Amazon Kindle site lists over one thousand feng shui books in English alone; there are countless thousands, if not hundreds of thousands, of commercial feng shui web sites; likely millions of people throughout the world daily visit these sites and to varying degrees regulate or inform their life by what they read and purchase.

Feng shui is a set of beliefs and practices arising from an ancient deeply-entrenched Chinese and East-Asian worldview, the core of which is belief in chi (*qi*) an all-encompassing, universal life-force and mysterious energy. Chi belief has been an integral part of Chinese culture – Confucian, Daoist, Buddhist and other variants - for at least three thousand years. The practice of directing and controlling personal chi (*qi*) is called *qigong* (*gong* meaning work/effort). Feng shui belief bears upon most aspects of everyday life: the design of domestic, commercial and government buildings; the siting and orientation of graves; personal fortune telling and divination; choosing auspicious times for marriage, commencement of building construction, opening a restaurant, launching a public company, going on holidays, and much more.

The worldview underwrites and justifies traditional Chinese medicine (TCM) practices of acupuncture and herbal medicine. From once being banned, it is now heavily promoted by the Chinese Communist Party for nationalist ends. It is a booming, billion-dollar business.

Feng shui’s worldview is purportedly naturalistic yet the mysterious chi life-force is yet to be identified in any science laboratory; there is no chi meter comparable to a Geiger counter. The claim to naturalism does invite the attention of science teachers.

Simon Brown, author of *The Feng Shui Bible*, gives an account of chi that can be found in thousands of popular books on the subject:

Chi is the subtle charge of electromagnetic energy that runs through everything, carrying information from one thing to another. The chi flowing through your body predominantly carries your thoughts, beliefs and emotions. At the same time some of your chi is floating off, while you are also drawing in new energy. ... Your energy field connects you to everything else, whether you like it or not. The secret to making this energy work is understanding the process and finding out how you can make it help you in life. (Brown 2005, p.24)

In 1986 the Qigong Cooperative Research Group at Tsinghua Technical University in Beijing claimed that:

the mind power or *Qi* emitted by a trained Qigong master can influence or change the molecular structure of many test samples, including those of DNA and RNA, even if these test samples are 6 to 2,000 kilometers away from the master. *Qi* can also affect the half-life of radioactive isotopes and the polarization plane of a beam of light as emitted from a Helium-Neon laser. (<https://www.coursehero.com/file/29182201/chinesechiresearchdoc/>)

These and countless other such feng shui claims about chi and its powers are truly staggering. One advocate wrote: ‘They change our view of what science is’. If the claims

are true, they certainly do change our view of what science is. Yet there is a surprising asymmetry between the presence, spread and impact of feng shui and its philosophical and scientific appraisal. There is much of the former and little of the latter.

The philosophical examination of feng shui leads directly to important and engaging issues about the role of metaphysics in science, realism versus instrumentalism, ontological versus methodological naturalism, the function of empirical evidence in theory appraisal, the demarcation of science from non-science, and more specifically the demarcation of science from pseudoscience. Many philosophers deny that such a distinction can be made, much less defended. I maintained that the distinction can be made and defended; and that feng shui can firmly be placed in the pseudoscience category.

To say that feng shui practitioners are engaged in and informed by ‘unorthodox’ or ‘alternative’ science is too generous. Too easily feng shui exponents resort to this ‘mysterium’ defence as is well illustrated by the following authors:

Life is defined by *Qi* even though it is impossible to grasp, measure, quantify, see, or isolate. Immaterial yet essential, the material world is formed by it. (Beinfeld & Korngold 1991, p.30)

And,

To subject alternative therapies to sterile, impersonal double-blind conditions strips them of intrinsic qualities that are part of their power. (Sampson 1996, p.195)

The mysterium defense is ruled out of science. It might function as a short-term place holder, but it cannot be entrenched beyond that. Failure to find and measure chi in 3,000 years means it is an unscientific concept, yet it is the very heart of the whole feng shui enterprise.

Where, as in Asia, the beliefs are commonplace, science students can usefully and with great benefit come to appreciate the inherent problems with the practice. Indeed, such examination should be seen as a professional obligation of science teachers and curriculum writers. Where feng shui is not commonplace, its examination is still educationally beneficial; it can be, like astrology, a case study that sheds light on important psychological, scientific, philosophical, and cultural dimensions of human life.

The early appraisals of the book are encouraging.

Wang Youjun, Philosophy, Shanghai Normal University, China:

The book is one of the best research works published on Feng Shui. It opens up vast horizons for viewing science in new perspectives. It is an outstanding contribution to the fields of the history of science, philosophy of science and science education.

Yao Dazhi, History of Science, Chinese Academy of Sciences, China:

This excellent book provides a commendable study for those interested in theory, practice, and history of this pre-modern knowledge system, especially from a perspective of the ‘demarcation problem’ between science and pseudoscience.

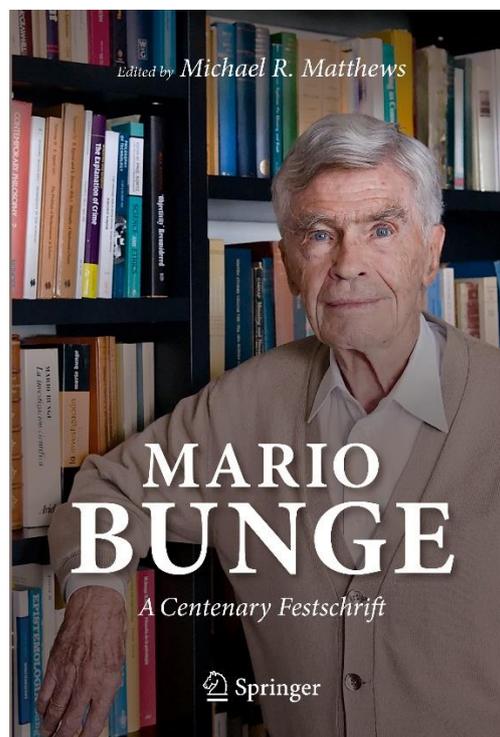
Bangping Ding, Education, Capital Normal University, China:

A terrific book. It cogently explicates how fengshui is a pseudoscience, and why it is of momentous importance in teaching about science and pseudoscience in our time.

VI Mario Bunge

An important part of my intellectual life since 1995 has been my friendship with the Argentine/Canadian physicist and philosopher Mario Bunge who died in February 2020 just a few months after his 100th birthday. Pleasingly I was able to edit a 41-chapter, 830 page *Festschrift* that was published just prior to his 100th birthday. In an [Obituary](#) I have tried to give some limited account of his remarkable life and intellectual achievements; and have elaborated a little more on these in my [Introduction](#) to the *Festschrift*. His 500 page autobiography – *Between Two Worlds* – was written at age 95 years entirely from the well-springs of his extraordinary memory. It was published in 2016. It is one of the most informative and engaging of philosophers' autobiographies. The Name Index has 1,200 entries and for nearly all he provides a succinct evaluation of their views. Pleasingly, a [gratis pre-publication pdf file](#) of the book is available.

Bunge was born in Argentina in 1919. He learnt atomic physics and quantum mechanics from Guido Beck an Austrian refugee who had been a student of Heisenberg. In 1938 he was admitted to the *Universidad Nacional de La Plata*, where he studied physics and mathematics. Shortly thereafter he founded a Workers School (the *Universidad Obrera Argentina*). In doing this he was inspired by the Mexican socialist and educator, Vicente Lombardo Toledano (1894-1968), who had established in 1936 the Workers University of Mexico (still in existence today as part of Mexico's national university system). This exemplified Bunge's Enlightenment thinking about education. The school's effectiveness prompted its closure by the government five years later in 1943. At the time it had 1,000 students enrolled.



Mario Bunge *Festschrift* (2019)

Bunge taught himself modern philosophy in an environment that was a philosophical backwater and he was the first South American philosopher of science to be trained in science. Unfavourable political developments in Argentina forced Mario out of the country in late 1962. Pleasingly he had been offered joint professorships in physics and philosophy at a number of US universities including Texas, Temple and Delaware, before being appointed in 1966 professor of philosophy at McGill University in Montreal where he remained to the end.

Bunge has [500 or so publications](#) in physics, philosophy, psychology, sociology and the foundations of biology. Among them are 134 books (including translations and editions), these include a massive eight-volume *Treatise on Philosophy*. At eighty-five years of age he published an article in the *International Journal of Theoretical Physics* titled ‘Velocity Operators and Time-Energy Relations in Relativistic Quantum Mechanics’ (2003). The same year he published another philosophy book *Emergence and Convergence: Qualitative Novelty and the Unity of Knowledge*. At eighty-eight years of age he published *Chasing Reality: Strife over Realism* (2006). In 2009 he celebrated his ninetieth birthday, and in 2010 his book *Matter and Mind* was published as Volume 287 of the Boston Studies in Philosophy of Science. In 2019, at 99 years of age he published on ‘Gravitational Waves and Space-Time’ in the *Foundations of Science* journal.

My first contact with Mario was when he and Martin Mahner, a German biologist/philosopher, submitted to *Science & Education* journal a long article titled ‘[Is Religious Education Compatible with Science Education?](#)’ The article concluded that:

Science and religion can only coexist if one of them is distorted. For example, one can adopt a phenomenalist-positivist or instrumentalist view of science ... Or one can distort religion by adopting a mere pragmatist stance, or by regarding all of its doctrines as mere allegory or poetry without any cognitive or truth content. (Mahner & Bunge 1996, p.115)

The article was published in 1996, and I took the opportunity to make a [journal special issue](#) of the topic by inviting two Christian philosophers – Hugh Lacey and Tom Settle – and a theologian, scientist and educator to respond. The issue was overprinted, and all 250 extra copies immediately sold. The Bunge-Mahner article became a landmark in science education debate on the topic. Another article - ‘Energy: Between Physics and Metaphysics’ – was published in *Science & Education* in 2000.

In 2001 Bunge came to UNSW for six months as a visiting professor. The same year he offered a workshop to the then annual ‘HPS & Science Teaching’ conference on “Science and Politics: The Ethical Dilemmas of Max Planck during the Nazi Era’. It was an informed, considered and gripping lecture/workshop for teachers. Not least because he had met a good many German physicists who had fled, and a good many who stayed.

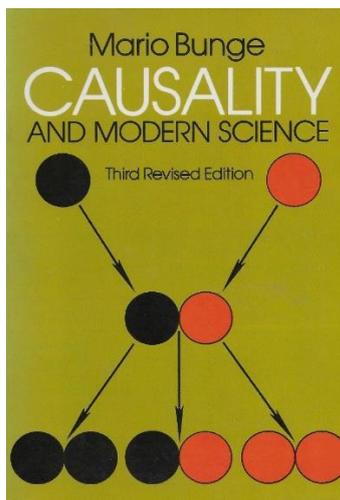


Mario Bunge at 100 years in Montreal

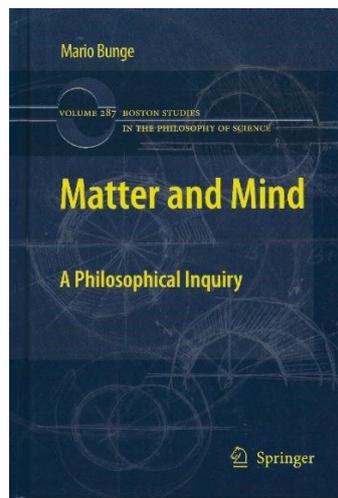
Many in the audience subsequently expressed to me the view: ‘Why aren’t teachers exposed to more such presentations?’ One answer is that, sadly, HPS simply does not occur in science

teachers programmes of study. They well know of Planck's Constant, but not of his deeply personal and considered justifications for continuing his science in the Nazi era. The strengths and weaknesses of his justifications have relevance and applicability for individual scientists across a wide spectrum of science/society/commercial interfaces.

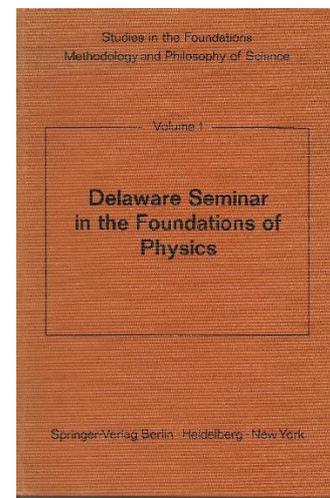
In 2003 Bunge's article '[Twenty-Five Centuries of Quantum Physics: From Pythagoras to Us, and from Subjectivism to Realism](#)' was published in *Science & Education* journal and was the basis of a special issue on '[Quantum Theory, Philosophy and Education](#)'. In 2011 a long article on [science and pseudoscience](#) was published. In this he lays out a 'philosophical matrix' for progress in science: Realism, Humanism, Scientism, Systematism, and Materialism. His claim is that the more that each component is rejected, the more fertile is the ground for pseudoscience.



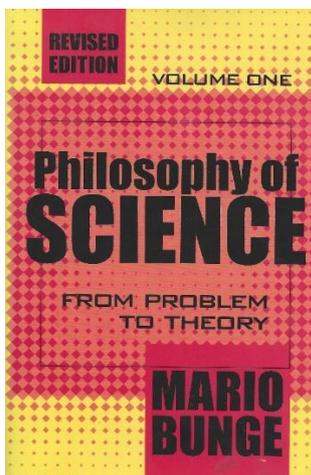
Causality (1956)



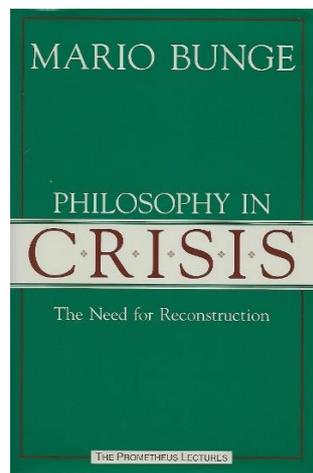
Matter and Mind (2010)



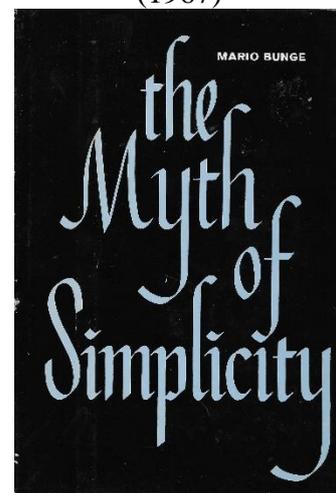
Foundations of Physics
(1967)



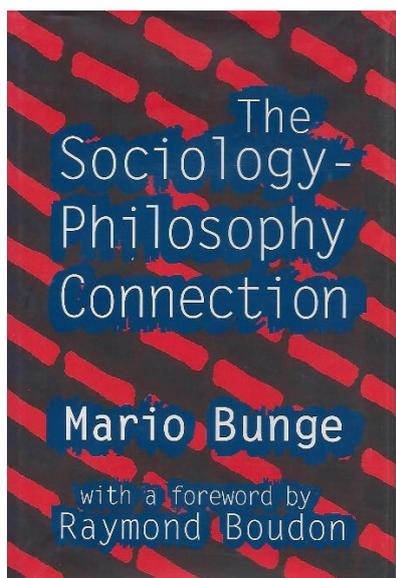
Philosophy of Science (1967)



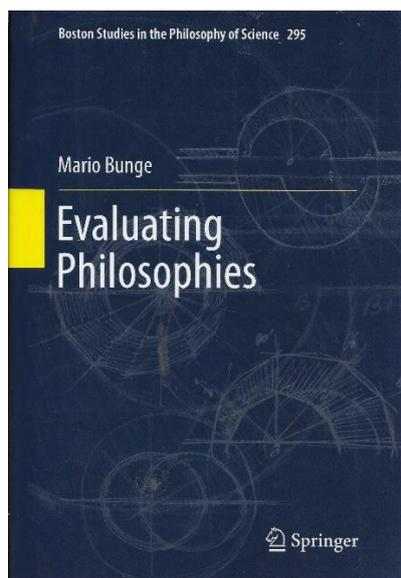
Philosophy in Crisis (2001)



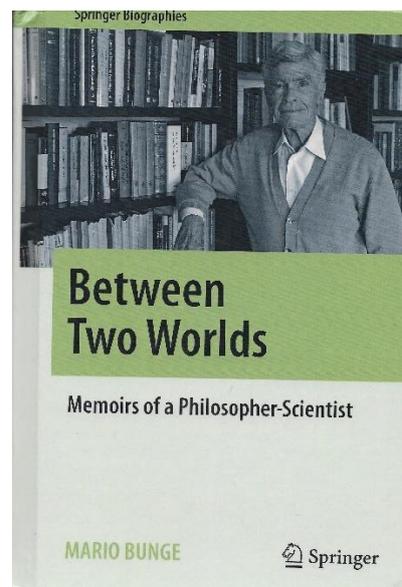
Myth of Simplicity (1967)



Sociology-Philosophy (1999)



Evaluating Philosophies
(2012)



Between Two Worlds (2019)

The unifying thread of Bunge's scholarship is the vigorous advancement of the [Enlightenment Project](#), and criticism of cultural and academic movements that deny or devalue the core planks of the project: namely its naturalism, the possibility of truth, the universality of science, rationality, and respect for individuals. At a time when specialisation is widely decried, and its deleterious effects on science, philosophy of science, educational research and science teaching are evident – it is salutatory to see the fruits of one person's pursuit of the 'Big' scientific and philosophical picture. Bunge was a tireless critic of postmodernism, obscurantism, and what he calls 'academic charlatanism'. As he wrote:

Up until the mid-1960s whoever wished to engage in mysticism or freewheeling intellectual deceit or anti-intellectualism had to do so outside the hallowed groves of academe. ... nowadays many intellectual slobs and frauds have been given tenured jobs, are allowed to teach garbage in the name of academic freedom, and see their obnoxious writings published by scholarly journals and university presses. (Bunge 1996).

Bunge and Shimony are two of the few philosophers of science of their generation who are as competent in physics as they are in philosophy. Despite the obvious benefits, this conjoint competence remains uncommon. Overwhelmingly, philosophers had taken physics as their exemplar of science, and as the base for their own philosophy of science, or at least philosophising about science, but the philosophers were spectators not practitioners. The difference was manifest in the philosophical reflections produced.

Clearly competence in physics, or any science, did not necessarily flow over into philosophical competence. Eighty years ago, Susan Stebbing in her *Philosophy and the Physicists* (Stebbing 1937/1958) wrote critically of the philosophical mistakes of the famed and knighted Nobel laureates Arthur Eddington and James Jeans. Bunge provides more recent examples of high quality physics conjoined with low quality philosophy – David Bohm being a particular example. But ignorance of physics does make more likely poor philosophising about it.

The analysis of causation is an example of the difference between 'insider's' and an 'outsider's' philosophising about science. Bunge's first major book in philosophy was

Causality and Modern Science (Bunge 1959/1979). The book was an instant success and put Bunge, and Latin American philosophy of science, firmly on the international map. It was a landmark in the treatment of causation. For decades philosophers had eschewed all serious investigation of causation as practiced by scientists. The Humean picture was widely accepted: there was no causation or necessary connection in nature; there was just regularity to which the mind brought the label ‘causation’. In Hume’s words: ‘Upon the whole, necessity is something, that exists in the mind, not in objects’ (Hume 1739/1888, p.165).

Philosophers brought detailed philosophical analysis and debate to the *consequences* of this position, but rarely questioned its empiricist presuppositions (Sosa 1975). Bunge utilized his first-hand knowledge of science to dismiss the Humean story that made causation ‘imaginary’; that replaced real-world causation with correlation; that kept the ‘causation’ label, but denied it had any ontological reference. And he did the same with the currently popular revival of Aristotelian powers-based causal analysis that gave ontological reality to causes, but misunderstood the real processes. He wrote:

The main ground why causal chains can at best work as rough approximations for short periods of time is that they assume a fictitious *isolation* of the process in question from the remaining processes. (Bunge 1959/1979, p.127)

And:

The picture of linear causal chains is ontologically defective because it singles out a more or less imaginary line of development in a whole concrete stream. (Bunge 1979, p.132)

Both Bunge and Shimony are ontological *and* methodological naturalists; both believe that metaphysics and ontology have to be linked to, and come out of, science; both regard science and the scientific method as the only way to come to knowledge of the world and its processes, including human processes and interactions. This leads Shimony to a Whiteheadian, almost Aristotelian, Process Metaphysics (Shimony 1965). He thinks that our current best understanding of microphysics (quantum theory) requires that we grant real existence to potentialities which then become actualised at the quantum level – see essays in his two-volume *Search for a Naturalistic World View* (Shimony 1993a ,b).

Bunge embraces an emergent materialist ontology, but not as emergent as Whitehead’s. Metaphysical differences aside, both Bunge and Shimony vigorously support the Enlightenment project against its detractors. Shimony, in his [1996 Presidential Address](#) to the US Philosophy of Science Association, canvassed contemporary criticisms of the Enlightenment, specifically the postmodern and Kuhn-inspired attacks on the possibility of objectivity and truth in science, but concluded that ‘despite the weight of these criticisms, all of them have been, or are still in the process of being, accommodated by an analytic continuation of the historical Enlightenment’ (*Philosophy of Science* Vol.64 No.4).

This is certainly at odds with the rejection of the Enlightenment powerfully voiced in contemporary science education. For instance:

What remains here is the question how to deprivilege science in education and to free our children from the “regime of truth”. (Eijck & Roth 2007)

It is noteworthy that no government or private group seriously dealing with the current COVID-19 crisis regards scientific rationality and problem-solving skills as mythical;

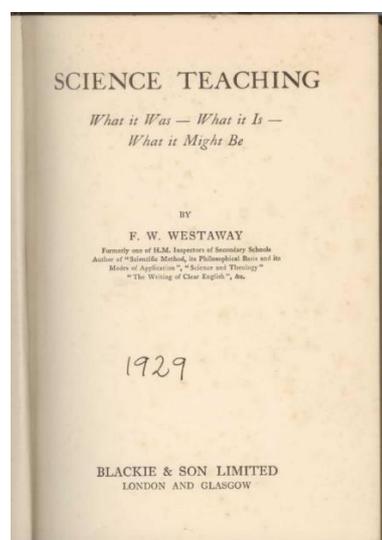
everyday they utilise both to formulate and refine treatments and policies for the deadly pandemic. But such views were and are the rage in science education and folk enunciating them have risen all the way to the top of the profession. Country after country adopted constructivism as their ‘official’ and guiding science education philosophy. If nothing is at stake, talk of deprivileging science is cheap; when it is a matter, literally, of life and death, such talk is not so cheap.

VII Teacher Education

My idea of good science teaching is not novel. Almost a century ago Frederick Westaway, who was ‘His Majesty’s Inspector of Schools’ responsible for science education in England and Wales, wrote substantial books on the history and philosophy of science, and also wrote a masterful, and widely used textbook, titled *Science Teaching: What it Was, What it Is, What it Might Be* (1929). Westaway there characterized a good science teacher as one who:

knows his own subject ... is widely read in other branches of science ... knows how to teach ... is able to express himself lucidly ... is skilful in manipulation ... is a logician ... is something of a philosopher ... is so far an historian that he can sit down with a crowd of [students] and talk to them about the personal equations, the lives, and the work of such geniuses as Galileo, Newton, Faraday and Darwin. More than all this he is an enthusiast, full of faith in his own particular work. (p.3)

This needs to be up-dated for the contemporary web and Google world, but the thrust is correct.



Westaway *Science Teaching* (1929)

Eighty years ago Mortimer Adler argued for the same conception of the teacher, and warned against reducing teacher competence to mere ‘know how’ or pedagogical competence. In his 1939 *Reforming Education* he wrote:

For the most part, the members of the teaching profession are over-trained and undereducated. Teaching is an art and a teacher must be trained, but since the technique is one of communicating knowledge and inculcating discipline, it is not educational psychology and courses in method and pedagogy that train a teacher, but the liberal arts ... Further, a teacher should have a cultivated mind, generally cultivated regardless of his field of special interest, for he must be a visible and moving representative of the cultural tradition to his students. (p.79)

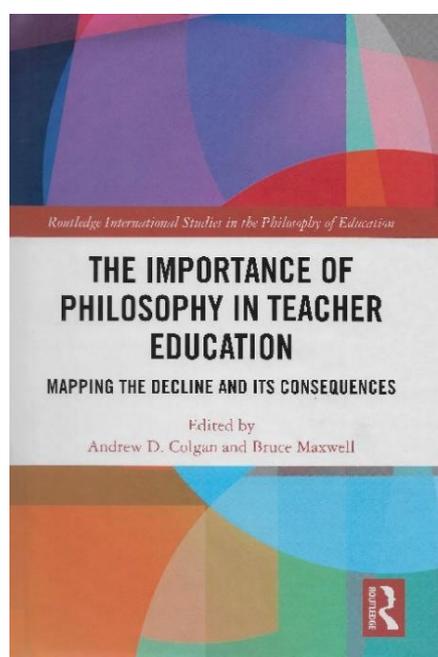
Westaway and Adler have high expectations of teachers. Among the mountain of educational research, committee reports, national commissions in the near century since their arguments were expressed, it is rare to find such illuminating and informed statements about good teachers and good science teaching. Such ideals of education are of paramount importance for teachers: they set goals and provide guidance to teachers across the spectrum of their engagements with pupils, administrators, parents and colleagues. Philosophy, stated or

unstated, guides the professional life of teachers who are permanently involved in ethical and even political decision making. Psychological and sociological study provides some assistance to teachers, but it is good and grounded philosophy that is most needed. This was manifest to me in my second ever day of science teaching in 1969 when I clashed with the subject head over the merits of the supposed Spiral Curriculum. My argument was about the ends, purposes, aims, or goals of education; my position was a philosophical one, education has to promote *understanding* of subject matter.

HPS&ST research has done a great deal to show the importance of not just ‘talking about ‘the work of such geniuses as Galileo, Newton, Faraday and Darwin’, but having students variously relive and re-enact such work through replicating the major experiments (mostly very simple and inexpensive), through repeating then contemporary debates over the interpretation of the experiments, through creative and dramatic performances that capture something of the life, times and work of the scientists – an approach that has been labelled ‘Historical-Investigative Teaching’ (Heering & Höttecke 2014).

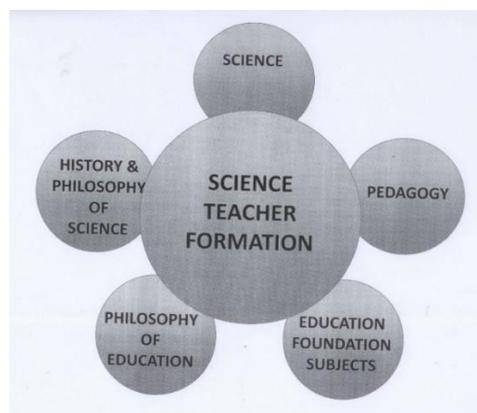
In 2020 Routledge published an anthology titled [*The Importance of Philosophy in Teacher Education*](#) edited by Andrew Colgan and Bruce Maxwell from Canada.

Appropriately it was in the Routledge Philosophy of Education Library, the series edited then by Israel Scheffler in which my 1994 *Science Teaching* book appeared. I contributed a paper titled ‘The Contribution of Philosophy to Science Teacher Education’.



Philosophy in Teacher Education (2020)

The paper argues that the components needed for the best science teacher education programmes are some range and depth of science disciplines, pedagogical theory and practice, education foundation subjects such as psychology and sociology, philosophy of education and HPS. All teachers should have rudimentary knowledge of the history and philosophy of the discipline they teach. This should be a commonplace, but it is not.



A Structure for Science Teacher Education

Rightly at the next level, NOS is much researched in science education, but the proportion of NOS researchers with training in HPS is very small. This is a peculiar and unfortunate situation. Often there are gross mistakes: as announcing that constructivism is ‘the most mature epistemological theory’, or that ‘positivism does not recognise science as a cultural product’, confusing realism with positivism, endorsing a raft of contentious Kuhnianesque propositions as HPS findings, and so on. In NOS writing, the situation of educators ‘borrowing’ from learning theorists, bemoaned by Peter Fensham is too common. For Fensham, ‘The influence of these borrowings is better described as the lifting of slogan-like ideas’ (Fensham 2004, p.105). The unfortunate history of Constructivism in science education is witness to the perils of shallow, ill-informed philosophical thinking.

This situation mirrors what Peter Fensham lamented about educational research on children’s learning – researchers pick up their psychology second hand and often as slogans (Fensham 2004).

Everyone should recognise that most of the issues in the history and philosophy of science are complex and contentious. The jury is still out on important matters, including constructivism discussed above. The art of the teacher is to judge the sophistication of his or her students and present a picture of science that is intelligible to them without being overwhelming. Students need to get their feet, to become familiar with a tradition, before they are confronted with the ‘cutting edge’ questions. The teacher may have strong opinions on various HPS issues, but the point of education is to develop the students’ minds, which means giving students the knowledge and wherewithal to develop informed opinions about HPS.

If HPS in science teaching becomes a catechism – either of a realist, constructivist, Marxist, Maoist, Thomist, Islamic, Feminist or any other kind - then it defeats one of its major purposes, namely broadening the mind of students.

For instance, Wolff-Michael Roth, who used to be a leading advocate of constructivism, co-authored a piece in 1994 that starkly asserts that the educational goal of constructivist teachers is to turn students into constructivists:

Thus, science educators seek to help teachers in changing from worldviews that are commensurable with objectivism to ones that are commensurable with constructivism. (Roth & Roychoudhury 1994, p.6)

And further:

If the epistemological development is partly a factor of age, then we could simply wait for the students to become constructivists, the most mature epistemological commitment ... However simply exposing students to an environment in which constructivist epistemology is implicit may not be sufficient. (Roth & Roychoudhury 1994, p.28)

This published article was originally given at the large NARST conference in, I think, 1992. I was in the audience and made the comment, with some elaboration, to the authors: ‘I think you have confused education with indoctrination’. I cannot much remember their response, but the following year at the prize-giving ceremony the paper was awarded the coveted ‘Best Paper at Previous Conference’ award. This was revealing. At the following year’s

conference, the paper was awarded ‘Best Article in *Journal of Research in Science Teaching*’ (the official journal of NARST). Thus, all the way through the NARST system, the original authors, commentators, reviewers and editors did not think it important to untangle the confusion between education and indoctrination, or thought that there was nothing to untangle.

Having read and listened at conferences to many such ‘let’s make them constructivists’ appeals, usually accompanied by foot-stomping and clapping, I responded in a [paper](#) saying:

There is a danger that teachers, curriculum developers, and examiners will define ‘epistemological development’ merely as ‘believing what I believe about epistemology’. When this happens, we confuse education with indoctrination. (Matthews 1998, p.167)

Bertrand Russell was alert to this in 1916 when he said of British education during the Great War that it should ‘aim at making [pupils] able to think, not at making them think what their teachers think’ (Russell 1916/1961, p,401). This is an issue that anyone coming out of a philosophy of education programme can recognise (Snook 1972). It has particular dimensions for science teachers, as was well elaborated by Lena Hansson in [her contribution](#) to *History, Philosophy and Science Teaching: New Perspectives* (Hansson 2018).

HPS in teacher education programs can widen the vision of teachers, and in turn contribute to having their students not only arrive at destinations (scientific knowledge, a scientific habit of mind, a grasp of scientific methods), but arrive with richer understandings of the whole scientific enterprise. This contributes to the health of society and of science. Igal Galili has argued these matters in a number of publications (Galili 2019). I developed these points in the foregoing 1998 paper and later in a 2012 paper ‘[Changing the Focus: From Nature of Science \(NOS\) to Features of Science \(FOS\)](#)’. In the former paper, I argued:

Science educators should be modest when urging substantive positions in the history and philosophy of science, or in epistemology. ...Modesty does not entail vapid fence-sitting, but it does entail the recognition that there are usually two, if not more, sides to most serious intellectual questions. And this recognition needs to be intelligently and sensitively translated into classroom practice. (Matthews 1998, pp.169-170)

The retreat of philosophy from teacher education is a serious general problem for the teaching profession, and a specific one for science teaching. The base-level challenge has always been what Israel Scheffler identified: teachers of any discipline need to know what they are talking about, need to know the basic terms, concepts, methodologies, truth-tests, epistemology, ontology, and something of the personalities of their discipline. These matters can only be illuminated by the history and philosophy of the discipline.

Now provincial, national and international (PISA, Europa) curriculum authorities are requiring that students come to a better, deeper and more informed understanding of science and its interaction with society and culture; that they have a more informed understanding of the nature of science. From Canada to Croatia to China, and most countries in between, NOS is being written into curricula. But for NOS to be effectively taught, teachers at a pre-service or in-service level need to gain knowledge, interest and hopefully enthusiasm for the history and philosophy of science; without HPS there can be no NOS.

Additionally, from many quarters, science teachers are being urged to promote equity and social justice (Papa 2020). This is something that, no less than it does for NOS, calls for

philosophical acumen in order to avoid platitudes and ideologies. To the credit of the Thomist tradition, that was influential in my undergraduate education, the Thomists dealt with social and political philosophy as part of a whole; social and political thinking needed to cohere with a theory of persons (anthropology) and the State. Many other traditions, for instance Liberalism, likewise sought encompassing accounts of social justice (Rawls 1971).

Any sensible account of social justice has to be systematic and historically informed. But as philosophy is being stripped out of teacher education programmes, just where that philosophical and historical perspective will come from is completely unknown. The pressure for some ideology to step forward becomes irresistible.

Accommodating philosophy, specifically HPS, in teacher education is a complex matter, for which different solutions have been proposed: having a HPS course in teacher education programmes or sending students to a HPS department for completion of a course, having joint faculty appointments between Education and HPS, and other proposals. In my own case, the HPS competence was acquired by doing a philosophy degree whilst school teaching, then a HPS degree in my beginning years of university teaching. But this was a path that not everyone, or their employer, can afford.

At the 1989 Tallahassee conference Fabio Bevilacqua warned against such HPS courses being experienced by students as just ‘another brick in the wall’. My teaching of HPS&ST confirms such warning. Ideally the HPS course should be a ‘HPS for Science Teaching’ course; it should be framed around pedagogical, curricular and theoretical issues with which science teachers routinely deal (Kampourakis 2020).

Joseph H. Hazen Prize and Other Recognitions

In 2007 I was asked by Fabio Bevilacqua, Vice President of the Division of History of Science and Technology ([DHST](#)) of the International Union of the History and Philosophy of Science ([IUHPS](#)), to become President of the Division’s Teaching Commission (TC). Despite the efforts and earlier achievements of Jaroslav Folta (Technical University of Prague), Alistair Duncan (Loughborough University) and Horst Remane (Martin Luther University) the TC was exhausted. With diligent assistance from Peter Heering and others, during my two terms as president, it came back to life.

In 2010, two years after my retirement as a full-time staff member at UNSW I was awarded the ‘[Joseph H. Hazen Education Prize for Excellence in Education](#)’ of the US History of Science Society. This was an important occasion. The prize citation reads:

More than any other single individual, Michael Matthews deserves credit for instilling the History (and Philosophy) of Science in Science Education.

A more vigilant editor would have struck out the opening ‘more than’. Prize recipients have included Gerald Holton, James Rutherford, Jane Maienschein, Stephen Brush, Robert Hatch, Paul Farber, Falk Riess, Graeme Gooday, Sally Kohlstedt and Michael Osborne. To be considered in their company is an honour.

In 2011, the Division of the Logic, Methodology and Philosophy of Science ([DLMPS](#)) of the IUHPS was itself investigating the establishment of a Teaching Commission. I proposed to them that as students mostly experience the history and philosophy of science as conjoint

disciplines, and as the pedagogical issues are common, there should be an Inter Divisional Teaching Commission (IDTC) rather two separate commissions. This was agreed to by DLMPS Council and I became the initial president.

In 2015 the International History, Philosophy and Science Teaching Group initiated a 'Lifetime Achievement Award' I was honoured to be its first recipient.

In 1989 Michael Matthews successfully brought together historians, educators, philosophers, and sociologists from around the world to engage in friendly, scholarly discourse at what became the first IHPST conference. Since then IHPST conferences have been biennially. His early efforts to ensure the sharing of multiple, diverse perspectives set the tone for IHPST which can still be seen today with the friendly and collegial nature of the group. Michael ensured that the group met every other year at the Biennial Conference and that this conference rotated to various parts of the world. Under his direction IHPST's journal, *Science & Education*, flourished during his 20+ years as editor. Michael Matthews impact on the IHPST group is immeasurable.

The subsequent recipients were Ian Winchester (2017) and Fabio Bevilacqua (2019).

Closer to home, in 2019 I was nominated then elected as a Fellow of the Royal Society of New South Wales (FRSN) for my contribution to HPS&ST.

I value and appreciate the public recognition, but more to the point, the recognition validates the importance of HPS&ST scholarship to an international community.

Acknowledgements

As is clear from this story, my early years in the Philosophy of Education Society of Australasia (PESA), membership of the International History, Philosophy and Science Teaching Group (IHPST), and my 25-years editorship of *Science & Education* journal - have been of the utmost importance for my own development. There is always a problem with picking out individuals, but perhaps those who have most influenced my thinking in HPS&ST are Wallis Suchting, Robert Cohen, Marx Wartofsky, Abner Shimony, Gerald Holton, Mario Bunge, Fabio Bevilacqua, Robert Nola, Harvey Siegel, Robert Carson, Edgar Jenkins, Michael Martin and Peter Slezak. I owe them a special debt. But I am also indebted to many others who have been mentioned in this story, and some who have not been.

I have had the great good fortune of knowing and learning from so many serious scholars, all of whom shared the Enlightenment's commitment to the cultural importance of good (namely HPS-informed) and diffuse science education.

John Locke saw himself as 'an underlabourer in the garden of Newton'; someone who prepared ground for seeds to grow, and who tried to keep weeds away. I am happy to think of myself as having performed the same role in the HPS&ST community. The preparation of good publishing ground (journals, anthologies, handbooks and monographs) for planting HPS-seed was facilitated over decades by the sterling assistance of Springer editorial staff – originally Peter de Liefde, then Bernadette Ohmer, Marianna Pascale, Lucy Fleet, and others. More recently, Paulo Maurício in Lisbon has continued this task by creating and managing the HPSST [website](#) where material is stored for continuing use. Preparing ground is one thing; weeding is another more fraught, and contentious, matter. One person's weed is another's herb. With strong, competent editorial and reviewing support, I think the weeding

task has been well done. Being an underlabourer for a good cause, namely the advance of HPS&ST scholarship, is career satisfaction enough.

This has been an intellectual, not a personal, autobiography. Thus, many important personal and family milestones have not been mentioned though details of the Fitzpatrick family, and of my Christian Brothers schooling, have been given in order to better situate my story. The obvious connecting thread of the narrative is that I have had a very fortunate academic and scholarly life. So too I have been blessed to have had a fortunate and happy family life.

In 1982, aged 34 years, I married Margaret McHarg a social worker. In 1983 our daughter Clare Alice, now a science teacher, was born. In 2006 she married Luke Musgrave (coincidentally, from a Dubbo family). They have four delightful children, my grandchildren: Joshua, Elanor, Noah and Hugo. In 1988, after divorce, I married Julie House, who had been an English teacher in Malaysia, a craft coordinator and business manager in a Hmong refugee camp in Thailand, an Aboriginal crafts manager at [Yirrkala](#) in the Northern Territory, and a finance-manager/accountant in a mid-sized family manufacturing-business. We had known each other since the early 1970s. In 2020, after 32 years we remain happily married, with two daughters: Alice Deryl, an English language teacher, born 1991; and Amelia Kathleen, a maths teacher, born 1996. Through the efforts of Margaret, Julie, Luke, my three daughters and I, we have had the good fortune to maintain close, warm and caring relationships, with all family occasions spent together.

Needless to say, all of the writing, editing, organising, conferencing, and travel time that has gone into the HPS&ST work documented in this autobiographical story, has impinged on family life. Had the work not been done, assuredly there would have been more time for family matters. This is a common enough tension for everyone. I hope my own family are forgiving of this.

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