

[partial and preliminary draft]

History, Philosophy and Science Teaching: A Personal Story

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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 the newly established 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 and crafting an extended essay for circulation to family, friends and colleagues. There were a good many encouraging responses to that essay with suggestions elaborating upon it and producing a book. I am grateful to Nick Melchior, the Springer Australasian editor, who after receiving positive external reviews of the essay and its expansion to a book, issued contract. Along with founding and editing for 25 years the Springer journal *Science & Education*, this is my ninth Springer book. For over 30 years they have been a remarkably professional, competent and conscientious publisher.

This is much more an academic autobiography rather than a personal one. There are elements of the personal, but only as they bear upon my intellectual and career trajectory which was a move from science teaching to philosophy of education to science education. More particularly, from completing a science degree and teacher training at Sydney University, high school science teaching, teaching philosophy of education at Sydney Teachers College then at the 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 core of the book is 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 book is an intellectual autobiography; it is not meant to be an overview or summation of HPS&ST research. I have written and edited books that provide such an overview and summation. Details of the disciplinary arguments, and my own positions on them, can be read at length in the books, articles, anthologies referenced in this work, 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, I believe, is that science education, at all levels from classroom teaching to university research, is enhanced if teachers and researchers have competence and interest in both HPS and philosophy of education. This is because both disciplines make unique and indispensable contributions to the numerous theoretical, curricular and pedagogical issues that occupy science students, teachers, curriculum writers, examiners and policy makers.

The great challenge, if not tragedy, of the present time is that precisely both these central disciplines are disappearing from teacher education programmes, and indeed from many university programmes.

Irish Catholicism in Australia

For at least 150 years after the 1788 arrival of the British ‘First Fleet’ transporting its convict ‘overflow’ to Sydney, the Irish were the second largest ethnic group in Australia’s new, non-Aboriginal population. At the end of the 19th century they amounted to a third of the population, with 50,000 arriving as convicts (O’Farrell 1986, chap.2). The First Fleet, with its Irish and other convicts, arrived in Sydney in 1788. For 30 years there were no priests to minister to the ‘flock’, provide the sacraments, or give instruction. The practice of Catholicism was essentially banned by the colonial authorities. The Reverend [Samuel Marsden](#) (1765-1838), the Anglican chaplain of New South Wales and concurrently a magistrate deservedly known as ‘the flogging parson’, contended that if the Catholic religion were ever allowed by authority to be celebrated the colony would be lost to the British Empire in less than a year. In 1807 he wrote:

The number of catholic convicts is very great in the settlement; and these in general composed of the lowest class of the Irish nation, who are the most wild, ignorant and savage race Men that have been familiar with robberies murders and every horrid crime from their infancy ... governed entirely by the impulse of passion and always alive to rebellion and mischief they are very dangerous members of society ... They are extremely superstitious artful and treacherous. (O’Farrell 1986, p.39)

Marsden's wish to legally suppress Catholicism was thwarted by cooler and more reasonable heads, and the first priests - two Irishmen, Fathers Therry and Connolly - arrived in the colony in 1820. For the next 200 years, the Irish church dominated Australian Catholicism (O'Farrell 1969). After a brief 'engagement' with Benedictines from England's Downside-Abbey - Archbishops John Bede Polding (1794-1877) and Roger Bede Vaughan (1834-1883) - Irish clerics filled the Australian episcopacy.

The major figures in this lineage being Sydney's Cardinal Patrick Moran (1830-1911), Melbourne's Archbishop Daniel Mannix (1864-1963) and Brisbane's Archbishop James Duhig (1871-1965). They were all energetic, enthusiastic, and capable builders, literally, of churches, schools, and seminaries. As late as 1914, 70 per cent of all priests in Australia had been born in Ireland (Campion 1987, p.78). Every second or third country town, and Melbourne, Sydney or Brisbane suburb, had a St Patrick's church and probably school as well. In 1889 the first Catholic seminary in Australia opened in Sydney. It was conceived and built by Cardinal Patrick Moran and, not unexpectedly, was named St Patrick's College (Walsh 1998). The St Patrick's Day Sports Carnival was a holiday for most Catholic schools right through to the 1960s.

For 200 years Australian Catholicism had an Irish hue: It was 'manly', practical, more devotional than spiritual, suspicious of too much thinking or theorising, completely adverse to free-thinking of any kind, combative when faced with the Church's foes such as Protestants, atheists, communists and promoters and enablers of licentious behaviour, chauvinistic towards women, hierarchical and authoritarian in its internal life, fearful and renouncing of 'the flesh' and the inevitable sins associated therewith (but having no trouble with drinking, dancing or gambling), inordinately devoted to Mary 'the Mother of God'. Not all traditions in the Roman Catholic Church had the same hue; they had other colours on their palettes and the common ones were mixed in different proportions. Irish priests, brothers and nuns opened churches, schools, hospitals, aged-care homes, and performed countless other social services.

Irish-Catholic Family

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 in the south of Ireland, 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 600 hectares 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

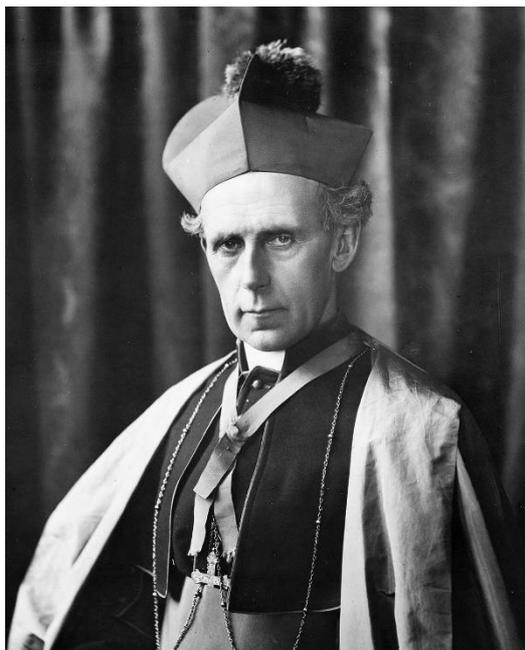
and weaknesses of the religious, moral and social traits of Australian rural Irish-Catholicism that has been so well captured in stories, poems, ballads, and histories (Franklin 2019). In an obituary published 9 July 1918 the [Dubbo Liberal and Macquarie Advocate](#) newspaper wrote of him:

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. At the time Dubbo had a population of perhaps 10,000 with two Catholic high schools (boys and girls) and two primary schools.

Three of Patrick's sons volunteered to fight for the 'Mother Country' in the first Great War. This was despite the Irish owing nothing to the English, indeed the contrary; and despite Archbishop [Daniel Mannix](#) of Melbourne being a staunch critic of the war and the government's conscription policy. Mannix was formerly Principal of Maynooth College in Ireland, the preeminent Catholic seminary that prepared priests for Ireland and for the Irish diaspora in the USA and British colonies and he denounced the war as a 'Trade War between British and German industrialists' (Franklin 2015).



Archbishop Daniel Mannix

My mother's stepbrother, 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.

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.

The suicide might well have been 'war related', but such happenings were shrugged off at the time, at best thought of as 'shell-shock'; recognition of Post-Traumatic Stress was decades away.



John Bede Fitzpatrick (1884-1917)

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. Sometimes at the main altar, other times at one of the 3-4 side altars. There was an overflow of priests: The parish priest, a number of curates, and priests visiting the adjacent Franciscan headquarters, so finding altars for their required daily mass was oft a problem. Holiness, or at least it's manifestation, was 'bountiful': in addition to the Franciscan church and monastery, abutting the church was a convent for Enclosed Poor Clare nuns. Within 500m was Waverley College and St Clare's convent and college with its community of Poor Clare teaching nuns.



Mary Immaculate Church Waverley



Main Altar

My father left our home when I was 12 years of age. It was a reflection of the times that he just left. I did from time-to-time hear doors slamming, and very occasionally shouting; in the scale of things this was certainly not ‘way out there’, but it was enough for me to know it was an unhappy marriage, and that my stay-at-home mother had the worst of it. My father’s only words on leaving were ‘when you grow up, you might understand’. This was before the era of counselling, express-your-feelings, talk-it-through, and shared custody routines. 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 telephone but a nearby 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 that I rode it home. 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 and calmer twilight years but alas they were denied.

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)

The imposing eastern suburbs Christian Brothers school, at the end of our street, was Waverley College, a member of the Combined Associated Schools group, a second-tier private school organisation. The college went through to the Leaving Certificate, while there were three smaller, eastern suburbs Christian Brothers ‘feeder’ schools (Bondi Beach, Rose Bay, Charing Cross) that went only to the Intermediate Certificate. I attended one of these – St. Charles, at Charing Cross.

St. Charles was a working-class school of the kind envisaged by [Edmund Ignatius Rice](#) (1762-1844), the widowed Irish small-businessman who in 1820 founded the Congregation of Christian Brothers. With a May birthday, I was equal youngest in the class. I was athletic enough, and the school was small enough - with about 300 students spread over seven grades - for me to be in the school running, swimming and under-age rugby league team each year I was there. In a small pond, it does not take much to be among the big fish. The corridor had framed photos of school classes and teams going back to the 1940s. The great rugby league player and captain of Australia, Dave Brown, looked down on the passing boys; as did numerous Sydney first grade league and union players including Bob Dwyer the Australian rugby union coach. Also distinguished swimmers such as Murray Garrerty, a national swimming champion in the 1950s. At every athletic and swimming carnival these names appeared in the records list. School athletic and swimming records were religiously kept and noted.

The school, in every sphere, fought well above its light weight. The brothers did not have to promote a sense of belonging; there was no artificial ‘rah rah-ing’ or class bonding; the sense of pride, belonging and gratitude was simply there. When the school closed in 1968 hundreds of ex-students and parents packed the commodious hall to suitably mark the occasion.

In the final year, the Intermediate Certificate, I did well enough to come third in the class of 40; a class taught by a solitary brother, Bro. Hawley. Each school grade had just one class of 40-50 students. Pleasingly, through all the school years, teachers had no discipline problems: ‘be quiet’ meant be instantly quiet and pay attention; ‘sit down’ meant sit down. 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 very different educational experience from what now prevails.

At the Intermediate Certificate I ‘won’ a scholarship to complete my Leaving Certificate (Years 10-11) at the prestigious, imposing and large 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 Sydney Harbour.



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

‘Winning a scholarship’ meant that the Irish principal of the college, Brother Michael (Mick) Maximus O’Connor (1896-1978), told my mother: ‘Michael should not be attending a State school. 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 at age fourteen and begun a trade. Because of my mother being raised ‘on the land’ and her younger brother, Tom, working as a shearers mechanic at the famed Haddon Rig merino stud out of Warren, wool-classing was investigated as a career option at Sydney Technical College whose Principal was a friend of my mother’s from her Dubbo years.

Going to Waverley involved no fuss, no bother, no applications, no committees - just a brief meeting between Brother O’Connor and my mother, with me in tow. His Christian Brothers obituary does obliquely refer to his non-consultative style, he did not like wasting his own, or brothers’ time, in meetings. For good or bad, as with so many things, such a simple, direct and efficient procedure is no longer found in education; everywhere bureaucratisation and managerialism have triumphed. The adage ‘If you have nothing to do, call a committee meeting’ had no traction around Bro O’Connor.

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’ and certainly hear the brogue in his voice.

Michael O’Connor had been born in 1896 in Liscannor on County Clare’s west coast within a mile of the rolling Atlantic waves; in nearby Ennistymon he attended the very first Christian Brothers school established in Ireland; then a Christian Brothers novitiate and training college; he took vows and was professed in the order; began teaching at age 20; and sailed for

New Zealand and Australia in 1920, aged 24 years. In his 1964 Principal's address, reproduced in the Waverley College Yearbook he said:

Our task is stated simply enough: we must, by word and still more by example, manifest those principles on which a sense of responsibility is based, and then we must be ready to afford the children under our care a due measure of liberty to follow or not to follow these principles. This, you will agree, is a duty that demands a high degree of wisdom and human understanding and especially a bond of sympathy and co-operation between parents and teachers who share the task ... we, as teachers, must admit that the degree of moral and social responsibility shown by our pupils when outside our immediate control is a fair measure of the efficacy of our teaching.

The two Waverley years were happy and full, with rugby, debating, swimming, and enough study to ensure success in final exams. Waverley was a big school; and like St Charles, comfortable with itself and its sporting and academic traditions. A few years before my arrival, [Michael Cleary](#) had left the college to become, in order, an Australian sprint champion and bronze medallist at the 1962 Commonwealth Games, an Australian rugby union winger, an Australian rugby league winger, a Labor member of state parliament and Minister for Sport. In 1960, another old boy, [Tony Madigan](#) who had been college boxing champion, fought Cassius Clay (as Muhammad Ali then was) in the semi-final of the 1960 Rome Olympics thus winning a bronze medal. In 1962 he won the silver medal in the Commonwealth Games. Numerous other old boys were in national, state and Sydney rugby, swimming and cricket teams, and were sitting on different judicial benches, government benches, and university chairs.

There were twenty Christian Brothers and a small number of lay teachers on staff. The most noteworthy of the latter were [Thomas Keneally](#), the Australian novelist and former student at Christian Brothers Strathfield, and [Peter \(Percy\) Watson](#) the energetic English and Economics teacher who subsequently took a doctoral degree in theology, became deputy principal at another major Sydney school, and for ten years, was Education Editor of *The Australian* newspaper. The brothers were all fine men and conscientious teachers, as were the lay teachers.

There were about 140 pupils in the final year, placed in six, graded classes. The Leaving Certificate results were commendable: Leaving Certificate Passes (135), University Matriculation (106), Leaving Certificate honours (42), Commonwealth University Scholarships (27), Teachers' College (university) Scholarships (27). From Fifth Year One all the way through to Fifth Year Three, students gained university scholarships, and in still lower classes, university entrance (matriculation) was obtained. A good many of my classmates went on to be doctors, lawyers, bankers, politicians, businessmen, farmers, academics, pharmacists, engineers, accountants, teachers, and into sundry other trades and useful occupations.

One classmate, [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. Michael objected not on religious or pacifist grounds, but on political grounds: he maintained that the state did not have such powers over individuals. The school captain, Desmond Rankin, gained entry to medicine, but

chose to enter the Diocesan seminary to begin training for the priesthood. After five years he left and did his medical degree.

Development of religious knowledge (Christian Doctrine) was taken seriously with scheduled weekly classes and annual prizes. Cultivation of Catholic spirituality was also central to college life. Novenas, recitation of the rosary, 'First Friday' prayers, marching to Mary Immaculate church for special feast day masses, membership of the college St Vincent de Paul society and the Legion of Mary sodality, religious retreats, recitation of the Angelus, the huge May Day (Mary's day, not the political day!) procession, and so on were all part of the fabric of college life.

Some decades earlier, the May Day procession drew upon most Sydney Christian Brothers schools who assembled in Centennial Park, and marched carrying aloft a large statue of the Virgin Mary through Bondi Junction to the college. By the 1960s this annual procession had scaled down to being just Waverley College: Old Boys, staff, students and families, and the route was just a few kilometres of local streets. In procession, the rousing, faith-defining Marian hymns – 'Hail Queen of Heaven, the Ocean Star', and others - were sung, along with the rousing 'Faith of Our Fathers', decades of the rosary prayed, and Marian litanies recited. The priest or brother would intone: 'Holy Mary, Queen of Heaven'; 'Holy Mary, Immaculate Virgin'; 'Holy Mary, Mother of Christ'; 'Holy Mary, Help of Christians'; 'Holy Mary, Queen of all Saints'; 'Holy Mary, Queen of the Rosary'; and down the long list of Mary's terrestrial and theological virtues. The procession would in unison respond: 'pray for us'.

The Christian Brothers, perhaps more than any other order, emphasised the place of Mary in the Christian redemptive story. The Lourdes (1858) and Fatima (1917) apparitions were taught as straight-forward, no-questions-asked historical events. This is hardly surprising, as both apparitions have been officially sanctioned by papal decrees; such things could only be questioned or problematised if papal authority were questioned – something that was not going to happen in a Christian Brothers' school. Likewise, the hundreds of thousands of miraculous cures resulting from on-site prayers to Our Lady of Lourdes and Our Lady of Fatima were simply accepted. Statues of both Ladys abounded in churches and homes; Lourdes hospitals and nursing homes were everywhere. Mary Immaculate church had a Lourdes Grotto in its forecourt. My own mother ended her days in Lourdes House, Waverley.

The 1958 centenary of Our Lady's appearance to Bernadette Soubirous, the 14-year-old Lourdes peasant girl was richly celebrated throughout the Catholic world, including Christian Brothers' schools. The second largest basilica in Christendom was built at Lourdes to suitably recognise the centenary; this took its place alongside two other substantial churches. For the centenary, millions of gallons of Lourdes Holy Water were sold, ending up in Catholic homes throughout the world.

The two relatively recent dogmas of first, Mary's Immaculate Conception, formalised by Pius IX in 1854 whereby it was decreed that Mary was conceived without bearing Original Sin; and second, her bodily Assumption direct into Heaven upon her death, proclaimed by Pius XII in 1950 - were specially celebrated feast days at college. Assumption Day, August 15, was, throughout the Church, a Holy Day of Obligation with mass being obligatory. At college there was a combined-schools mass with St Clare's College celebrated at Mary Immaculate church.

My own (formerly my father's) 2,000+ page Daily Missal (*Saint Andrew Daily Missal with Vespers for Sundays and Feasts* (1937)) has among its collection of prayer and devotional cards, a 'Prayer for the Marian Year' issued by Pope Pius XII on the 'Feast of the Presentation of Our Lady, November 21st, 1953'. The card well encapsulates the Marian devotion of the Catholic Church, a devotion distilled at Waverley:

Enraptured by the splendour of your heavenly beauty, and impelled by the anxieties of the world, we cast ourselves into your arms, O Immaculate Mother of Jesus and Our Mother, Mary, confident of finding in your most loving heart appeasement of our ardent desires, and a safe harbour from the tempests which beset us on every side.

Though degraded by our faults and overwhelmed by infinite misery, we admire and praise the peerless richness of sublime gifts with which God has filled you, above every other mere creature, from the first moment of your Conception until the day on which, after your Assumption into Heaven, He crowned you Queen of the Universe.

O Crystal Fountain of Faith, bathe our minds with the eternal truths! O Fragrant Lily of all Holiness, captivate our hearts with your heavenly perfume! O Conqueress of evil and death, inspire in us a deep horror of sin which makes the soul detestable to God and a slave of hell!

O well-beloved of God, hear the ardent cry which rises up from every heart in his Year dedicated to you. Bend tenderly over our aching wounds. Convert the wicked, dry the tears of the afflicted and oppressed, comfort the poor and humble, quench hatreds, sweeten harshness, safeguard the flower of purity in youth, protect the Holy Church, make all men feel the attraction of Christian goodness. In your Name, resounding harmoniously in Heaven, may they recognise that they are brothers, and that the nations are members of one family, upon which may there shine forth the sun of a universal and sincere peace.

Receive, O Most Sweet Mother, our humble supplications, and above all obtain for us that, one day, happy with you, we may repeat before your throne that hymn which today is sung on earth around your Altars: *You are all beautiful, O Mary! You are the Glory, you are the Joy, you are the Honour of our people! Amen*

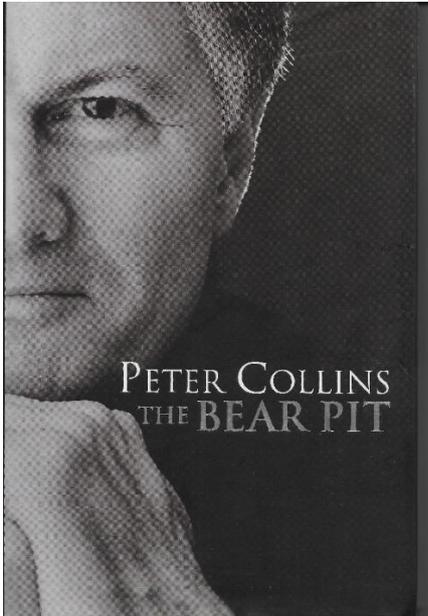
The card does relate:

Five years' indulgence each time recited; plenary, on the usual conditions on the feasts of the Immaculate Conception, 1953 and 1954, and each Saturday of the Marian Year'

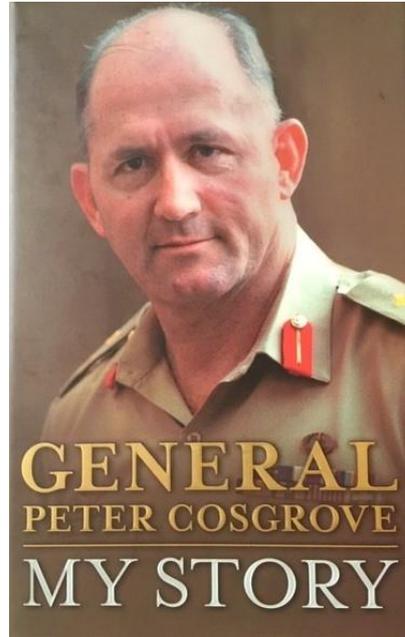
The prayer card could be Exhibit A, and many other exhibits can easily be marshalled. Marian devotion was central to students' experience at Waverley. The school was reflecting the wider Australian Catholic commitment to Mary. Australian bishops at the Council sided with the minority who wanted the Church to issue a separate decree on Mary as an agent of redemption. This move failed by only a few votes (Campion 1987, p.213). The psycho-sexual impact of Marian devotion on generations of pupils, caused by elevating women's or female 'purity' and 'holiness' so far beyond earthly reality, has not been tabulated. Anne Summer's classic 1975 *Damned Whores and God's Police* (Summers 1975), in which she identifies the stereotypical Australian bifurcation of women into virtuous mothers whose function was to civilise society or bad girls who led men astray and deserved vilification - might be a starting point.

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. Brothers Farrell, Dixon, Taylor, Hall, Massingham, McKay,

White, Dimittina, Mousley and others were remembered with appreciation, with a number of fellows attributing their outstanding first-class honours results in Mathematics, Physics, English, History and a few other subjects, to the dedication of particular teachers. When Brother O'Connor, who presided over the whole show died, his entire estate fitted into two suitcases and his clothes were too worn to be given to the St Vincent de Paul store. That the repute of the Christian Brothers has been mired in deserved scandal has been a significant matter with which Old Boys have had to comprehend.



Peter Collins *The Bear Pit* (2000)



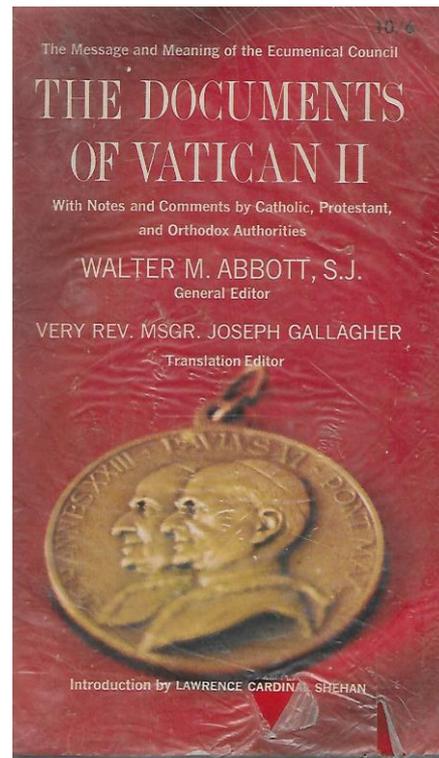
Peter Cosgrove *My Story* (2010)

A Destabilized Church (1965-69)

My Christian Brothers schooling occurred entirely - but just - in the 'Old Days' of un-reconstituted, un-reformed, confident, infallibly led, assertive Catholicism. Known fondly by conservatives, and the aged devout, as the 'Good Old Days'. But the 'times were a-changing'.

Pope John XXIII's tumultuous Second Vatican Council (1962-65) concluded one year after I left Waverley, in the pontificate of Pope Paul VI. Although many Australian clerics and laity were enthusiastic about the Council and wanted quickly to move forward with its reform agenda (*Aggriomamento*) made cheaply available in red-covered paperback edition (Abbott 1966), many lacked such enthusiasm, were bewildered, indifferent and some outrightly opposed. Australia was slow off the conciliar mark.

The Council had opened in October 1962 and Cardinal Gilroy told an audience of priests that ‘it would be all over by Christmas, the experts in the Vatican knew just what was needed for the church’ (Campion 1987, p.203). Bishops who had been in Rome came back saying that ‘there was a lot of useless talk and nothing had been finalised’ (Geraghty 2003, p.323). The Council’s theological and philosophical debates passed them by. They probably recognised the names of some of the theological luminaries advising the different commissions - Yves Congar, Hans Küng, Edward Schillebeeckx, Karl Rahner, Hans Urs von Balthasar, Henri de Lubac, Jean Daniélou and others - but these internationally renowned Catholic scholars had never featured in their own education, their teaching, and certainly did not feature in the lecture rooms of the Australian seminaries they controlled.



Vatican Council Documents

Most of the seminaries were stubbornly Tridentine in their organisation, culture and education. Lectures in Latin, on ancient texts, were still the staple at St. Patrick’s Manly seminary through to the 1960s, reading outside the course was not encouraged, genuine questioning was off the educational table (Geraghty 2003). English seminaries of the time were also Tridentine. The Catholic historian and sometime seminarian, John Cornwell (Cornwell 1999, 2001, 2003), wrote of his 1958-60 seminary experience:

The intellectual regimen was narrow and austere. Our studies, in philosophy, theology, Scripture and Church history, came packaged in published theses and aging manuals, mostly in Latin. We were not encouraged to read original texts. The tone of most of what we were taught was dogmatic. ... These were the final days of an academic regimen that went back almost one hundred years to the reign of Leo XIII. (Cornwell 2001, p.72)

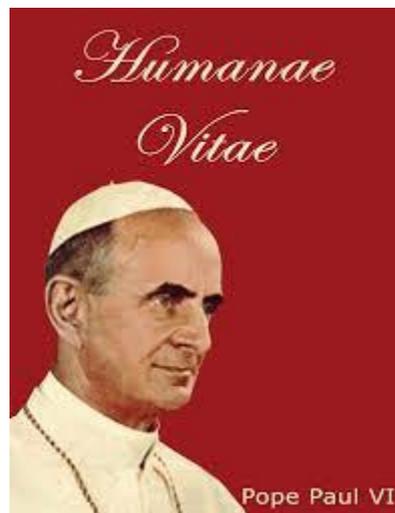
The Australian bishops, with perhaps a few exceptions, did not bring back to the Australian church the intellectual ferment of Rome. But eventually the Council decisions were enacted and the writings of the ‘new guard’ found their way into seminaries, adult education programmes, and university Catholic societies. The cheap 800-page English translation of *The Documents of Vatican II* (Abbott 1966) were widely-enough read; they were a ‘must have on bookshelf’ for serious young Catholics. My own copy still has the plastic protective cover I put on it in 1967. However, to put it crudely, the Council decrees, and the disseminated new theology, compromised the successful long-time ‘business model’ of the Christian Brothers, along with that of most of the orders of priests, brothers, and nuns. For many conservatives, the Council compromised the ‘business model’ of the Church itself.

For all orders, including Christian Brothers, immature teenagers could no longer be accepted into novitiates; seminaries could no longer cut their ‘inmates’ off year-after-year from contact with family, society and the world; seminarians could now read letters, newspapers and

periodicals; they could watch TV; they could take books out of public libraries; they could have personal friendships and conversations with other seminarians; they could venture out to the city or beach on their own or with a fellow seminarian, they did not have to move around in groups of three or more; they were encouraged to attend university courses; and, in a huge step forward, they were free to talk and engage with women.

The clear Augustinian-Manichean cosmology that underwrote the mission of the Church with its black and white dualities of good/evil, spirit/body, them/us, saved/unsaved began to dissolve. Protestants rose in rank to ‘separated brethren’; the door was opened to salvation outside the Church; evil was not confined to personal sin, it was also manifest in social and institutional arrangements; socialism was not the forecourt of communism; numerous long-standing ‘divinely’ ordained practices and liturgies, were seen less as divinely ordained and more as culturally and historically ordained – e.g., no meat on Fridays - indeed gender ordained, where arguments about the ordination of women were very serious; and so on. The Green Catechism, so confidently and successfully expounded by the Christian brothers, could no longer be taught and examined, at least in the same manner and with the same confidence. The catechism answers were on their way to becoming ‘discussion points’ in religion classes.

For both outsiders and insiders, the sturdy Catholic edifice, the largest structure in the 2.5-billion person Christian world, was seen as having feet of clay. Near fatal damage to the Church was caused in 1968 by a shot fired from, of all places, the Vatican. Pope Paul VI took it upon himself, and before awaiting the outcome of a bishops’ commission, to issue the encyclical [*Humanae Vitae*](#) reaffirming the Church’s historic opposition to contraception (Noonan 1965), and stating that its practice contravened natural law, was sinful and could not be practised by Catholics.



Humanae Vitae (1968)

The release, and ready availability from the early 1960s, of the contraceptive pill had pushed Church teaching on contraception to the forefront of many Catholics’ thinking. The title and contents of a pre-encyclical 1964 anthology edited by Archbishop Thomas Roberts captures the Catholic, and my own, preoccupation of the time - *Contraception and Holiness: The Catholic Predicament* (Roberts 1964). Contraception was regarded, and always taught, as selfish and illicit. This had to be remembered by Catholics even when allowed ‘natural’ rhythm methods of contraception were encouraged by clergy and practised by the faithful. The encyclical was clear that for all married couples:

The Church, nevertheless, in urging men to the observance of the precepts of the natural law, which it interprets by its constant doctrine, teaches that each and every marital act must of necessity retain its intrinsic relationship to the procreation of human life.(#11)

And for priests:

And now, beloved sons, you who are priests, it is your principal duty—We are speaking especially to you who teach moral theology—to spell out clearly and completely the Church's teaching on marriage. In the performance of your ministry you must be the first to give an example of that sincere obedience, inward as well as outward, which is due to the magisterium of the Church. (#28)

And underpinning the whole corpus of the Church's teaching on contraception was the long-held doctrine of natural law, not scripture or revelation, not even historical teaching, but natural law that is 'engraved' in the nature of 'man'. Without natural law, the Church's teaching is adrift. A Jesuit priest well stated this dependence:

There would seem to be small grounds in Scripture for a strictly theological position nor does tradition in its other forms make up for this lack. In point of fact, the papal documents which have specified the Catholic position seem to argue from revelation very little if at all; rather, the emphasis is upon the natural law and upon the role of unaided reason in the establishing of the norms of human conduct. The arguments adduced by [Catholic] moralists have followed along the same path. (Baltazar 1964, p.130)

The encyclical was explicit on this point:

For man cannot attain that true happiness for which he yearns with all the strength of his spirit, unless he keeps the laws which the Most High God has engraved in his very nature. (#31)

Paul VI was continuing the explicit teaching of Pius XI who in his lengthy 1930 encyclical [*Casti Connubii*](#) maintained:

54. But no reason, however grave, may be put forward by which anything intrinsically against nature may become conformable to nature and morally good. Since, therefore, the conjugal act is destined primarily by nature for the begetting of children, those who in exercising it deliberately frustrate its natural power and purpose sin against nature and commit a deed which is shameful and intrinsically vicious.

55. Small wonder, therefore, if Holy Writ bears witness that the Divine Majesty regards with greatest detestation this horrible crime and at times has punished it with death. As St. Augustine notes, "Intercourse even with one's legitimate wife is unlawful and wicked where the conception of the offspring is prevented. Onan, the son of Juda, did this and the Lord killed him for it."

Aquinas, following Augustine, was explicit about the paramount status of natural law. In his treatment of 'Human Law' in Question 95 of the Second Part of Part One of *Summa Theologica* he wrote:

... therefore the force of a law depends on the extent of its justice. Now in human affairs a thing is said to be just from being right according to the rule of reason. But the first rule of reason is the law of nature, as is clear from what has been stated above (Q.95 Art.2 Reply 2). Consequently, every human law has just so much of the character of law as it is derived from the law of nature. But if in any point it differs from the law of nature, it is no longer a law but a corruption of law. (Aquinas 1270/1952, vol.2, pp. 227-228.)

The clear positive side of commitment to Natural Law was that it allowed, indeed commanded, rejection of the laws and commands of dictatorial, unjust regimes; there was a non-political, philosophical court of appeal. In Nazi Germany, Stalinist Russia, Mao's China,

and so many other places – this emboldened and gave comfort to the brave. But the theory did depend on identification of, and agreement about, what was natural in the natural law.

A historian of the natural law tradition observed:

The modern Thomist will insist that the proper foundation of natural law is a metaphysical foundation. But the metaphysics which he has in mind is the Christian, or rather the Thomist. His starting point is that of St. Thomas: ‘suppose the world to be governed by divine Providence’. (d’Entrèves 1951, p.46)

For the Catholic Church, as will be detailed in the following section, its Natural Law doctrine was anchored in Thomism. This thought-to-be firm anchor allowed the Church, where it had temporal power and influence, to make contraception more than just immoral and sinful, but also illegal.

There have been, of course, other metaphysical anchors, outside of Thomism and Aristotelianism, for natural law theory (d’Entrèves 1951, Evans 1965, Pufendorf 1991). [Hugo Grotius](#) (1583-1645) the Dutch philosopher and political theorist, who is recognised as the founder of modern natural law legal theory, held that natural law would maintain its validity even if God did not exist. It would survive the demise of Thomism. The Nuremberg war trials proceeded on a natural law foundation without explicit reference to St. Thomas.

Pius XI in *Casti Connubii* had repeated the Church’s claims for the alignment of secular law with divine law, or at least with canon law.

124. For the preservation of the moral order neither the laws and sanctions of the temporal power are sufficient, nor is the beauty of virtue and the expounding of its necessity. Religious authority must enter in to enlighten the mind, to direct the will, and to strengthen human frailty by the assistance of divine grace. Such an authority is found nowhere save in the Church instituted by Christ the Lord. Hence We earnestly exhort in the Lord all those who hold the reins of power that they establish and maintain firmly harmony and friendship with this Church of Christ so that through the united activity and energy of both powers the tremendous evils, fruits of those wanton liberties which assail both marriage and the family and are a menace to both Church and State, may be effectively frustrated.

And:

125. Governments can assist the Church greatly in the execution of its important office, if, in laying down their ordinances, they take account of what is prescribed by divine and ecclesiastical law, and if penalties are fixed for offenders.

Pius XI pointed to the 1929 Lateran Pact between the Holy See (Vatican) and the Kingdom of Italy (Mussolini) that he had signed as an exemplar of such enlightenment of secular law and culture.

This alignment meant the secular prohibition of both divorce and contraception. So, in Ireland the sale of contraceptives was illegal from 1937-1980. In the US, the Comstock Law of 1873 made it illegal to advertise contraceptives and selling condoms was illegal in thirty states (Collier 2007). Similarly, contraception and divorce was illegal in the Philippines, Italy, Spain, Argentina, Brazil and numerous other Catholic countries. Divorce came to Argentina only in 1987. The Church’s Thomistic reading of natural law, had secular

legalistic consequences. And, of course, serious personal consequences for millions of citizens, perhaps the most damaging of which was unplanned and unwanted pregnancy.

When Pope Paul VI took it upon himself, and away from the Cardinals' Commission, to issue the *Humanae Vitae* encyclical in 1968, the bulk of Catholics, worldwide, simply rejected the teaching. It did not accord with their own lived experience, or their own reasoning. For married Catholics, and more so for unmarried ones, the ease, simplicity, cheapness and discreetness of the contraceptive pill which became available in 1961 and which in Australia in 1975 was placed by Prime Minister Gough Whitlam on the Pharmaceutical Benefits Scheme, meant that it was almost universally utilised. The complex and arcane natural law arguments against contraception simply did not wash; and without them, there was no other Christian basis for the prohibition. Something recognised by Protestants for centuries.



1968 Birth Control Sydney Press Conference
[Dr Radford, Bishop Thomas Muldoon, Cardinal Norman Gilroy, Monsignor James Madden, Dr Murray, a Catholic doctor]

The photo of the Church's 1968 Sydney Birth Control press conference reveals a great deal about the Church of the time. Enough said.

Many rightly pointed out that rejection of *Humanae Vitae* would be the 'thin edge of the wedge'. If papal teaching were rejected there, if the Church got something so important, for so many, so wrong, then why assent to its teaching elsewhere? The encyclical was just repeating a long tradition of formal encyclicals of the magisterium; it was not a one-off

aberration of a distracted, lone pope. If the philosophical, natural-law, basis of the Church arguments was deemed unsound, then what other social and moral imperatives advanced with the same natural-law arguments could be rejected?

Post Vatican Council, Catholic beliefs and injunctions lacked the dogmatic certainty of yesteryear; its practices, including its sacramental practices, ceased being practised. Confession has all but disappeared; attendance at Sunday mass, which used be compulsory under pain of mortal sin, has the same downhill trajectory; Catholics living together, without scruple or guilt, before marriage is as routine as it is for non-Catholics; almost no Catholic follows the Church's injunctions against contraceptive use; and so on.

Priests, brothers, and nuns left their ministries *en masse*. The Vatican Council destabilised a great deal of 'Old' Catholicism's core beliefs and practices. For huge numbers, *Humanae Vitae* swept away what vestiges of Church authority remained. The encyclical was authoritative, it was a solemn pronouncement of the magisterium of the Church; a Church that had defined itself as the source and determiner of Tradition which with Revelation constituted the twin sources of Catholic faith. Cherry picking was formally a Protestant option, but never formally a Catholic one. You had to take the bad with the good; the hard with the easy. However, by the 1980s, if not earlier, this was all changing: the monolithic Church with centralised divinely-ordained authority was believed in by a diminishing number of Catholics. They did not lose the Faith; they began having a Faith of a different hue from the previous generations.

Demise of the Christian Brothers

My Waverley years were the highpoint of almost a century of the Christian Brothers apostolate in Australia. The first of Edmund Rice's congregation came from Ireland in 1868 and spread throughout Australia establishing schools everywhere. In the 1960s there were about 1,600 men in the Order who were teaching in about 100 schools. The Strathfield novitiate and Training College routinely had about 100 'men' preparing to teach and to take the Order's entry vows of Chastity, Obedience and Poverty. Disturbingly in retrospect, and for many even at the time, some who entered were mere boys of 14-15 who completed their final two years of high school in the novitiate and then followed on with 2-3 years of pedagogical training and religious formation before being launched into their teaching career, or more properly, their vocation. They were literally in short pants when they entered the novitiate, and in not much longer ones when they emerged.

Obedience had the same rank as Chastity and Poverty. It meant obedience to superiors in the Order, and through ecclesiastical structures and lines of authority, obedience to the appropriate bishop, and ultimately the Vatican. It was natural that the brothers' in-grained obedience to those above, would also flow down, and be expected from their pupils. And it was given. As already mentioned, in my entire Christian Brothers education, I never heard a brother have to repeat themselves in class. There was simply no 'Haven't I told you', 'Again, please be quiet', 'How many times must I tell you', and so on – the daily debilitating staple of most teachers.

The Order was destabilised by the modernisation decrees of the Second Vatican Council. During the 1970s there was not so much an ebbing of the Christian Brothers tide, as the crashing of a wave. Or in another metaphor, the Order went over the cliff. Within a couple of decades of my leaving Waverley, the Order had just about disappeared in Australia leaving

just some retired brothers in dedicated care homes. And it was scorched by the Sexual Abuse scandals of the 1980s and '90s so thoroughly and depressingly documented in the 2015-17 [Royal Commission into Institutional Responses to Child Sexual Abuse](#); the same venality and criminality that bought opprobrium to so much of the Catholic Church throughout the world.

The Royal Commission was prompted by a cascade of allegations and criminal convictions for sexual abuse of children by scores of members of trusted and reputable sporting, cultural and educational institutions, including the Christian Brothers. To the shock and dismay of Waverley Old Boys, the Brothers had the highest number of complaints (1,015) of any Catholic authority. The Commission estimated that 22 per cent of brothers were paedophiles or at least had on occasion abused pupils. The Order has paid over \$350 million in compensation. It paid \$1.5 million in legal fees defending three, ultimately convicted, brothers. In the USA and Ireland comparable abuse compensation has been paid, and brothers, priests, and bishops jailed.

The Australian Broadcasting Commission (ABC) produced an [insightful programme](#) 'Celibacy, order and obedience: Inside the Christian Brothers' about two long-term Brothers who entered the order at 14 years, were professed, taught for 10+ years, then left the Order and the Church saying, as so many did, that they 'could no longer themselves believe what they had to teach their students'.

In the lead-up to the 50th Waverley reunion in 2014 I contacted the very helpful [Bro Dominic Obbens](#) at the Christian Brothers Archives to get biographical details of our teachers which were then sent to 130 or so class fellows. These were rich, informative and appreciated pen-pictures most taken from the Christian Brothers authoritative *Necrology*.

A couple of years ago, I again contacted Bro. Dominic for more information. I was unable to do so. This because he was in jail convicted for abuse of three pupils at St Patrick's Goulburn in the 1970s, and another three pupils some decades later. To their discredit, the Order had bobbed, ducked and weaved protecting him; he was taken out of the Goulburn school when accusations were first made and put in a head-quarter's office in Sydney away from public sight. But finally, his accusers had their day in court, and he has his years in jail.

To the best of my knowledge, and that of the, admittedly self-selecting, 50-60 fellows who fifty years later attend five-yearly reunions, Waverley College was in a 'no abuse' bubble. Despite their limited training, and their equally and limited living conditions and life experiences, the teaching brothers were all fine, decent and fondly-remembered people.

This was not the case for the long-time college chaplain, Fr Kieran O'Connell OFM whose photo year-after-year from 1950 graced annual Yearbook pages meeting with visiting dignitaries, bishops and cardinals, seated in the centre of the college Sodality of Our Lady group, leading prayers at the May Procession, and performing various other esteemed roles in college life.

A significant personal event occurred in July 2020 when I read [John Cornwell's](#) autobiography, *Breaking Faith: The Pope, the People and the Fate of Catholicism* (Cornwell 2001), in which, writing of his 1957 junior-seminary life, he says:

A priest, now long since dead, asked me during confession in his room if he could look at my penis. His excuse was that I might have a deformed sexual organ which was causing 'overstimulation'; to inspect my penis would satisfy us both as to whether I suffered from this condition. The word ['sexual abuse'] was rarely used in that context in those days, but I had the sense to realize that his suggestion was inappropriate and I declined his offer, but I wonder to this day how many other boys fell for this tactic. (Cornwell 2001, p.163)

I had exactly the same experience with Kieran O'Connell but seemingly with longer duplicitous 'grooming' and more prolonged after-effects. The humiliating details can be left unsaid. For a number of months, my meetings, and confessions, were in one of a number of rooms off the busy, main presbytery foyer. I told my mother that I was going to the presbytery to see Fr Kieran. She was clearly happy, though, of course, not knowing that these meetings were to assist me in struggles against impurity, sins of the flesh, or more plainly called masturbation. I had no inkling of Fr Kieran's 'long game'. The final episode occurred on a Saturday morning in 1964, when I was 16 years old, not in the presbytery, but in a meeting room underneath Mary Immaculate church.

Telling my mother what happened was not an option. Her mind, her mental world of devout, simple Irish Catholicism could not comprehend or adjust to such behaviour from a priest, to tell her would be completely destabilising of her world. I doubted if she could ever adjust to such news. Telling friends was not an option. That would be bringing scandal on the Church, something against the grain of all my mother's upbringing. I took the common option: say nothing, remain silent. The usual mechanisms kicked in: It was the aberrant behaviour of a disturbed individual; Fr Kieran was an isolated outlier; he did not represent the Catholic priesthood; protect your own dignity; distinguish the Church's message from the messenger, and so on.

My serious and devout Catholicism moved forward: weekly mass, confession, prayer, continued consideration of a vocation to the priesthood, remaining a virgin till age 21. The episode was never mentioned. Just this year (2020) I told my wife, my first wife and two Catholic friends from the time. Through 55 years of college reunions I never mentioned the episode. Reading Cornwell's revelation of the same disturbed behaviour tipped the scales from remaining silent, to being public. Fr Kieran O'Connell died in 1985.

It turns out that Fr Kieran was not the only disturbed man in the Waverley Franciscan community. On 4 September 2016 the [Sydney Morning Herald](#) revealed that molestation charges had been made by a number of middle-age men against Brother Paschal OFM who for 50 years supervised altar boys in different parishes, including Waverley where, the *Herald* noted, 'some of whom [altar boys] were pupils at the Christian Brothers' Waverley College'. The complainants had remained silent for decades until the hearings and findings of the Royal Commission into Sexual Abuse were released in 2016. In the same year, the men contacted the Franciscan Order who did not contest the charges. They organised an apology printed in the Waverley parish newsletter and the newsletters of the other parishes where Bro Paschal had served. He died in 1994.

The Strathfield novitiate closed in the 1980s; the pleasant and huge complex becoming a campus of the Australian Catholic University. Waverley College is not advertised as a Christian Brothers school, it is not even advertised as 'in the Christian Brothers tradition'; it is advertised as a school 'in the Edmund Rice tradition'. A description which assuredly means nothing to anyone, which sadly is perhaps its point. The same fate has befallen the many esteemed Christian Brothers schools throughout Australia. They are no longer called

‘Christian Brothers’ schools; not even in the ‘Christian Brothers tradition’. A number of those who left the order do not publicly admit to ever having been in it; to do so is a damaging career and social move. Akin to a German admitting he or she used work for Stasi.

A year ago, at a social gathering, I talked for some while with a high school teacher and mentioned that I had been to Waverley. Later in the evening I meet his wife who remarked that her husband had been a Christian Brother. He gave no inkling of this in our conversation. How the esteemed have fallen. Yet for most of those in the Waverley ‘bubble’, myself included, and doubtless in most other Christian Brothers’ schools, our memories of the brothers were of fine, dedicated men who achieved so much with their very limited means.

The Church and Thomism in Sydney

At the final assembly in 1964, among other things, Brother O’Connor said: ‘Now don’t any of you boys go studying philosophy at Sydney University, if you must then make sure you also attend the Aquinas Academy’. Brother O’Connor’s warning about Sydney Philosophy was given in nigh on all Catholic schools, and perhaps many other religious schools.

That a school principal would say anything about a university philosophy department seems odd; but given Catholicism, the times, and the department, it was not so odd. More than any other Christian denomination, Catholicism took philosophy seriously: faith and reason needed to be reconciled; faith had propositional content expressed in Creeds, dogmas, papal and Council decrees all of which had to be philosophically coherent and ‘sensible’, they could not offend reason; fideism (the content of faith comes from revelation alone) had long been opposed in the Catholic tradition, whereas it had been enshrined in much of the Protestant tradition; emotionalism, whereby Christianity is just a matter of feelings, attitudes and raptures, was regarded with suspicion; formal philosophy had always been a major component in the seminary programme for priests. [Brand Blanshard](#) (1892-1987), a distinguished American philosopher and critic of Catholicism wrote:

The Catholic church is not anti-rational; it has a profound respect for reason. Any fair critic must admit that it has made a larger use of reason, that it has a creed more closely articulated intellectually, and that it has engaged in its service a more distinguished succession of philosophic minds, than any other religious body, Christian or pagan. (Blanshard 1975, p.24)

Since colonial times, Australian Catholicism has been tied to a particular philosophy: Scholastic philosophy or Thomism. 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 Thomist priest [Austin Mary Woodbury](#) who had Roman doctoral degrees in both philosophy and theology. He was learned, lucid and immensely popular. In 1962 when the University of Chicago Thomist philosopher, Mortimer Adler, came to Sydney, 1500 past and present Academy students packed Sydney Town Hall to hear the US philosopher. [Patrick Ryan](#), the crusading anti-communist Sacred Heart priest, was also prominent in Sydney Thomism and Catholic

life. 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, 1956, 1971) whose *Christian Theology and Natural Science* (Mascall 1956) had an influence on my own early thinking about science and faith after I first read it in 1972.

In 1879 Pope Leo XIII in his encyclical [*Aeterni Patris*](#) had decreed Thomism to be the official philosophy of the Catholic Church; it was to be taught, elaborated and defended in all seminaries, and to inform religious teaching in all schools. In June 1914 Pius X issued his [*Doctoris Angelici*](#) decree, restating the primacy of Aquinas's metaphysics for Catholic teaching, and requiring its placement at the core of all seminary philosophy. The decree affirmed:

The chief doctrines of St. Thomas' philosophy cannot be regarded as mere opinions—which anyone might discuss pro and con, but rather as a foundation on which all science of both natural and divine things rests. If they are taken away, or perverted in any way, then this necessarily follows: that the students of sacred studies will not perceive even the meaning of those words whereby the divinely revealed dogmas are uttered by the teaching of the Church. (ibid.)

Further:

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. (ibid.)

And:

it is our will and we hereby order and command that teachers of sacred theology in Universities, Academies, Colleges, Seminaries and Institutions enjoying by apostolic indult the privilege of granting academic degrees and doctorates in philosophy, use the *Summa Theologica* of St. Thomas as the text of their prelections and comment upon it in the Latin tongue, and let them take particular care to inspire their pupils with a devotion for it. (ibid.)

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).

The traditional and then canonical commitment to Thomism was such that non-Thomistic philosophical works that purportedly established the existence of God were placed on the *Index librorum prohibitorum*. Thus Descartes, Malebranche, Rousseau, Kant – believers all – were on the Index (Gilson 1968, p.238)

Thomist philosophy underpinned the Catholic Catechism that was learnt by rote by generations of pupils. 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 since remained a touchstone for orthodoxy in Catholicism, and for all Christian Churches.

Consider:

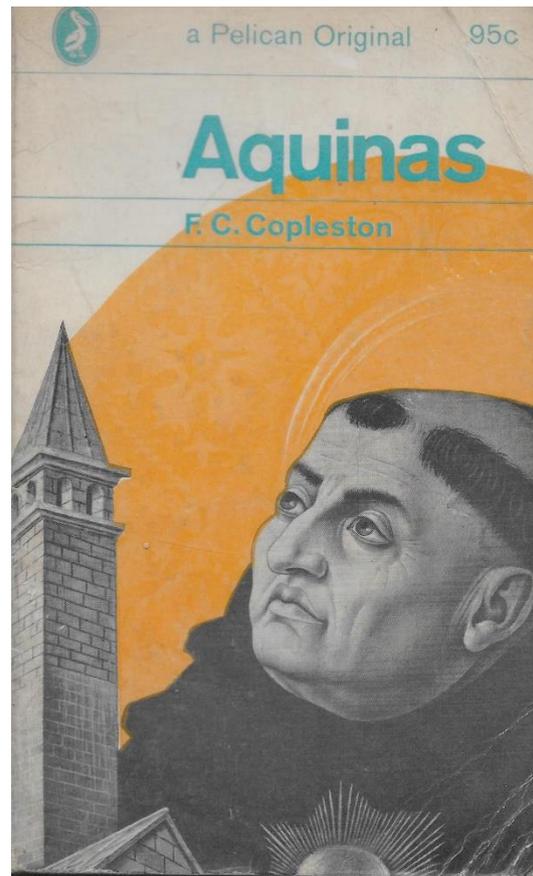
We believe in the Holy Spirit, the Lord,
and the giver of life,
who proceeds from the Father and the Son,
who with the Father and the Son
is worshiped and glorified

Making sense of the Nicene Trinitarian formulation was a struggle, but the option of ‘it makes 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. Understandable at least to philosophers, so that the Church could say to the less philosophically acute clergy and laity: ‘The creed is sensible and coherent, just difficult for you to appreciate’. In this, the Church’s position is somewhat similar to contemporary belief in quantum entanglement: almost the entirety of the world cannot understand it, or even formulate it, but have ‘faith’ that some sophisticated physicists do understand and justify the belief. This is enough to go on with.

Of course, being sensible and coherent is not the same as being believable. The Church never held that the Creed could be ‘proved’ or demonstrated; only that it was ‘reasonable’, that it did not offend reason. Belief was ultimately a leap of faith.

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. Jacques Maritain (1935/1951, 1948) and Etienne Gilson (Gilson 1929, 1936, 1952, 1960), exemplified the best philosophical qualities of modern Thomism, yet liberal Catholics maintained that philosophy had to stand on its own feet; it could not deflect its own problems by appeal to any papal authority.

The issue for all religions based on putative divine revelation embodied in scriptures (Judaism, Christianity, Islam, Zoroastrianism, Sikhism, Mormonism, and others) was the reconciliation of philosophy with that revelation. Etienne Gilson (1884-1978) expressed the matter thus:

A philosophy open to the supernatural would certainly be compatible with Christianity, but it would not necessarily be a Christian philosophy. If it is to deserve that name, the supernatural must descend as constitutive element not, of course, into its texture, which would be a contradiction, but into the work of its construction. Thus I call Christian, every philosophy which, although keeping the two orders formally distinct, nevertheless considers the Christian revelation as an indispensable auxiliary to reason. (Gilson 1936, p.37)

The additional requirement for Catholic philosophers is that the content of revelation is determined by the Church; there is an authoritative interpretation of scripture which resides in the tradition of Church teaching, pronouncements, encyclicals and ultimately in papal authority. The Church long recognised that a revelation which is open to anyone to interpret as they see fit, is hardly divine revelation. And along with the responsibility for interpretation came the requirement for making revelation understandable and intelligible.

The language of the earliest Christian community was Hebrew and its culture Jewish, but within decades of the death of Jesus, under the influence of Paul and others, there grew a divergent community whose language and culture was Greek (Stanley 1966). The Christian community, or Church as it was becoming identified, needed to express its beliefs, or ‘doctrines’ in Hellenistic culture using Greek language. The British historian Arnold Toynbee (1889-1975) well recognised this:

... the exposition of Christianity in Greek language (and Christianity was expounded in the Greek language at a very early stage of its history) implicated Christianity in Greek philosophy, because, by the first century of the Christian Era, the Greek language was long since imbued with a Greek philosophical vocabulary, conveying Greek philosophical ideas. And I think that as soon as the Epistles and the Gospels were written, and written in Greek, Christianity was committed to expressing itself sooner or later in terms of Greek philosophy. (Toynbee 1958, p.6)

Thus began the much-debated issue of the ‘Hellenization of Christian Dogma’ that has long occupied both Catholic (Dewart 1966, 1969, Lonergan 1967) and Protestant philosopher/theologians ().

Toynbee’s observation elides the important fact that Greek philosophy was not homogeneous; there were a number of Hellene philosophical systems, and just one or two non-materialist ones were taken up by the early Church, and enthroned in the subsequent almost two millennia of religious, theological, philosophical and scientific discussion and debate. Wallis Suchting described these struggles in the cradle of Western science and philosophy as:

Despite all the differences between Plato and Aristotle the latter carried on the work of the former in essential ways, like that of offering a metaphysical ‘foundation’ for the sciences and a teleological view of the world. Christianity took up elements of Platonic thought ...but, its philosophical high-point, in Thomism, mainly appropriated Aristotle. Atomism carried on a basically marginal existence, ...till it was recuperated by Galileo. (Suchting 1994, p.45)

As will be later illustrated, in the mechanical worldview of the Scientific Revolution there was simply no place for the entities that Aristotelianism utilised to explain events in the world: hylomorphism, immaterial substances, unfolding natures and potentialities, substantial forms, teleological processes and final causes were all banished from the philosophical firmament. Much can be said about atomism and the New Science, but for current purposes it suffices to repeat Craig Dilworth’s observation that:

The metaphysics underlying the Scientific Revolution was that of early Greek atomism. ... It is with *atomism* that one obtains the notion of a *physical* reality underlying the phenomena, a reality in which *uniform causal* relations obtain. ... What made the Scientific Revolution truly distinct, and Galileo ... its father, was that for the first time this empirical methodology [of Archimedes] was given an ontological underpinning. (Dilworth 1996/2006, p.201)

Returning to Toynbee’s observation, a basic divide has been between Christians who recognise that there needs to be philosophical interpretation of belief and those who reject all interpretation as deviation from revelation. The latter is the common fundamentalist option. For the former group, a basic issue what counts as authentic, or justified, interpretation; and for Catholics, what counts as ‘authorised’ interpretation.

[Claude Tresmontant](#) (1925-1997), the French philosopher, Hellenist and theologian, gave a very clear and unambiguous statement of the 'interpretation' side of the debate, maintaining that:

... there is one Christian philosophy and one only. I maintain, in other words, that Christianity calls for a metaphysical structure which is not any structure, that Christianity is an original metaphysic. I maintain that Christian theology and Christian dogma contain in themselves a metaphysical substructure, a body of very precise and very well-defined theses which are properly metaphysical, though it is only progressively with time, in the course of its history, that Christian thought becomes conscious of it. (Tresmontant 1965, pp.19-20)

He does realistically acknowledge that 'The idea itself of Christian metaphysics can give rise to dispute from many points of view' (Tresmontant 1965, p.28). Cutting a very long story (which will be taken up later) short, Thomism was the philosophical system officially endorsed and utilised by the Catholic Church in its interpretation of revelation and as the philosophical substrate for its own teaching and formulation of dogma.

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 of Thomism.

Some years ago, I went to the Catholic University of Louvain in part because an uncle, Fr. Harry Reid did his Doctor of Divinity degree there before WWII. He was the son of my grandmother's brother and a particular friend of my mother's, a welcomed visitor to our flat at Waverley, in 1949 he was the founding President of Chevalier College in Burradoo. 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. A sure sign of the waning fortune of Thomism.

In the final years of the twentieth century, Pope John Paul II, in his lengthy 1998 philosophically-focussed encyclical *Fides et Ratio* (*Faith and Reason*) tried to re-energise the philosophical heritage of St Thomas, writing:

In an age when Christian thinkers were rediscovering the treasures of ancient philosophy, and more particularly of Aristotle, Thomas had the great merit of giving pride of place to the harmony which exists between faith and reason. Both the light of reason and the light of faith come from God, he argued; hence there can be no contradiction between them. (ibid. #43)

And:

It should be clear in the light of these reflections why the Magisterium has repeatedly acclaimed the merits of Saint Thomas' thought and made him the guide and model for theological studies. This has not been in order to take a position on properly philosophical questions nor to demand adherence to particular theses. The Magisterium's intention has always been to show how Saint Thomas is an authentic model for all who seek the truth. In his thinking, the demands of reason and the power of faith found the most elevated synthesis ever attained by human thought, for he could defend the radical newness introduced by Revelation without ever demeaning the venture proper to reason. (ibid. #78)

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 greatest philosophers 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](#) (1923-1985), 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)

This historical-philosophical method is displayed in Weisheipl's own masterful biography of Aquinas (Weisheipl 1974) and his studies on *Nature and Motion in the Middle Ages* (Weisheipl 1985).

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 elaborated this point when putting together a collection of texts on the scientific background to early modern philosophy (Matthews 1989). Encouragingly, the anthology has now sold 50,000 copies, and Hackett Publishing has invited me to do a revised and expanded edition. Likewise, understanding and learning from educationalists such as Comenius, Rousseau, Dewey, Hutchins and others, benefits from the same combination of historical compass and philosophical attention.

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 and Beginning Philosophy (1965-67)

At the Leaving Certificate (1964) 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. The scholarship enabled me to go to university. Our mathematics teacher, Brother MacKay, had said that 'being a teacher means you can help people grow up'. These words made an impression, so training to be a teacher was an easy career decision.

My mother's less than bountiful financial situation meant I could receive a 'living away from home allowance' despite continuing to live with her in our two-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; owners of rent-controlled properties did not think it so enlightened.

Despite the episode mentioned earlier with the Waverley College chaplain, the only career competitor I had 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. As mentioned above, the Catholic Church took philosophy seriously. I, along with thousands of others in Australia, and still more hundreds of thousands in the US and UK, listened to the Sydney radio philosopher-priest, Dr. [Leslie Rumble](#) (1892-1975) where week-by-week, in responses to listeners questions, Materialists, Marxists, Methodists, Masons, Muslims, Mormons (these being just the ‘M’s), were all in a scholarly, quiet and deliberate manner shown the strengths, but more particularly the errors, 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. For instance:

- Question: Did not Luther give ninety reasons for leaving the Catholic Church?
 Reply: He gave many excuses but no real reasons. Before he left the Church, he was a member of a religious order, vowed for the love of Christ to poverty, chastity and obedience. He broke all three vows. Vices, whether intellectual or moral, are excuses, not reasons, for leaving the Church.
- Question: Do you know of any good in Luther?
 Reply: Intellectually, not much. He declared that reason was of the devil, and that the Christian must regard it as his greatest enemy. (Campion 1987, p.136)

His subsequently published book *Radio Replies: Classic Answers to Timeless Questions about the Catholic Faith* sold hundreds of thousands of copies throughout the English-speaking world

I bought numerous Australian Catholic Truth Society pamphlets sold in the vestibule of Mary Immaculate Church at every Sunday mass. The ACTS was established in 1904 and published some 1200 titles in its first fifty years, with a total print run of 13 million. The author of its first pamphlet was Cardinal Moran, the title: *Priests and People of Ireland: A Vindication* (Campion 1987, p.129). Publications on philosophical questions were my particular interest. 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. All of 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. This was a life-changing enrolment.

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.

Unlike any other Australian philosophy department, Sydney's was dominated by and formed in the image of its early and long-time Head, [John Anderson](#) (1893-1962).



Philosophy Corner, Sydney University

Anderson was a Glasgow-trained philosopher who was appointed Head of Sydney Philosophy in 1927 and who held this powerful position for 30 years till his retirement in 1958. He was a public intellectual of unequalled stature, probably generating more newspaper column-inches than the totality of Australian philosophers, if not more than all Australian academics combined. He was the antithesis of an Ivory Tower philosopher: He had an appetite for controversy and polemic of all kinds, especially political and religious. Importantly, his appetite was for controversy rather than action. Giving a speech or writing a pamphlet constituted action. This stemmed from a deep-seated pessimism; a view that the system was stacked against progress and reform.

Anderson was an atheist, a socialist, an ethical relativist, an early advisor to the Australian Communist Party, and much else that brought him social opprobrium (Kennedy 1996). In the 1930s he supported the Australian Communist Party before turning against Russia and communism in the 1950s; he founded and was president of the Australian Freethought Society; he was resolute in his defense of academic freedom; he opposed censorship on any grounds – religious, political, moral or aesthetic.

Anderson campaigned against the influence of religion in all levels of education (Franklin 2003, Weblin 2014). He claimed that religion was antithetical to education: ultimately pupils (children) had to believe on the basis of authority, and what they were believing required them to be credulous. Both things – deference to authority and credulity - were contrary to the fundamentals of liberal education. For publishing and stating such views he was censored by the NSW Parliament.

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, p.27)

And:

... there are reasons, which I think conclusive, for holding that a realist can only be an empiricist. (Anderson 1962, p.27)

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. His epistemology was anti-foundationalist.

In Anderson's time, philosophy used figure in public life. 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 the soul existed and, if so, whether only *homo sapiens* had one; on whether materialism is coherent; on whether the existence of God could be proved; and so on. Anderson contributed to and fuelled this public debate. Austin 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, from the pulpit and in a widely-distributed pamphlet, the Sydney department for its immoral teaching and its 'corrupting of youth'. The department was the subject of an NSW Government Inquiry into the corruption of youth. It is not surprising that Bro. O'Connor advised Waverley boys not to study philosophy at University of Sydney.

Anderson was a founder, 'theorist', and until the early 1950s was sustainer of the loose-knit, heavy-drinking, horse, dog and card-gambling, poetry-reciting, bawdy-ballad singing, free-loving, argumentative, anarcho-bohemian, libertarian 'Sydney Push'. Its 'members' included many actual and want-to-be writers, poets, philosophers, psychologists, anthropologists, journalists, feminists, and the like. In the immediate post-war years, most of those linked to the Push were enrolled in or came from the University of Sydney Faculty of Arts. Editing, and writing for, the influential student paper *Honi Soit* constituted honourable Push labour.

When Anderson's anti-communism became strident that he refused to campaign against prime minister Robert Menzies referendum to ban the Australian Communist Party, his 200 or so member 'Freethought Society' collapsed. It reformed as the Libertarian Society, and informally as The Push. Early members of one or both groups were David Stove, David Armstrong, Darcy Waters, John Maze, Lillian Roxon, Bill Bonney, Roelof Smilde, Jim Baker, George Molnar, Ian Bedford, Ross Poole, Frank Moorhouse, Sandra Grimes, Clive James, Liz Fell, Paddy McGuinness, David Ivison and many others who became prominent legal, academic, literary, newspaper and cultural figures.

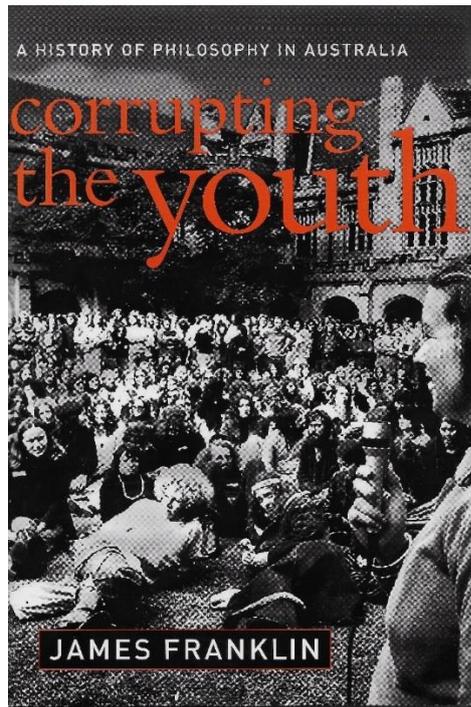
Andersonians and Push members were torn between on the one hand, a fatalism about the utility of group action and campaigning – 'no matter who you vote for a politician is always elected', and 'whatever is done is only scratching the surface' - and on the other, trying to do good works, improve structures, ameliorate conditions. The term 'futileism' captured the first option, or less extreme, the title 'trade unionism'.

A history of the Push was titled: *Sex and Anarchy* (Coombs 1996). These two title words were the anthesis of everything for which Brother O'Connor and Waverley stood.

By the time I went to University of Sydney in 1965, the distinctive, confined, and scandalous ethos of the Push had begun seeping out into mainstream student and Sydney life. The seepage was accelerated by the contraceptive pill's arrival in Sydney in 1961. The very idea of 'sex before marriage' had disappeared. Not the reality, but the concept; the concept, even the phrase, was just was not there; even religious students rarely thought or spoke in those terms. Being against authority, whether state or church, may not have been the norm - as it was for Andersonians, Freethought or Libertarian members, and the Push – but it certainly was normal. Anti-war, anti-conscription, anti-apartheid, anti-South African rugby tour, anti-President Johnson visit, and other causes, including, to a shameful far lesser extent, aboriginal land rights, filled the streets and the lone 1965 Freedom Ride bus (Curthoys 2002).

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, Lacan, Derrida 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)

But even this whimper has died out as universities become 'preparation of jobs' factories; staff become more and more casualised; and full-time students become more and more part-time students on account of having to work to pay fees.

The exception to 'no interest' in university philosophy is the current Australian 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 and get so far through the cash-starved university system so to be accepted by three universities, and yet the history of science is 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? And of

course, once born, modern science belongs to everyone; it is a human patrimony, not a Western one.

Anderson, in his teaching, directly influenced a huge cohort of Australian philosophers including Alan Stout, John Passmore, John Mackie, Tom Rose, David Stove, and David Armstrong. Some of these had moved on by the time I arrived at the university in 1965, and pure ‘Andersonianism’ had ebbed though its spirit survived. Nevertheless David Armstrong (appointed Head in 1964), Charlie Martin, David Stove, Graham Nerlich, Tom Rose, Wallis Suchting, Keith Campbell, John Burnheim, George Molnar and others were on staff and ensured the Sydney’s department’s place in the Australian philosophical firmament.

Sydney staff were committed, broadly, to the Andersonian tradition of realism, rationality, science, and free inquiry (Anderson 1962). Neither Oxford analytic philosophy nor Cambridge Wittgensteinian philosophy had much traction in the department. Armstrong had been to Oxford in the 1950s and was distinctly under-impressed by Strawson and Grice and the ‘philosophical’ programme they were promoting. There were, of course, Oxford and Cambridge visiting philosophers and Sydney staff used take sabbaticals at both venerable institutions. One visitor was, from memory, Philippa Foot whose Ethics-course text was R.M. Hare’s *The Language of Morals* (Hare 1952) in which he articulated a *Prescriptivist* theory of ethics that uneasily combined Kantian universality with Millian utilitarianism or consequentialism. I should have a better memory of the course because in the essay I obtained a ‘HD+’, a result never equaled in any subsequent university course. A worry to think that one peaked intellectually at age seventeen!

When beginning first year philosophy in 1966, I borrowed a Waverley school friend’s philosophy lecture notes. He was the soon-to-be famous Australian anarchist and Vietnam War draft-dodger Michael Matteson. The one class at Waverley College produced both the future Head of the Army (Peter Cosgrove) and the country’s ‘most wanted’ resister. On one page of his notes, Matteson had drawn a caricature of Wallis Suchting, and had written 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). He routinely set and went through ‘informal logic’ exercises. For any slab of philosophical or popular argument, he set the simple task of identifying and lettering (in propositional form) premises, conclusions, intermediate premises; drawing a structure diagram; and then working out which ones it is necessary, sufficient, or necessary and sufficient to affirm or deny in order to accept or to reject, the argument’s conclusion. These exercises made an immediate and lasting impression on me. They were followed by working through the bulk of Irving Copi’s international best-selling *Symbolic Logic* text (Copi 1965).

All of this in first year philosophy for large classes of teenagers. Critical thinking is not the same as logical thinking; but you cannot have the first without the second. It was much later that the importance of critical thinking in education (Hager 1991, McPeck 1981, Norris 1992, Siegel 1989), and more specifically argument skills in science teaching and learning, was duly recognized (Adúriz-Bravo 2014, Duschl & Osborne 2002, Erduran, S. & Jiménez-Aleixandre 2008, Siegel 1995).

Too often critical thinking is promoted in education without attention to developing the basic skills of informal logic, and at least the rudiments of formal logic. In education, the word ‘critical’ has become a verbal confetti; it is simply scattered everywhere. Published papers begin with ‘This will be a critical examination/exposition/appraisal/account of ...’ As if a published paper would be uncritical. Using the word is frequently a substitute for being critical.

A logic course, especially informal logic, disciplines reasoning: it does something to 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 published a critique of the common argumentative thread found in such philosophical luminaries of the time as Popper, Lakatos, Kuhn and Feyerabend – *Popper and After: Four Modern Irrationalists* (1982). He claimed:

These authors’ philosophy of science is in substance irrationalist. 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)

Later, to my complete surprise and dismay, I would learn that their view was a commonly lauded and rewarded view in the science education research community. The lead co-author of the following is, apparently, the most cited researcher in science education, and has been awarded the prestigious National Association for Research in Science Teaching (NARST) ‘best researcher’ prize:

. Knowledge ‘survives’ when it is viable in the experiential world, but it is generally ‘abandoned’ when individuals recognize that it cannot describe their experience. Thus, in constructivism, the classical notion of truth is replaced by the notion of viability. This notion implies that there may exist alternative constructions, none of which can ever claim truth for itself. (Roth & Roychoudhury 1994, pp.6-7).

Stove addressed students by their family names. So as an 18-year-old I was ‘Mr. Matthews’. He was an atheist who had opined that ‘Catholicism was Stalinism mixed with holy water’, 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 of Cambridge: ‘Mister Alexander, I would like you to meet Mister Matthews. You have beliefs in common.’ Subsequently, Alexander contributed to a number of joint Newman Society / Student Christian Movement conferences.

In 1994, rather than continue a painful and losing battle with oesophageal cancer, Stove at age 67 took his life among the trees he had long-ago planted on his small rural holding outside of Sydney.

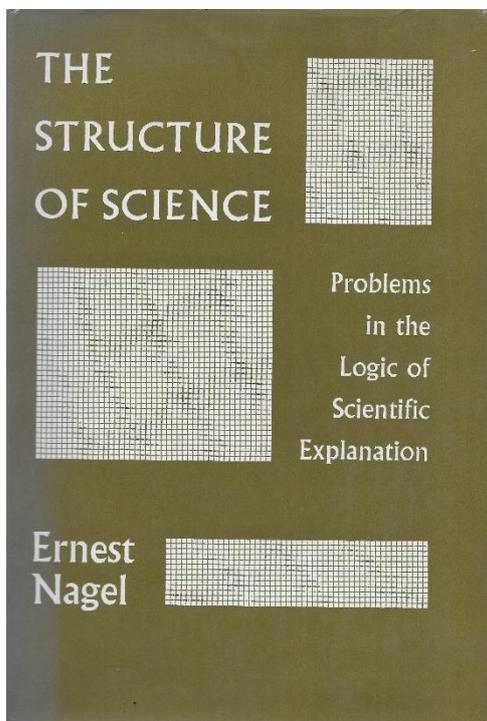
Jumping ahead in this story, it is worth noting that at my last faculty meeting at the University of New South Wales in mid-2008, the UNSW Faculty of Arts agreed with its School of Philosophy and voted to make Logic optional for majors in philosophy. I pointed out that at Sydney University in 1965 one 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. Unsurprisingly, even fourth-year honours theses in the Faculty show little understanding of a structured argument, let alone a valid argument.

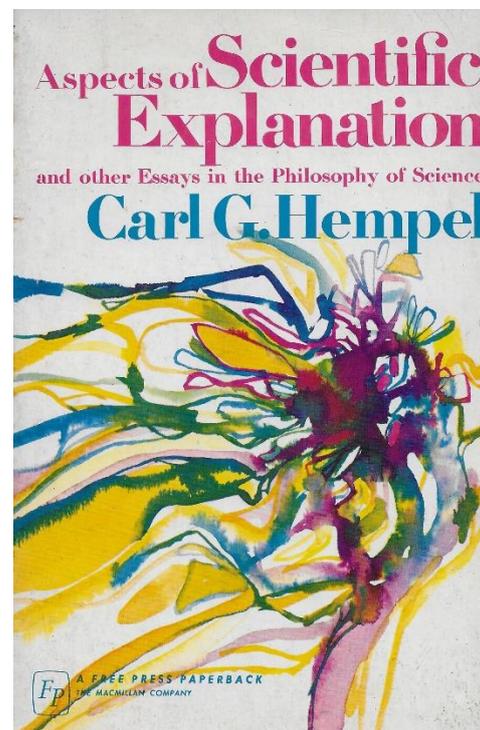
In the context of this story, it is worth relating that David Stove’s journalist son, [Robert Stove](#), after his completely atheist upbringing, converted as an adult to Catholicism writing a detailed account, including:

It won't have escaped readers' notice that the time I formally entered the Catholic Church was the very period at which the gutter-press' crusade against "pedophile priests" entered its first vociferous phase. Some may wonder how this crusade affected me. My answer is that it hardly affected me at all (though the scandals of 2010, to a certain extent, did). I never deluded myself into supposing that priests were free from Original Sin. (ibid.)

The second-year philosophy of science course was straight Logical Empiricism with readings from Nagel (Nagel 1961), Hempel (Hempel 1965) and other classics. Tutorial exercises involved, in part, the writing of Ramsey or Carnap reduction sentences. The idea was to get from non-empirical, theoretical statements ‘There is a force of 5 dynes on the body’ to empirical, testable statements without too much loss of meaning.



Ernest Nagel *Structure of Science* (1961)



Carl Hempel *Scientific Explanation* (1965)

I do not remember whether the crucial idea of the necessity of *idealisation* in science was discussed, perhaps it was. But this would have rendered the very idea of exhaustive reduction sentences problematic, if not impossible. Idealisation means ‘abstracting from or disregarding impediments and counter-vailing factors’ (Appiah 2017). Much later I would

appreciate that this was the methodological heart of the Galilean-Newtonian revolution in science.

Logical Empiricism's programme of explicating and understanding key scientific concepts such as law, theory, observation, reduction, explanation and so on, and its concern with clear and unambiguous writing left a lasting impression. 'Write clearly' was the Sydney philosophy department's mantra.

The logical empiricists defended the following theses about the nature of science:

1. Science seeks the truth; it endeavours to find out how the physical, social and personal worlds work and are constituted.
2. Ultimately empirical testing and evidence is determinate for scientific truth claims.
3. Statements that, in principle, were non-empirical (theological and traditional metaphysical) were nevertheless meaningful, but were neither true nor false.
4. Science is unified, although there are different *methods* employed across natural sciences and across social sciences, there is a unified family of *methodology* involved in all science.
5. The methodology of science is rational.
6. Science is universal; there are no 'local' sciences; the truths of science are equally true across cultures.
7. Science methodologically assumes a naturalistic (but not materialist) world view.
8. A naturalistic world view is the only true one; supernatural, transcendental, idealist, and orthodox religious world views are mistaken; the world and its causal processes are not the way they describe.
9. Science is part of the Enlightenment tradition; this tradition has had positive benefit to the world and needs to be defended and extended.

At the time, and subsequently with suitable refinements, I concurred with all of these theses.

Now reading the post-modern avalanche of unintelligible sentences and excruciating verbiage in Education, the era of logical positivism seems positively luminous. I 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* (Armstrong 1978). Philosophy of Religion was taught by Graeme de Graaf, 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.

Sydney University Newman Society (1965-1969)

I joined the Newman Society in my first 'Orientation' 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 John Henry Newman's (1801-1890) *The Idea of a University* (Newman 1852/1959) was commonly read; worse authors could have been. 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 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. In his *Apologia* he wrote:

From the age of fifteen, dogma has been the fundamental principle of my religion: I know no other religion; I cannot enter into the idea of any other sort of religion; religion, as a mere sentiment, is to me a dream and a mockery. As well can there be filial love without the fact of a father, as devotion without the fact of a Supreme Being. What I held in 1816, I held in 1833, and I hold in 1864. Please God, I shall hold it to the end ... (Newman 1864/1959, p.)

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.

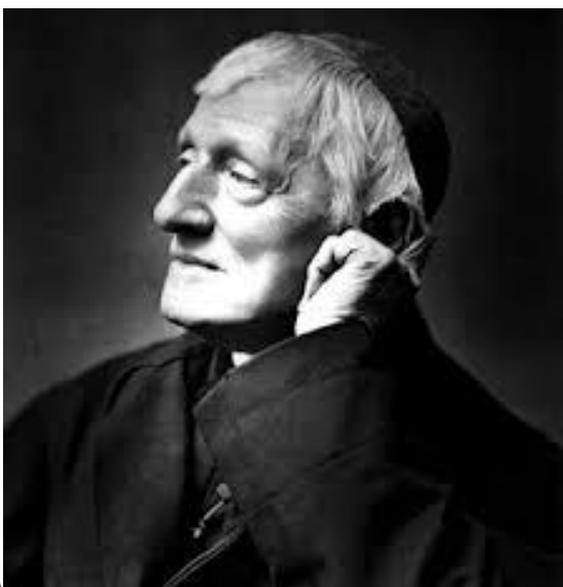
In an address to English Roman Catholics, Newman wrote:

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)

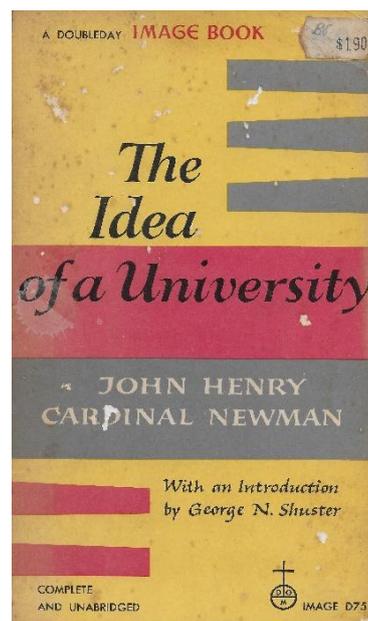
Such a collegial view provided an intellectual network, or at least theoretically so, for the Newman Society where members were undergraduate and graduate students in diverse disciplines. There was however recognition that we had something in common; we should be able to learn from each other and benefit 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 (1889-1943) 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 lecture titles from a notebook I had at the 1967 National Newman Society Conference at Melbourne University 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'. The bulk of participants were, like me, teenagers. But we saw ourselves as adults.

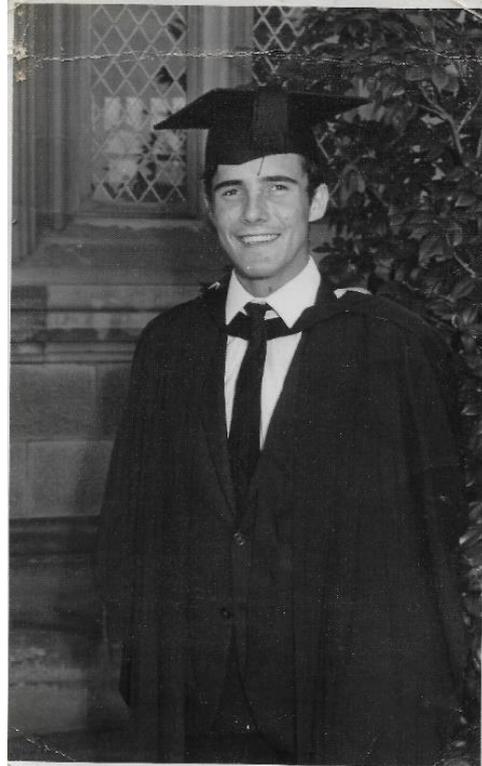
A paper given by one student who had been studying philosophy at [Villanova University](#) was succinctly titled: 'Sex and the Sacraments'. It drew attention and an audience. He was in the University of Sydney honours stream for both English and Philosophy. Eventually he gave up the latter saying that 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, naïvely I tried to arrange for the newly appointed Catholic Chaplain, Fr. Frank Mecham, who had been teaching Thomism in the Springwood and Manly seminaries, to engage with the Sydney philosophers, but this came to naught. Neither side wanted the engagement.

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



Science Graduation (1967)

The circumstance is well captured in the autobiography of Chris Geraghty, a former priest and Sydney District Court judge. He went into the Springwood junior seminary at age 12 where he completed high school then passed into four years priestly education before moving in 1958 to the senior seminary, St Patrick's at Manly, for another four years of philosophy and theology. To outsiders, and certainly to Catholic students and adults, this constituted a formidable education regime; good education was a proud mark of Catholic clergy. To many insiders, Geraghty being one, it was not so formidable, at least at Manly. He describes Frank Mecham's seminary philosophy classes:

The subject was cosmology. It was a branch of some pseudo-scholastic philosophical system which by Vatican decree Leo XIII had made compulsory in Roman seminaries. ... What I was learning ... was how to become subservient, how to suppress question, how to respect and reverence my superiors. On reflection, there was little real learning, no illumination of minds, no mutual search for meaning, no path of discovery or sparkling insightful flashes.

The accumulated scholastic wisdom of the Middle Ages, which had been re-interpreted and mangled in the nineteenth century, was processed, distilled, prepacked, reduced to soft baby-food, spooned down my throat and reproduced for examinations. (Geraghty 2003, p.41)

Depressingly Geraghty proceeds:

With unworldly seriousness I laboured to translate the Latin pages. In retrospect, our course was not even an accurate, scholarly, historical presentation of medieval thought. This pseudo-philosophical system was being passed by the institution from textbook to notebook, without travelling through the brain. (ibid.)

This was an abomination; the neglect of enormous intellectual opportunity. One writer on theological studies of the time says: ‘There seems no gainsaying that the decade 1954-1964 reveals itself to have been decisive for theology, particularly for Catholic theology’ (O’Brien 1965, p. i). Manly, or a good many on staff there, were asleep.

Geraghty then articulates a fundamental issue not just for Catholicism, but for Christianity, that rises well above the adequacy or otherwise of philosophy teaching at Manly:

These categories and definitions would later be needed to provide a ‘rational’ system of thought to ‘explain’ the mysteries of the Incarnation, the Trinity, the Eucharist. A foundation was being laid on which to base my theological world. (ibid.)

The Catholic Church, through the seminaries, sought to make faith intelligible; there was content that had to be believed; faith was not just a feeling, emotion or ‘outlook’; the creeds were not just a jumble of words. For the past seven hundred years, the Catholic Church has decreed that Scholastic philosophy and its categories provided the most adequate way of making the faith intelligible. This was Frank Mecham’s task. If Thomism is rejected, then either another system takes its place, or it is admitted that faith need not be made intelligible.

I knew none of this ‘background’ when I tried to have a meeting of minds between the Sydney philosophers and Frank Mecham, the newly appointed university chaplain.

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 Toongabbie 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 travesty of philosophy teaching in seminaries was not just a Sydney problem, it was an international one. Anthony Kenny, the distinguished English Thomist philosopher, president of the British Academy, knight of the realm, excommunicated priest, and former Catholic now agnostic, describes, in his autobiography *The Path from Rome* (Kenny 1985) the miserable philosophy training at the English College in Rome. Those in the doctoral programme had to have their supervisor’s signed permission to borrow David Hume’s *On Religion* from the college library! At Sydney it was a first-year philosophy text bought and read freely by teenagers.

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. It had been a rewarding and educative three years; an exemplar of good university education.

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

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

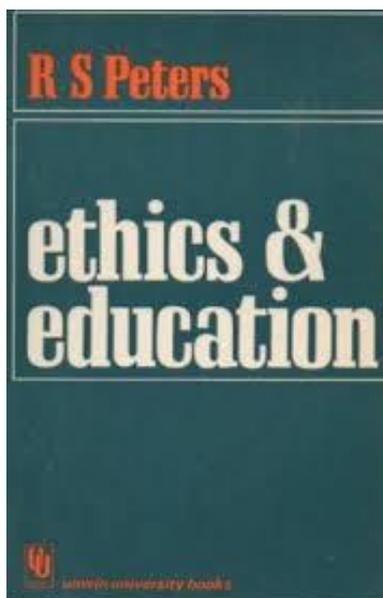
Along with science methods, physical education, and classroom practice, I did a course in Philosophy of Education taught by [Anna Hogg](#) (1910-2011), a Scottish Christian academic who in 1932 was the first woman to be awarded the University Medal in Philosophy at Sydney University. In 1968 she had 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.



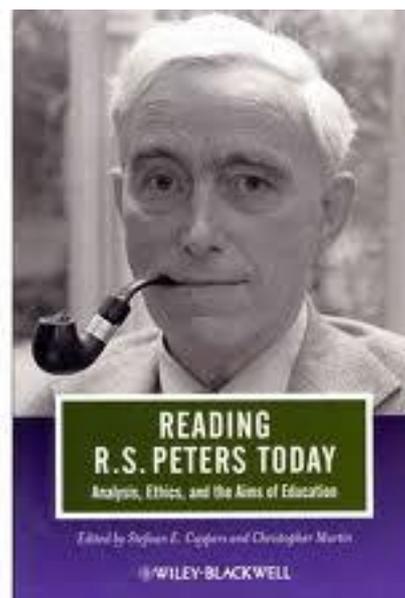
Anna Hogg

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

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 that person. 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 being educated is some breadth of knowledge; and built into an educational regime, is the provision of such breadth.

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 is the goal of *Bildung*. Some teaching arrangements and processes warrant identification as *Bildung*, whilst others fall short. Other arrangements – systematic indoctrination, for instance - not just fall short, but thwart the realisation of *Bildung*.

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 one. 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 good reasons for beliefs, 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).

The years of Newman Society activity, and reading Newman’s *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.

Charles Silberman writing fifty years ago on the then crisis in American education well stated the rationale of Anna Hogg’s course, and more generally the foundational rationale of teacher education programmes:

The central task of teacher education, therefore, is to provide teachers with a sense of purpose, or, if you will, with a philosophy of education. This means developing teachers' ability and desire to think seriously, deeply, and continuously about the purposes and consequences of what they do - about the ways in which their curriculum and teaching methods, classroom and school organization, testing and grading procedures, affect purpose and are affected by it. (Silberman 1970, p.472)

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 school and university activities and pedagogy.

Concerning science teaching, Peters 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' 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, Adelman 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. It was this that had to be elaborated and defended, simply assuming it was philosophically irresponsible.

Liberal or General Education was 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 firstly, teachers, then students, come to have knowledge or appreciation of the history and philosophy of the different domains they teach and are learning; 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 with a variety of different, but aligned, political, religious, cultural and educational interests. The liberal tradition had a clear core but this became less clear as it diffused in society and culture. The tradition was not 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. But, so as to speak, the devil is in the detail.

John Dewey in his justly famous 1916 *Democracy and Education* stated a fundamental of the Western Rationalist Tradition:

Our predilection for premature acceptance and assertion, our aversion to suspended judgment, are signs that we tend naturally to cut short the process of testing. We are satisfied with superficial and immediate short-visioned applications. ... Science represents the safeguard of the race against these natural propensities and the evils which flow from them. ... It is artificial (an acquired art), not spontaneous; learned, not native. To this fact is due the unique, the invaluable place of science in education. (Dewey 1916/1966, p.189)

Peters, and proponents of Liberal Education, assumed, usually without explicit argument, the principles of this 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 not have been in the foreground in typical London Institute Analytic Philosophy discussion, but clearly they underwrote all APE debate about teaching, curriculum, discipline structure, assessment and so on. They were backroom or silent partners in the APE programme. If you are not a realist about historical events – for instance, the 1968 assassination of Martin Luther King or the 1939 invasion of Poland – why are they in the curriculum? If different accounts, or hypotheses, about these events cannot be evaluated against evidence, why ask students to do so? Elaboration and defence of the principles of liberal education, along with educational implications to be drawn from them, will be returned to later in this book.

A surprising feature of formal philosophy of education has been its relative neglect of science education, and the specific philosophical considerations that arise in the teaching of science. The vast corpus of Analytic Philosophy of Education which dominated the professional field in the final decades of the last century, including my 1968 DipEd year, is almost devoid of questions about science education; and little, if any, analysis is informed by the history and philosophy of science. There is only minimal mention of science education or HPS in the influential books of Richard Peters that largely defined the field (Peters 1966, 1967, 1973) or in collections such as the major 3-volume anthology *Education and the Development of Reason* (Dearden, Hirst & Peters 1972) that was the flag-ship of analytic philosophy of education.

The neglect at the time of science and HPS is the more puzzling as across the world, science curricula were being overhauled in the post-Sputnik era, and at the same time HPS had its own ‘Sputnik-moment’ with the publication of Kuhn’s *The Structure of Scientific Revolutions* (Kuhn 1970) and the consequent tsunami of scholarly studies that washed over *all* university faculties. It could have been expected that formal philosophy of education would have engaged with both science curricula and the scholarly HPS enterprises. But with some exceptions this did not happen.

One exception is Robert Ennis who, 40 years ago, wrote a comprehensive review of the minimal literature on philosophy of science and science teaching. His review listed six questions that science teachers constantly encounter in their classrooms and staffrooms, questions that the deliberations and researches of philosophers and historians of science could illuminate. These questions were:

- * What characterizes the scientific method?
- * What constitutes critical thinking about empirical statements?
- * What is the structure of scientific disciplines?
- * What is a scientific explanation?
- * What role do value judgments play in the work of scientists?
- * What constitute good tests of scientific understanding?

These questions are of perennial concern to science teachers, and science teacher education programs. But Ennis made the melancholic observation that:

With some exceptions philosophers of science have not shown much explicit interest in the problems of science education. (Ennis 1979, p.138).

At the time, philosophers of education showed not much more interest.

Peter Nidditch, the Hume scholar, did contribute the final article titled ‘Philosophy of Education and the Place of Science in the Curriculum’ to the 1973 anthology *New Essays in the Philosophy of Education* (Nidditch 1973). David Stenhouse published a book on philosophy of education and science education (Stenhouse 1985). Denis Phillips, a former Australian biology teacher, later president of the US Philosophy of Education Society (PES), published a number of valuable pieces in the field (Phillips 1981, 1985). Harvey Siegel, another former PES president and student of Israel Scheffler also published important articles on issues in science education (Siegel 1978, 1979, 1989, 1993). Israel Scheffler, professor of philosophy and of education at Harvard, was the standout philosopher of the time to pay serious attention to issues in science education (Scheffler 1970, 1973, 1982).

Twenty years after my DipEd, in the late 1980s, the disciplines of philosophy of education, science education and HPS would be brought together to produce an incredibly rich vein of research and informed teaching (Schulz 2014a,b). It was my good fortune to play a role in that flowering of research and pedagogy that became known as ‘History, Philosophy and Science Teaching’ research (HPST).

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 so continuing to study, whilst teaching, was a real and simple option. And one that I took up.

Full of Peters-inspired ideas of liberal education, I put enormous energy into both teaching and broader school life. 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 just competent 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 fragmented, and 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 Jerome Bruner, in his *The Process of Education* (Bruner 1960/1977) was advocating, indeed almost the reverse. Bruner was not part of our DipEd studies.

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 'thought-to-be' spiral curriculum.



Dulwich High School

Bruner brought the 'cognitive turn' that was taking place in psychology to education discussion and research. He was in large part responsible for initiating the cognitive turn with his *The Study of Thinking* (Bruner 1956). At the time psychology had been taken over by behaviorism, and his own Harvard Department was 'locked in a standoff between Skinner's operant conditioning and Steven's psychophysics' (Bruner 1983, p.122).

Bruner's *The Process of Education* was a landmark study in educational theory. It emerged out of a ten-day meeting at Woods Hole on Cape Cod, Massachusetts, convened by the US National Academy of Sciences to address the problems of science education and the promotion of scientific literacy in society. Some 35 major scientists, psychologists, mathematicians and educators participated with a goal of discerning and laying out:

... the fundamental processes involved in imparting to young students a sense of the substance and method of science' (Bruner 1960/1977, p.xvii).

The meeting was one of countless many at all levels initiated by the US government in response to the [Sputnik Crisis](#) occasioned by the Soviet's launch of its first earth-circling satellite in October 1957. Dianne Ravitch, a historian of education, has commented:

The Soviet launch . . . promptly ended the debate that had raged for several years about the quality of American education. Those who had argued since the late 1940s that American schools were not rigorous enough and that life adjustment education had cheapened intellectual values felt vindicated, and as one historian later wrote, 'a shocked and humbled nation embarked on a bitter orgy of pedagogical soul-searching'. (DeBoer 1991, p.146)

Bruner was charged with writing the meeting's report. Concerning the 'Spiral Curriculum' he writes:

If one respects the ways of thought of the growing child, if one is courteous enough to translate material into his logical forms and challenging enough to tempt him to advance, then

it is possible to interduce him at an early age to the ideas and styles that in later life make an educated man. (Bruner 1960/1977, p.52)

He proceeds with a restatement of the foundation of liberal education:

A curriculum ought to be built around the great issues, principles, and values that a society deems worthy of the continual concern of its members. (Bruner 1960/1977, p.52)

In a later work, *The Culture of Education*, Bruner wrote:

A long time ago, I proposed the concept of a 'spiral curriculum', the idea that in teaching a subject you begin with an 'intuitive' account that is well within the reach of a student, then circle back later to a more formal or highly structured account, until with how ever many more recyclings are necessary, the learner has mastered the topic or subject in its full generative power. (Bruner 1996, p.119)

All of this is a long way from the programme enacted at Dulwich High School in 1969. It confirms the educational truism that there is a lot of slippage between the generals of curriculum theory and writing, and the sergeants of programme writing, and privates of classroom teaching. Important things get lost, misunderstood, and confused on the way down. But conversely, not every deviation on the ground should be seen as a loss; locally it might be a gain. Teachers legitimately need authority to bend materials and methodologies to local conditions.

The NSF supported the explosion of 'alphabet curricula' in the late 1950s and early 1960s. The first curriculum to be widely used was that of the MIT's Physical Sciences Study Committee (PSSC). Then followed the Chemical Bond Approach (CBA), Biological Sciences Curriculum Study (BSCS), Chemical Education Materials (CHEMS), Earth Science Curriculum Project (ESCP), Introductory Physical Science (IPS), Project Physics and a host of others. By 1975 the NSF supported twenty-eight science curriculum reform projects. During the boom period, millions of students studied the NSF supported curricula: PSSC (one million in 1956-1960), CHEMS (one million in 1959-1963), BSCS (ten million in 1959 - 1990), IPS (one million in 1963-1972), ESS (one million in 1961-1971), SAPA (one million in 1963-1974). These constituted the major league of curricula. In 1976-1977 it was estimated that nineteen million students were using the new curriculum materials, this number represented forty-three per cent of the school population (Andersen 1969).

It is useful to note that no historians or philosophers of science were invited to participate in the influential 1959 Woods Hole conference. There were 35 imminent specialists and education-related scholars, but no philosophers of education, philosophers of science or historians of science. Yet the conference was focused on understanding and promoting the 'substance and method of science'. Surely something that historian and philosophers could have contributed to.

The ramifications of this 'constitutional' separation of science education from HPS is the story line of this autobiography.

Most of the NSF-funded projects neglected practical and technological applications of science. One review said:

There is little or nothing of STS [Science-Technology-Society] in currently available textbooks. Our group reviewed a number of widely used textbooks . . . and found virtually no references to technology in general, or to our eight specific areas of concern. In fact, we found fewer references to technology than in textbooks of twenty years ago. The books have become more theoretical, more abstract with fewer practical applications. They appear to have evolved in a context where science education is considered the domain of an 'elite' group of students. (Piel 1981, p.106)

In the absence of historians and philosophers, it is hardly surprising that 'street-corner' views about the substance and method of science would inform the new curricula. This can be seen in representative documents such as the 1966 *Education and the Spirit of Science*, published by the Education Policies Commission. There it is stated that in science: 'generalizations are induced from discrete bits of information gathered through observation conducted as accurately as the circumstances permit', and that science seeks for 'verification' of its claims (Education Policies Commission 1966, p.18). Just a little bit of HPS-input could have corrected this glaring mistake: science does not proceed by induction, nor does it seek to verify its claims, more modestly it seeks to confirm them.

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. The former explained what *was* the case, the latter pointed to what *should* be the case.

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* on the impact of Teacher Expectancy Effects had been published the previous year (Rosenthal & Jacobson 1968) but it did not figure in our DipEd course of readings. They described their research as:

.... 20 percent of the children in a certain elementary school were reported to their teachers as showing unusual potential for intellectual growth. The names of these 20 percent of the children were drawn by means of a table of random numbers, which is to say that the names were drawn out of a hat. Eight months later these unusual or 'magic' children showed significantly greater gains in IQ than did the remaining children who had not been singled out for the teachers' attention. The change in the teachers' expectations regarding the intellectual performance of these allegedly 'special' children had led to an actual change in the intellectual performance of the randomly selected children. (Rosenthal & Jacobson 1968, p.viii)

Pygmalion was a study on expectancy effects on IQ scores, and had been criticised by methodologists, but there was no gainsaying the impact of expectancy effects on more general student learning. 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. It took very special, committed teachers to embrace the GA class and promote their learning.

During one Practice Teaching session when a university student was at the school, and had been allocated a GA class, the student collected his books and aids together in the staff common room at the end of lunch to go to the class and the class teacher, only half-jokingly, told him: ‘don’t bother with all that, just take a watering can’.

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 HSC subject, called ‘General Studies’. This was a wonderful optional subject that ranged over philosophy, social and topical issues, cultural developments and criticism, and so on. It could have been a ‘capstone’ HSC course. In 1969, 26,500 students in NSW sat for the exam, perhaps a quarter or less of the cohort. 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 in the Blue Mountains west of Sydney and Araluen Valley south of Sydney. To these camps various Newman Society and other friends would come and talk about diverse subjects – the essays of George Orwell, Eric Fromm’s writings, the Enlightenment, Anarchism, the Vietnam War, lyrics of Cat Stevens, *Dolly* magazine, 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. 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; I had caught the education bug.

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 subject. 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 post-war 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, with Israel Scheffler’s programme at Harvard, one of two powerhouses in international philosophy of education. The London Institute provided well-trained philosophy of education teachers to

universities and teachers colleges throughout the far-flung British Commonwealth – Australia, New Zealand, Hong Kong, Canada, Fiji – and many other destinations.

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 Lakowski, 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 by 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. The general sense was that when Suchting made comment on the arguments of any such writers, then you should pay attention; he did not comment idly or in ignorance. We proto-philosophers thought that we were 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. In addition to John Dewey, Alfred North Whitehead, Jacques Maritain and other significant moderns, the examples of Israel Scheffler at Harvard, Richard Peters in London, Paul Hirst at Cambridge, Walter Feinberg in Illinois, 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. John Kleinig's *Philosophical Issues in Education* (Kleinig 1982) which came out of his own lecture course was a sterling local model of the genre. So choosing to major in philosophy for my BA was straightforward, but a second major was needed, and doing psychology was 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 of Behaviourism in Australia, and the Sydney department had sailed in on this Pavlovian-Skinnerian tide for some decades.

The Professor, Richard (Dick) Champion (1925-1999), 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. Champion had no interest in philosophy, but would have smiled if he had read the Australian philosopher Michael Scriven, himself an ardent critic of behaviourism (Scriven 1956), who wrote:

In point of fact, the concept of 'being more philosophically confused than humanistic psychology', for example, not only lacks instances but is probably beyond the reach of human comprehension. (Scriven 1976, p.413)

At Sydney, humanistic psychology and the like were side-shows 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 matter of opinion; they could not aspire to knowledge. Students in the honours stream understood that if you are serious, or at least serious about a good result, you do not go down those alternative routes.

The weighty texts were *Theories of Learning* (Hilgard & Bower 1966) and *Conditioning and Learning* (Kimble 1961). There was little, if any, distinction between learning and conditioning. As much as Kimble admits is:

... learning is not, as is so often said, a change in behavior. Rather it is a change in behavior *potentiality*. ...such reasoning leads naturally to a distinction between *learning* and *performance* which has figured in most of the influential systematic accounts of learning. (Kimble 1961, pp.4-5)

Rex Porcheron, another senior learning theorist in the Sydney department, thought that the term ‘learning’ was meaningless.

Sydney, of course, was not the Lone Ranger in its championing of behaviourism; it was the disciplinary norm in psychology through the 1950s to at least the 1990s; and it flowed over to education, clinical psychology, management, and numerous other fields. A cottage industry on ‘behavioural objectives’ was launched. The 72nd Yearbook of the US National Society for the Study of Education was titled *Behavior Modification in Education* (Thoresen 1973). Therein is a chapter on ‘Behavior Modification in Teacher Education’ which states that:

Teacher education programs may be conceptualized as behavior modification systems designed to modify complex behavioral repertoires which are adaptable to a variety of learning problems. (McDonald 1973, p.41)

And the chapter on ‘The Applications of Behavior Principles in Typical Classrooms’ concludes with the advice:

Various conditioned punishers such as threats, reprimands, and ‘dont’s’ may be effective if they are now and then backed up with an effective punisher. In classrooms, however, these procedures are generally found not to work because the teacher has difficulty providing the backup punishments when required. ... In general, the effective use of positive reinforcers usually makes it unnecessary to use punishment procedures. (Becker 1973, p.102)

In 1978 when visiting the University of Cincinnati I was told by Stanley Milgram’s – famous for his ‘Obedience to Authority’ studies – brother, an education professor, that ten years earlier, successful completion of an animal conditioning study was a requirement for progression in the education doctoral programme. Just as the philosophy doctoral programme required a foreign language proficiency, the education programme required animal conditioning proficiency. For Milgram’s brother, it was pigeon training.

My psychology honours degree involved an additional fourth year of study. As well as an honours seminar both a practical (empirical) and a theoretical thesis was required.

The empirical thesis was titled *An Examination of R.C. Bolles’ Safety-Signal Account of Bar Press Avoidance Learning in Rats*. As I was still science teaching at Dulwich High, this involved months and months of late-night, after-school, rat running in the psychology department’s animal laboratory. My idea was to construct a situation where the rat, by pressing the appropriate bar at the appropriate time, did not get shocked, but where the explanation could not be given without recourse to teleological or intentional constructs – these being *verboden* for behaviourism, and rarely uttered in the corridors of Sydney psychology.

Indeed, to describe the behaviour as ‘avoidance’ was already seen by Dick Champion as sliding down a dangerous mentalistic, teleological slope. For me, the thesis was to be a critique of behaviourism from within the cage, so as to speak.

Avoidance behaviour is as a major problem for behaviourist, stimulus-response (S-R) learning theory. A conditioned stimulus (CS, light) is paired with an unconditioned stimulus (UCS, electric shock) that itself produces an unconditioned response (UCR pain). If the CS is turned off by the subject, a conditioned response (CR), then the UCS does not occur, the

subject avoids pain. But how does a non-event cause the CR? How does something that does not happen, cause something to happen?

The initial behaviourist explanation was that the pain response was attached (conditioned) to the CS. So, there was an event causing the response, namely the pain attached now to the light. This was the supposed 'two-factor' theory of avoidance. The avoidance behaviour (turning the light off) was not really avoidance, but a learnt reaction to a now 'painful' stimulus. This sort of sounded OK. For some people digestion of a particular food might bring on nausea, and afterwards even the sight of food, without eating it, can bring on nausea. So the behaviourist, S-R, caravan could keep moving on through psychology, education, and medical departments.

But two-factor theory did not quite stack up: avoidance continued despite the CS no longer eliciting its own fear response. The subject did not fear the CS in the way it feared the UCS (shock). In a later work, the philosophers Barry Schwartz and Hugh Lacey detailed the problems avoidance behaviour posed for behaviourism (Schwartz & Lacey 1982, chap.8).

The thesis had 313 references with most being photocopied and filed in boxes which, like my philosophy photostats, 50 years later are only now being cleared out. I mention this because the scholarly pattern then was to absorb yourself in what has previously been written in the field and make some attempt to extend it. Fifty years ago, immersing yourself in the literature meant literally that - going to library shelves and stacks and reading and/or photocopying scores, if not hundreds, of articles. Very different from reviewing the literature on a phone while having coffee in a café.

Indicative of changing academic fashions, the Sydney psychology department now has a chair in animal cognition. For Champion, something unimaginable.

My theoretical thesis was a 200-page study of *Causality, Intentions and the Explanation of Behaviour*. Its core was Hume's account of causation, and modern critiques of it, along with accounts of dispositional constructs. I argued against the application of Hempel's hypothetico-deductive model to the explanation of human action, and argued in favour of local, idiosyncratic intentions, but concluded that 'we have to leave open the quest for historic and social factors being the determiners of *why* people have the intentions they have'. The thesis had hundreds of references, most laboriously photocopied and filed.

The thesis's conclusion was based on the distinction between proximal and distal causation, with psychologists concerning themselves with the former and sociologists and historians with the latter. There were hundreds of references cited, and boxes and boxes of photocopied articles collected, which only now are being cleared from my study.

Among other issues, the thesis criticised the behaviourist conceptualisation, or paradigm, of teaching and learning; and did so by reference to arguments advanced by philosophers of education that I had read in my MEd studies. I supported Israel Scheffler's view that:

Teaching ...is clearly not, as the behaviourists would have it, a matter of the teacher's shaping the student's behaviour or of controlling his mind. It is a matter of passing on those traditions of principled thought and action which define the rational life for teacher as well as pupil. (Scheffler 1967, p.133)

And Richard Peters' elaboration:

Teaching is a complex activity which unites together processes, such as instructing and training by the overall intention of getting pupils not only to acquire knowledge, skills and modes of conduct, but to acquire them in a manner which involves understanding and evaluation of the rationale underlying them. (Peters 1966, p.261)

Conversely, the behaviourist tradition maintained that learning had nothing to do with thinking; or more accurately, the science of learning could not include mentalistic terms; behaviourism meant just behaviour was studied, and behaviour was explained only by public, visible processes and events. Learnt behaviour was a particular response to a stimulus, the 'Stimulus-Response' (S-R) theory of learning. According to the basic Sydney text:

Learning is the process by which an activity originates or is changed through reacting to an encountered situation, provided that the characteristics of the change in activity cannot be explained on the basis of native response tendencies, maturation, or temporary states of the organism (e.g. fatigue, drugs, etc.). (Hilgard & Bower 1966, p.2)

Philosophers would pick at such definitions and ask, for instance, can activity be differentiated from behaviour without recourse to mentalist categories? Clearly the one behaviour, say throwing a stone at someone, can constitute a range of different activities: wanting to hurt them, warning them of some danger, showing off your throwing accuracy to some else, not realising that someone is within range, and so on.

One such philosopher, Godfrey Vesey, concluded an article on 'Conditioning and Learning':

... if by 'conditioning' is meant no more than the 'stamping in' of a response then at least those abilities which do involve 'knowledge that' cannot be acquired by anyone simply by a process of being conditioned. Whether what I earlier called 'purely bodily learning' can be explained in terms of conditioning is another matter. (Vesey 1967, p.71)

In contrast to the Sydney department's 'skeletal' account of learning, philosophers had a more full-bodied account. For Michael Oakeshott:

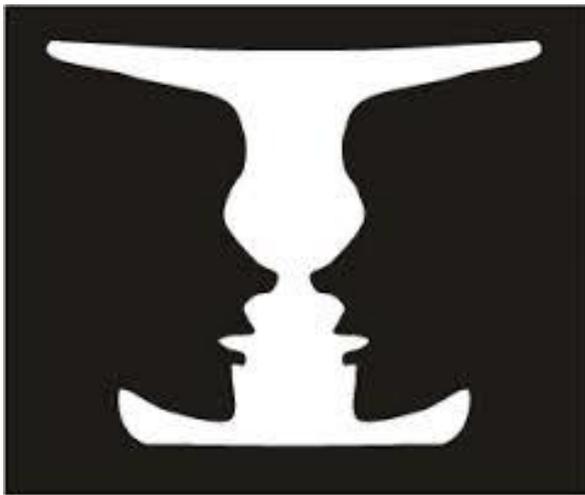
Learning is the comprehensive activity in which we come to know ourselves and the world around us. It is a paradoxical activity: it is doing and submitting at the same time. And its achievements range from merely being aware, to what may be called understanding and being able to explain. (Oakeshott 1967, p.156)

What was clear to me in studying philosophy and psychology in parallel was how diminished psychology was by its failure to engage with philosophy. In Sydney Psychology, apart from one or two individuals (John Maze and Terry McMullin), no philosophical input entered into the subjects taught. For instance, it 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 they 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, none of which were considered by the psychologists.

The same applies to the single course on cognitive psychology that, perhaps begrudgingly was allowed to be taught. It 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, every day they are so committed by millions. Amazingly, entire sacred scriptures can be committed to memory and this is taken as a signifier of holiness. 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.

I completed the psychology honours programme in 1973 and was awarded Second Class honours, Division One – a ‘two one’ in the vocabulary of the time.

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 philosophy 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, called the 'Prince of Translators' by the publisher, 'could order 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 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* (Suchting 1983) and *Marx and Philosophy* (Suchting 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.

The 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* (Winch 1958), 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 be captured. Indeed, Winch and the *Verstehen* theorists argued that this simply ruled out the possibility of any 'scientific' social science.

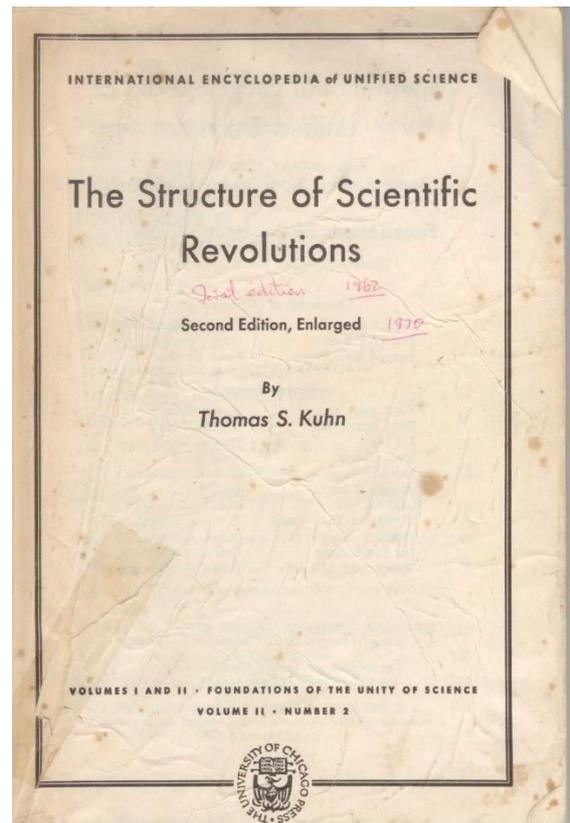
The thesis attempted a causal interpretation of action. It was awarded first-class honours, and I was placed second to Elizabeth Grosz who went on to fame as a feminist philosopher. Her subsequent writings, alas, lost a good deal of the precision and clarity that Sydney philosophy did its best to inculcate.

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* (Lakatos & Musgrave 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 that focussed on the production of scientific knowledge. It was 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)

Abner Shimony, a physicist and philosopher, said of the key Kuhnian move of deriving methodological lessons from scientific practice that:

His work deserves censure on this point whatever the answer might turn out to be, just because it treats central problems of methodology elliptically, ambiguously, and without the attention to details that is essential for controlled analysis. (Shimony 1976, p. 582).

Wolfgang Stegmüller opined that the crux of Kuhn's theory of science was 'a bit of musing' of a philosophical incompetent (Stegmüller 1976, p. 216).

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 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 (1968-75)

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 Manly seminary lecturers Fathers 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 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.

When I buy books, I put both my name and purchase date on them. And I keep them. My intellectual and religious interests of the time can be gauged from the relevant books in my library. The following is a small selection:

1967

- Evans, Illtud (ed.): 1965, *Light on the Natural Law*, Burns & Oates, London (20 December 1967)
- White, Victor: 1967, *God and the Unconscious*, Fontana Books, London (7 July 1967)
- Adolfs, Robert: 1967, *The Grave of God: Has the Church a Future?* Burns & Oates, London (20 December 1967)
- Bultmann, Rudolf: 1934, *Jesus and the Word*, Fontana, London (30 August 1967)
- Huxley, Aldous: 1946, *The Perennial Philosophy*, Fontana Books, London (31 May 1967)
- Roberts, David E.: 1959, *Existentialism and Religious Belief*, Oxford University Press, Oxford (12 July 1967)
- 1968**
- Adolfs, Robert: 1966, *The Church is Different*, Burns & Oates, London (24 February 1968)
- Baum, Gregory (ed.): 1967, *The Future of Belief Debate*, Herder and Herder, New York (28 March 1968)
- Wikenhauser, Alfred: 1958, *New Testament: Introduction*, Herder & Herder (12 October 1968)
- Stanley, David M.: 1966, *The Apostolic Church in the New Testament*, The Newman Press (28 November 1968)
- Perrin, Norman: 1963, *The Kingdom of God in the Teaching of Jesus*, SCM Press (27 September 1968)
- Neuner, Joseph (ed.): 1967, *Christian Revelation and World Religions*, Burns & Oates, London (9 May 1968)
- Mascall, E.L.: 1943, *He Who Is*, Darton, Longmore & Todd, London (25 November 1968)
- Davis, Charles: 1966, *God's Grace in History*, Fontana, London (5 April 1968)
- Pelikan, Jaroslav: 1960, *The Riddle of Roman Catholicism: Its History, Its Beliefs, Its Future*, Hodder and Stoughton, London (11 November 1968)
- 1969**
- Burns, Patrick J.: 1965, *Mission and Witness: The Life of the Church*, Geoffrey Chapman (12 May 1969)
- Bultmann, Rudolf: 1955, *Theology of the New Testament*, SCM Press, London (15 March 1969)
- Klein, Ludwig (ed.): 1965, *The Bible in a New Age*, Sheed & Ward, London (15 March 1969)
- Cullmann, Oscar: 1951, *Christ and Time*, SCM Press, London (28 March 1969)
- Durand, Alfred, Huby & Joseph (trans. Heenan, John J.): 1957, *The Word of Salvation: A Commentary on the Gospels*, Bruce Publishing (12 May 1969)
- Ward, Barbara: 1954, *Faith and Freedom*, Hamish Hamilton (12 May 1969)
- McKenzie, John L.: 1963, *Myths and Realities: Studies in Biblical Theology*, Geoffrey Chapman, London (12 May 1969)
- Tresmontant, Claude: 1965, *Christian Metaphysics*, Sheed & Ward, New York (12 May 1969)
- Bultmann, Rudolf: 1960, *Existence and Faith*, Fontana (8 July 1969)
- Robinson, James M. (ed.): 1968, *The Beginnings of Dialectic Theology*, John Knox Press (14 October 1969)
- Grandmaison, Léonce de: 1961, *Jesus Christ*, Sheed and Ward, New York (12 May 1969)
- Cullmann, Oscar: *The Early Church*, SCM Press (28 March 1969)
- Gleason, Robert W.: 1960, *Christ and the Christian*, Sheed & Ward, London (12 May 1969)
- 1970**
- Brown, Raymond: 1965, *New Testament Essays*, Doubleday (10 January 1970)
- Callahan, Daniel (ed.): 1969, *God, Jesus, Spirit*, Herder & Herder (15 February 1970)
- Belloc, Hilaire: 1920, *Europe and the Faith*, Burns & Oates, London (8 August 1970)
- Guitton, Jean: 1961, *The Church and the Gospel*, Burns & Oates, London (24 July 1970)

- Pelikan, Jaroslav (ed.): 1970, *Twentieth Century Theology in the Making* Vol. II, Fontana, London (26 May 1970)
- Xavier, Léon-Dufour: 1968, *The Gospels and the Jesus of History*, Fontana, London (9 June 1970)
- O'Brien, Elmer (ed.): 1965, *Theology in Transition: A Bibliographic Evaluation of the 'Decisive Decade' 1954-1964*, Herder and Herder, New York (16 May 1970)
- Cameron, J.M.: 1966, *Images of Authority*, Burns & Oates, London (16 May 1970)

1971

- Robinson, James M. (et al.): 1965, *The Bultmann School of Biblical Interpretation: New Directions?* Harper (24 October 1971)
- Dawson, Christopher: 1960, *The Historical Reality of Christian Culture*, Harper, New York (28 August 1971)
- Mackenzie, R.A.F.: 1963, *Faith and History in the Old Testament*, Macmillan Comp., New York (20 December 1971)
- Blomjous, Joseph J.: 1969, *Priesthood in Crisis*, Bruce Publishing (19 July 1971)
- Pelikan, Jaroslav (ed.): 1970, *Twentieth Century Theology in the Making*, Vol.3, Fontana, London (24 October 1971)

1972

- Pelikan, Jaroslav: 1966, *The Christian Intellectual*, Collins (20 January 1972)
- McNeill, John T.: 1935, *Makers of the Christian Tradition*, Harper (1 August 1972)
- Harnack, Adolf: 1901, *What is Christianity?* Williams and Norgate (20 January 1972)
- Dewart, Leslie: 1969, *The Foundations of Belief*, Herder and Herder, New York (20 March 1972)
- Granfield, Patrick: 1967, *Theologians at Work*, The Macmillan Company, New York (24 July 1972)
- Brunner, Emil: 1934, *The Mediator: A Study of the Central Doctrine of the Christian Faith*, Lutterworth Press, London (20 January 1972)
- Brunner, Emil: 1939, *Man in Revolt: A Christian Anthropology*, Lutterworth Press, London (20 January 1972)
- Jeremias, Joachim: 1954, *The Parables of Jesus*, SCM Press (20 January 1972)
- Fuller, Reginald H.: 1962, *The New Testament in Current Study: Some Trends in the Years 1941-1962*, SCM Press, London (20 January 1972)
- Maritain, Jacques: 1969, *On the Grace and Humanity of Jesus*, Herder and Herder, New York (20 March 1972)
- Baun, Herbert: 1968, *God and Christ: Existence and Province*, Harper & Row, New York (15 March 1972)

1974

- Gutiérrez, Gustavo: 1973, *A Theology of Liberation: History, Politics and Salvation*, Orbis Books (3 September 1974)

Sydney Teachers College (1972-74)

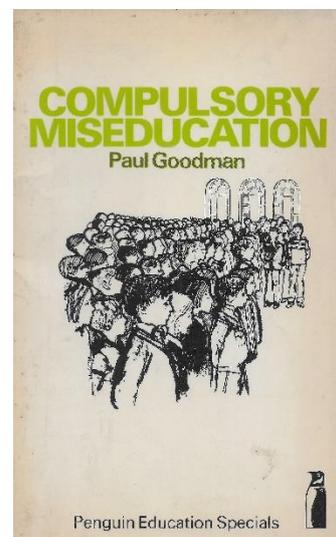
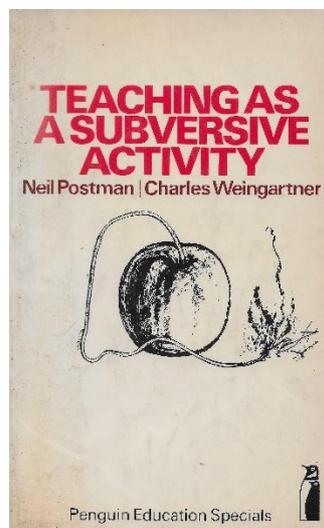
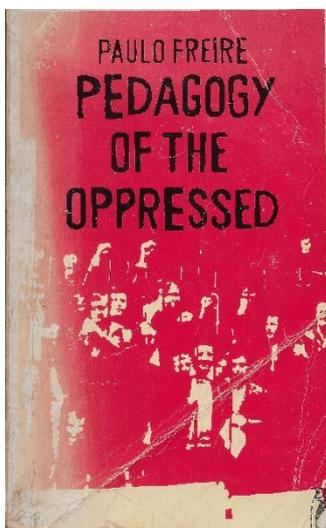
A career defining event occurred in mid-1972. While still teaching science and completing my BA and MEd degrees, I was offered an appointment as a lecturer in philosophy of education at Sydney Teachers College (STC). The appointment meant leaving classroom teaching and moving into teacher education. 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. I am forever pleased to have made this choice.



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. The decision ended my classroom teaching career, and began my teacher-education career. In this bygone, distant era, philosophers were in demand. There were half-a-dozen on staff at STC, but an extra was needed.

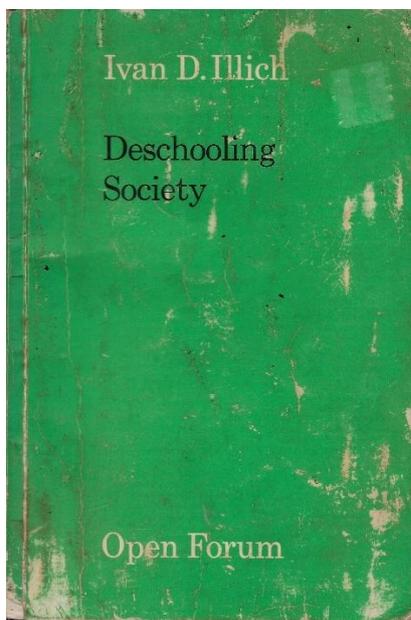
My Teachers College years were tumultuous. Radical education was in the air everywhere except at the college which was caught in a 1950s, or earlier, time-warp. The 1960s and '70s saw a flood of progressive and radical education books: A.S. Neill *Summerhill* (1961), Ivan Illich *Deschooling Society* (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).



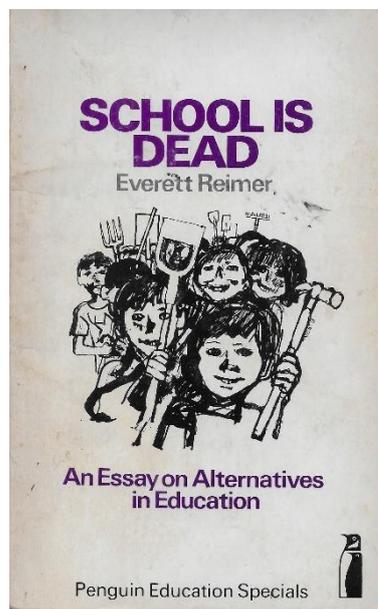
Paulo Freire (1972)

Neil Postman & Charles
Weingartner (1971)

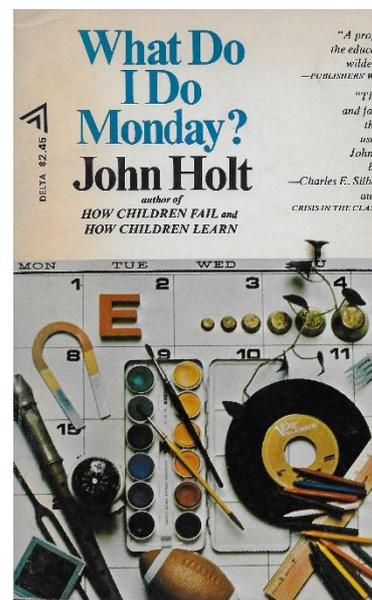
Paul Goodman (1962)



Ivan Illich (1971)



Everett Reimer (1971)



John Holt (1970)

The genre would grow exponentially in the late '70s, and change to a more sociological, systematic, and Marxist-influenced analysis. Progressive, psychology-influenced education gave way to radical, class-theory influenced educational analysis and action. The major works of this period were Samuel Bowles and Herbert Gintis *Schooling in Capitalist America* (Bowles & Gintis 1976) and Michael Apple's *Ideology and Curriculum* (Apple 1979). When these authors visited Australia, they lectured to packed classrooms, halls and auditoria. Apart from core philosophy of education, STC 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* (Freire 1972) appeared the year I was appointed to STC. In the second half of 1972 I taught, as an option, probably the first course taught in Australia on his educational theory and practice. I was privileged to spend time with him during his Australian tour in 1973. He was the subject of my first ever publication where I argued that Freire's epistemology is best understood as embodiment 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* (Gutiérrez 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 College 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.

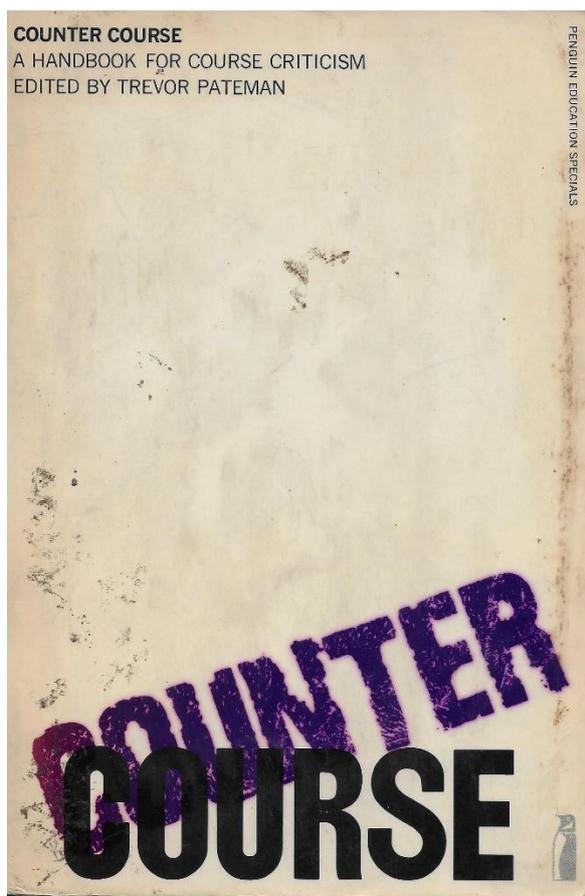
He passed, taught briefly in a boys' school, resigned, and went on to an outstanding international career in the theatre and cinema as an acclaimed choreographer for productions of *Moulin Rouge*, *Strictly Ballroom*, *The Great Gatsby*, *Shall We Dance?* and many other box-office hits. He became known 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. This supposedly violated the government's 'no politics in schools' policy.



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, the Republic, 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). One immediate response is that teachers' should stay mute on these topics for fear of dominating, if not manufacturing, students' opinions. On the other hand, what example is set if pupils see their thought-to-be educated teachers having no view at all on the roll call of issues that fill newspapers, TV news, and radio?

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.

Paul Hirst observes of the requirements of UK 1994 Education Act that:

These restrictions, insisting on the direct practical relevance of all education courses, have led to the near demise of all courses concerned specifically with the disciplines of educational theory within British universities. (Hirst 2008, p.309)

So, for instance, a recent 76-chapter *Handbook of Research on Teachers and Teaching* (Saha & Dworkin 2009) has no entry for ‘Foundation Studies’ or indeed any specific foundation discipline.

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.

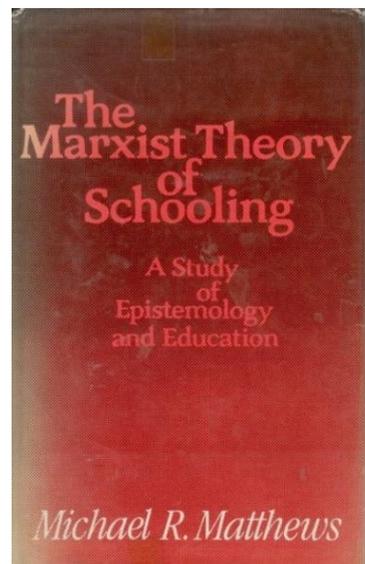


University of New South Wales

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: A Study of Epistemology and Education* (Matthews 1980b).

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 not have an unpublished thought. My sense was that the subject matter needed to be mastered before being written on. Some other educators of the period (notably none of those in the preceding parentheses) did not have this sense, and so lightweight publications on HPS subjects appeared, and of course have continued to appear. These lower the image and status of education research.

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. 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 that year, 1975, the inaugural PESA 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 1980a). 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. At the time it was widely recognised that there was a crisis in Western science education. Levels of science literacy were disturbingly low. This was anomalous because science is one of the greatest achievements of human culture. It has a wonderfully interesting and complex past, it has revealed an enormous amount about ourselves and the world in which we live, it has directly and indirectly transformed the social and natural worlds, and the human and environmental problems requiring scientific understanding are pressing – yet, disturbingly, students and teachers were and are deserting science.

It was and is internationally recognised that there are problems with science education. Orthodox, technical, non-contextual teaching is largely failing to engage students, or to promote knowledge and appreciation of science in the population. There is a well-documented crisis in contemporary science education evidenced in the flight from the science classroom of both teachers and students, and in the appallingly high figures for science illiteracy in the Western world. This has prompted massive rethinking and reforms in national curricula and science education policy across the world.

In the US these reform efforts have been rolling on for the past thirty years. The most visible and influential have been the National Research Council's *National Science Education Standards* (NRC 1996), *Inquiry and the National Science Education Standards* (NRC 2000), *America's Lab Report* (NRC 2006), *Taking Science to School* (NRC 2007), *A Framework for K-12 Science Education* (NRC 2012) and *Next Generation Science Standards* (NRC 2013); the American Association for the Advancement of Science's *Science for All Americans* (AAAS 1989), *The Liberal Art of Science* (AAAS 1990) and *Benchmarks for Science Literacy* (AAAS 1993).

Two decades ago, in the US seventy per cent of all school students dropped science from their program at the first available opportunity. The American National Science Foundation charged that 'the nation's undergraduate programs in science, mathematics and technology have declined in quality and scope to such an extent that they are no longer meeting national needs. A unique American resource has been eroded.' (Heilbron 1987, p.556). Recent US reports on college science enrolments are similarly bleak (Ashby 2006). The National Research Council says in its *Next Generation Science Standards* that:

The U.S. has a leaky K–12 science, technology, engineering and mathematics (STEM) talent pipeline, with too few students entering STEM majors and careers at every level ... We need new science standards that stimulate and build interest in STEM. (NRC 2013)

In Europe, political and educational effort has gone into similar wide-ranging reform initiatives (Dibattista & Morgese 2014). Acknowledging the failure of science teaching and the flight from science, a 2004 European Commission report was bluntly titled *Europe needs more scientists!* (EC 2004). The following year the Commission commissioned a Europe-wide survey that revealed that 50% of adults saw their school science courses as ‘not sufficiently appealing’ and curriculum and pedagogical changes were called for to redress the science literacy and engagement problems.

There are complex economic, social, cultural, and systemic reasons for this rejection of science. These are beyond the scope of teachers to rectify. But there are also educational reasons for the rejection of science that are within the power of teachers and administrators to change. In 1989, for example, a disturbing number of the very top Australian school science achievers gave ‘too boring’ as the reason for not pursuing university science. It is these curriculum and pedagogical failings that the history and philosophy of science (HPS) can help rectify, provided teachers are familiar with HPS and can appreciate its relevance to both the topics and the students they are teaching.

One part of this contribution by HPS is to connect topics in particular scientific disciplines, to connect the disciplines of science with each other, to connect the sciences generally with mathematics, philosophy, literature, psychology, history, technology, commerce and theology. And finally, to display the interconnections of science and culture – the arts, ethics, religion, politics – more broadly. Science has developed in conjunction with other disciplines, there has been mutual interdependence. It has also developed, and is practiced, within a broader cultural and social milieu. These interconnections and interdependencies can be appropriately explored in science programs from elementary school through to graduate study. The result is far more satisfying for students than the unconnected topics that constitute most programs of school and university science. Courses in the sciences are too often, as one student remarked, ‘forced marches through unknown country without time to look sideways’. A systemic embrace of Liberal Education normalises all of the foregoing; in liberal education programmes, interconnectivity is to be expected, it is the educational norm.

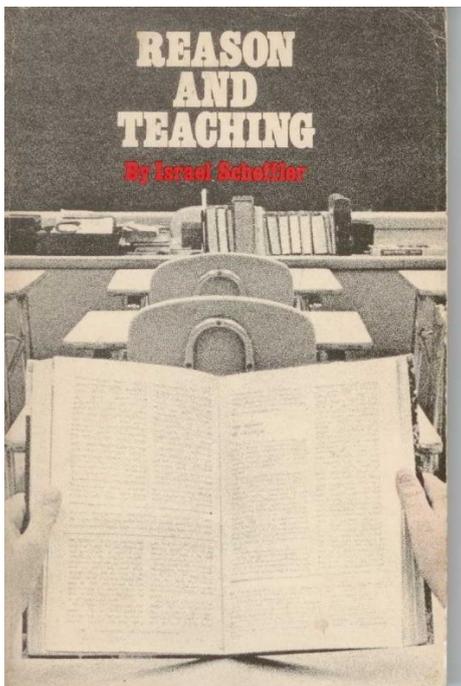
Two years before my appointment, Israel Scheffler published his essay ‘[Philosophy and the Curriculum](#)’. It was a convincing argument for the inclusion of courses in the philosophy of the discipline in programmes that are preparing people to teach that discipline. He maintained that: ‘philosophies-of 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)

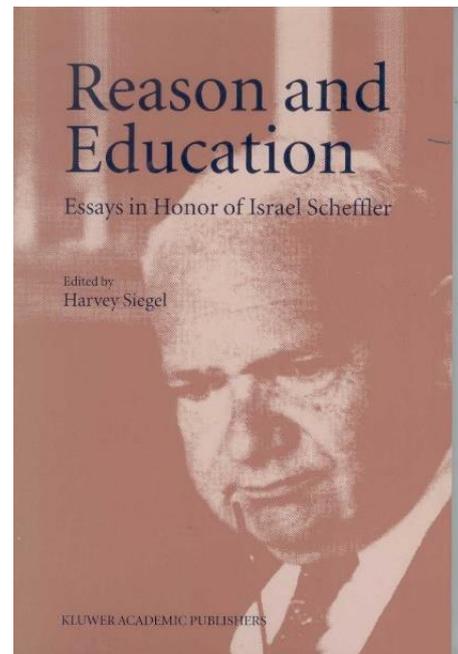
As I was teaching science graduates, and had been a science teacher, it was natural and easy to ‘take on board’ Scheffler’s argument. Thereafter my philosophy of education courses had

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.

Boston University Sabbatical (1978)

The year after the School of Education psychology assessment battles, 1978, was a watershed year. It was 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. Some years earlier, Suchting had visited the Centre and presented a paper on 'Regularity and Law' to the Boston HPS Colloquium (Suchting 1974). 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. It was arguably in the top three HPS book series at the time, and for some time thereafter. The Centre Colloquium was held each 6 weeks or so with stellar scholars presenting papers. The BU 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 and Philosophy’ taught jointly by Robert Cohen and Marx Wartofsky. The course text was Robert Tucker *The Marx-Engels Reader* (Tucker 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, history 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’, ‘subversive’ or just McCarthy-mentioned staff merely mentioned in McCarthy’s Hearing for Un-American Activities Committee. 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.

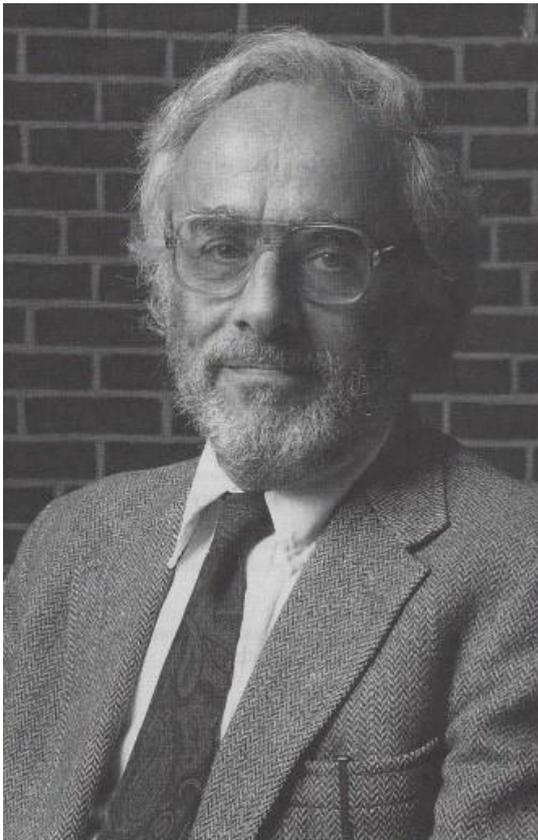
The Massachusetts Institute of Technology (MIT) just across the Charles River from Boston University, stood down for five years in the mid-1950s Dirk Jan Struik (1894-2000), the renown Marxist historian of mathematics. To MIT’s credit they did continue to pay him whilst stood down, but whatever guilt they may have felt about denying their students the benefits of his teaching, was not sufficient to overcome their fear of McCarthy and his Senate Un-American Activities Committee.

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 a luminary 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. Wartofsky graduated from Columbia in 1952 but on account of his very publicly-aired socialist views, could not secure an academic appointment for the following five years. In 1957 he was employed as a philosophy professor by the Methodist-controlled, Boston University. Wartofsky's masterful study *Feuerbach* had been published the year before I arrived (Wartofsky 1977). It would not have been unusual for his Marxism course to simply be based on the book, but it was not. Unfortunately, his *Conceptual Foundations of Scientific Thought* (Wartofsky 1968a) had not been mentioned in Sydney University philosophy of science programmes, nor indeed it seems in many other philosophy programmes. An over-looked rich philosophical resource.

The professional neglect of *Conceptual Foundations* is a pity as the book exhibits most of the features of good philosophy of science: it is wide-ranging in its historical sweep, it is informed by scientific practice, it connects philosophy of science to general philosophy and metaphysics, it recognises the place of ethical and social values in science and intelligently endeavours to accommodate values into the epistemology and methodology of science, and it is clearly written. In crucial respects, the book was decades ahead of its time.

What did, however, receive rightful and wide philosophical attention was his paper 'Metaphysics as Heuristic for Science' (Wartofsky 1968b).

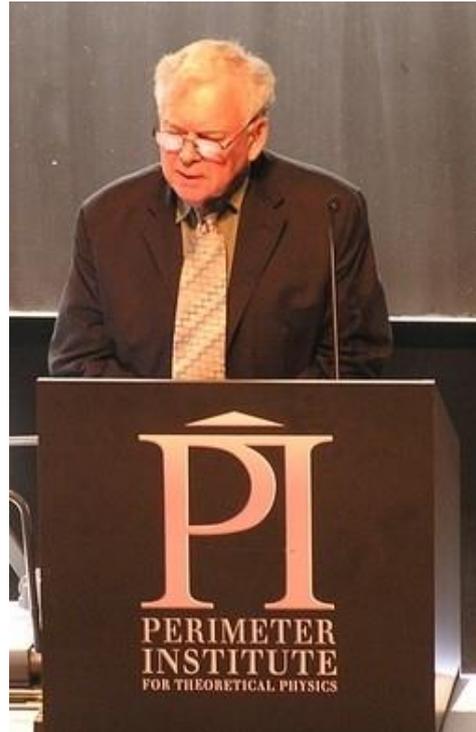


Robert S. Cohen



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 from Princeton University supervised by Eugene Wigner; he contributed original work to experimental quantum mechanics, specifically a monumental paper on the experimental test of Bell's Theorem. He had a second PhD in philosophy from Yale, supervised by Rudolf Carnap. He was one of Carnap's few doctoral students.



Abner Shimony

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.

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 different philosophers' arguments, but we did not read Galileo's text. This signifies, in part, the difference between philosophy making use of history, cherry-picking history usually to support a preciously arrived at position, and philosophy taking history seriously, and consequently being informed by it.

Shimony's course was a head-turner; it set me on a path of historical-philosophical investigation that I have tried to follow 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 1998b, 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).

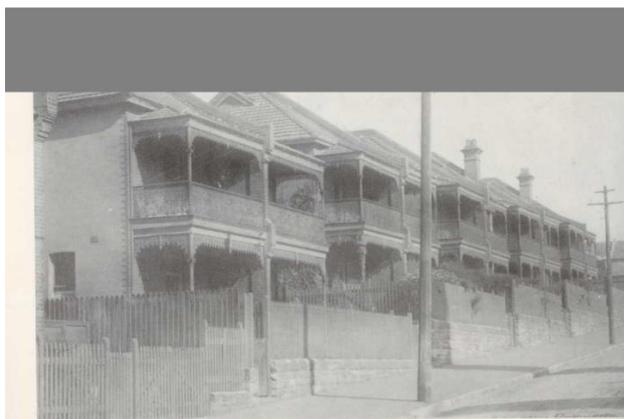
Another important 'takeaway' from Shimony's course was the role of thought experiment, *Gedankenexperiment*, in Galileo's new science, and subsequently in modern science. This led me to the rich world of Ernst Mach studies (Matthews 1989, 1990). A subject I returned to thirty years later (Matthews 2019).

Political Interlude: Sydney City Council (1980-85)

Returning at the end of 1978 from half-a-year of rich intellectual and personal life in Boston, 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, Sid Fegan, (who had never lived in the area) was retiring and he organised for his son John (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 party candidates for this inner-city ward in the 1980 election.

People were prepared to accept the son as their alderman. 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 hastily-formed Active Residents Campaign.

Phillip Ward was a collection of, at that time, poor inner-city suburbs – Pyrmont, 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. Pyrmont and Ultimo were called 'Sydney's Sink': whatever developments were not wanted by better suburbs went into Pyrmont and Ultimo: a coal-fired power station for the city tram network, a massive city garbage incinerator, wholesale vegetable and fish markets, the nation's largest sugar refinery, flour mills, wool stores, quarries, ship building, and so on. Locals told me that, not so long before I moved in it used be a race between washing drying on the line and turning grey with soot. In the house I bought, there was an inch of soot atop the ceiling boards, a matter discovered when I put in a skylight.



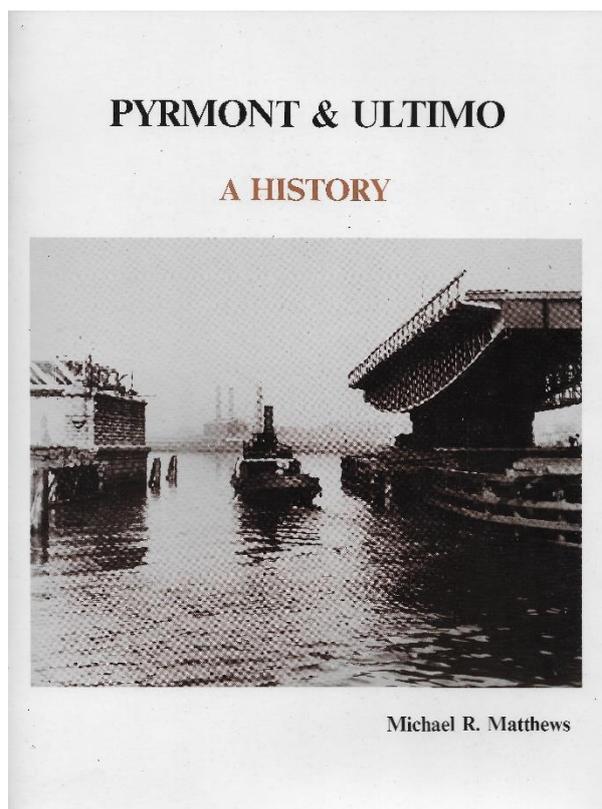
Pymont houses demolished for car park
(1980)



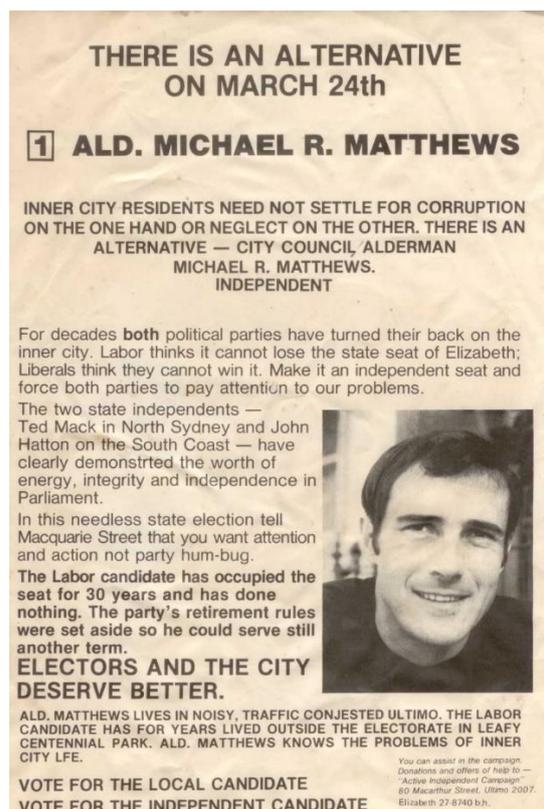
Ultimo abandoned light industry (1980)

Traditionally Phillip Ward returned two Labor and one Civic Reform (Liberal Party, conservative) aldermen. It was the Central Business District (CBD) that voted Civic Refordm. 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 inner cities all 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 resident and political 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. The *Sydney Morning Herald* published a letter from the Pymont Catholic priest, Father John Ford, supporting my stand and refuting the Labor Party's claims. The Party at the very next council meeting cut off funding to Father Ford's 'Mission to Seamen', a charitable work that the council had been funding for 50+ years. City politics was played hard. In Ultimo abandoned industrial sites were demolished for a road that was never built. With a stream of letters to the *Herald* and radio interviews I was able to publicise the 'underbelly' of council business.



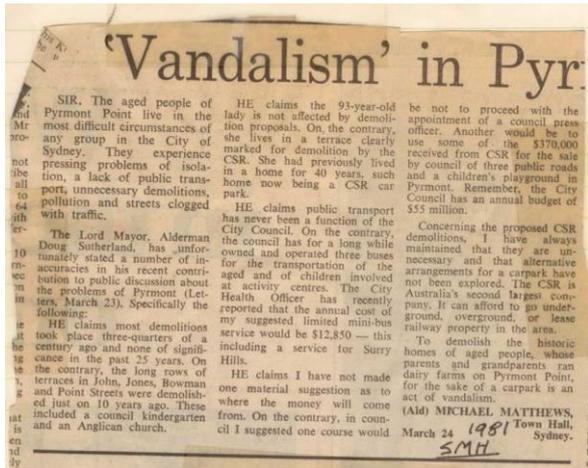
Pyrmont & Ultimo: A History (1982)



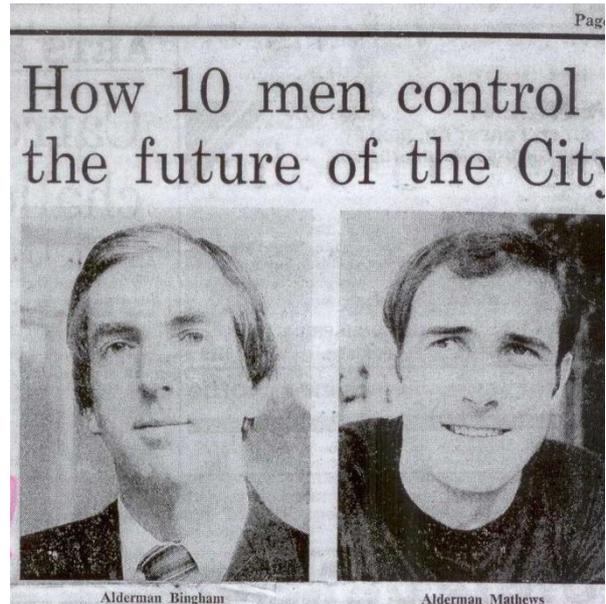
City Council Campaign (1984)

My unexpected election was one of those common-enough 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 just one vote (4:3), but the one vote had significant on-going repercussions for city life and politics. Losing control of council 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 favourable Sydney Central Business District (CBD) zoning, development applications and their modifications, and other 'favours' (opening hours, parking restrictions etc.) to its financial backers and friends. A spot-rezoning here, an extra story there, a street closure somewhere else – these were the accepted bread and butter routines of council, irrespective of what party was in control. Without control of City Council, either party 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, radio interviews, and so on. During this period, utilising the Council resources and records that were freely available to me, I wrote a local history book *Pyrmont and Ultimo: A History* (Matthews 1982). With just under 5,000 sales, this became at the time, and might still be, the largest selling 'local history' book published in Australia.

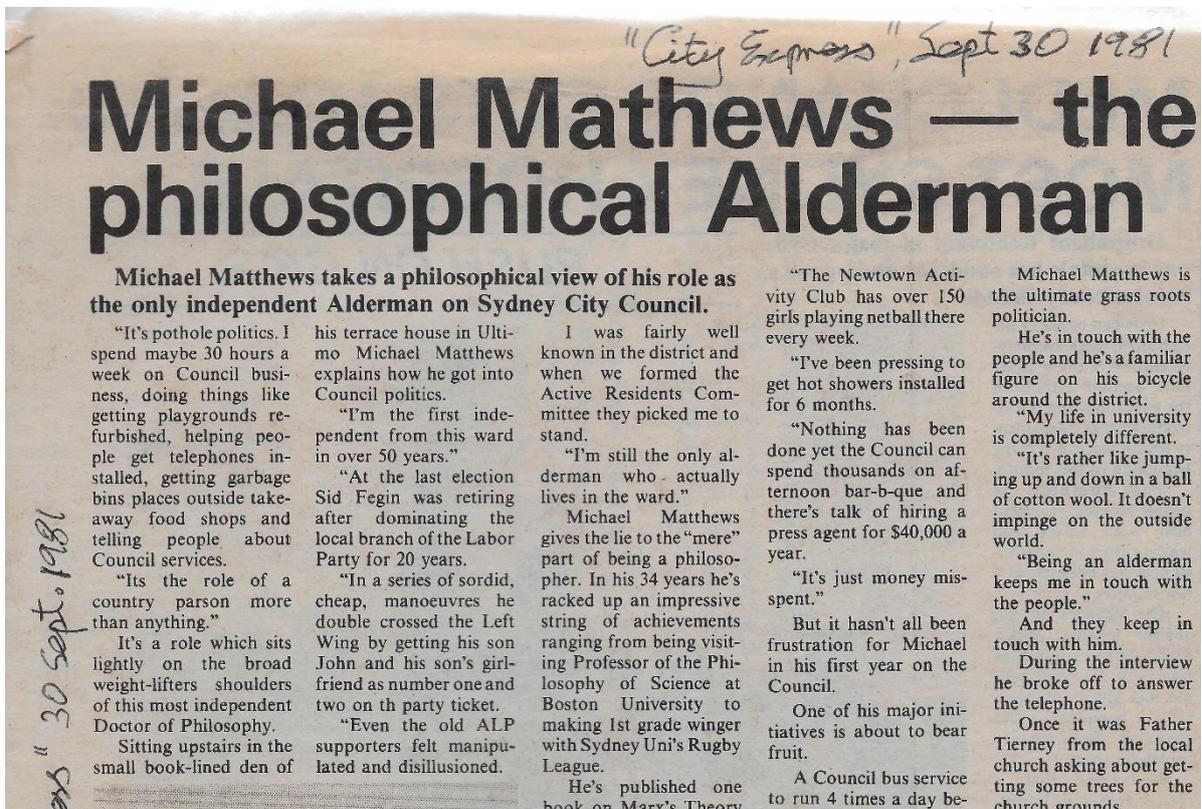


Sydney Morning Herald (1981)



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*. At the time of enrolment, I did not anticipate attending a local Ultimo protest meeting, much less becoming in the following year, the first independent alderman on City Council. Thereafter, research and writing competed with council commitments and UNSW teaching. A busy period.

I benefited from writings on the subject by Thomist philosophers of science, in particular William Wallace *Prelude to Galileo* (Wallace 1981) and James Weisheipl *Nature and Motion in the Middle Ages* (Weisheipl 1985). The six chapter-headings of the thesis chart 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, 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.

$$\text{Speed} = \text{force}/\text{resistance}$$

The bigger the force applied the faster the body moves; the more resistance by the medium, the slower the speed.

This is 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 unlearnt (diSessa 1982); and frequently it is not unlearnt. Students learn a formula, but they do not internalise the physics (Ebison 1993).

Pierre Duhem (1861-1916), the French historian/philosopher, warned against grounding science instruction in common sense:

Now is it clear merely in the light of common sense that a body in the absence of any force acting on it moves perpetually in a straight line with constant speed? Or that a body subject to a constant weight constantly accelerates the velocity of its fall? On the contrary such opinions are remarkably far from common-sense knowledge; in order to give birth to them, it has taken the accumulated efforts of all the geniuses who for two thousand years have dealt with dynamics. (Duhem 1906/1954, p. 263)

Idealisation in science has been recognized as one of the major stumbling blocks to meaningful learning of science. This is in part because intuitive beliefs are so strongly influenced by everyday, concrete experience. Lewis Wolpert, in his *The Unnatural Nature of Science* remarked:

Scientific ideas are, with rare exceptions, counter-intuitive: they cannot be acquired by simple inspection of phenomena and are often outside everyday experience . . . doing science requires a conscious awareness of the pitfalls of 'natural' thinking. (Wolpert 1992, p. xi)

The fundamentality of idealisation is, of course, a massive stumbling block for simplistic and naïve advocacy of discovery learning or inquiry learning. This is a point that I would return to in later in my writings on constructivism.

In physics, and everyday use, motion means an object's change of place, what Aristotle calls 'local motion', and what now is basically just called 'movement'. This can be absolute or relative. Aristotle thought in the broader term of change, of which motion is just one of three kinds; change of place, change of composition, change of size. For Aristotle, understanding change necessarily led to metaphysics (Buckley 1971, Pt.1). Famously he opens Book VII Chapter 1 of his *Physics* with the claim that:

Everything that is in motion must be moved by something. For if it has not the source of motion in itself it is evident that it is moved by something other than itself, for there must be something else that moves it. (Barnes 1984, p.407)

And then in Chapter 2:

And since there are three kinds of motion, local, qualitative, and quantitative, there must also be three kinds of mover, that which causes locomotion, that which causes alteration, and that which causes increase or decrease. (Barnes 1984, p.409)

In Thomism, the Aristotelian understanding of change led to theology, and on to God. In the *Summa Theologica* (First part, Quest II, Article 3) Aquinas succinctly stated that: 'The existence of God can be proved in five ways.' And 'The first and more manifest way is the argument from motion' (Aquinas 1270/1952, p12). This has been labelled the Kinetological Argument, which Aquinas takes direct from Books V-VIII of Aristotle's *Physics*. He elaborates it as:

Therefore, whatever is moved must be moved by another. If that by which it is moved be itself moved, then this also must be moved by another, and that by another again. But this cannot go on to infinity, because then there would be no first mover, and consequently, no other mover, seeing that subsequent movers move only because they are moved by the first mover, just as the staff moves only because it is moved by the hand. Therefore it is necessary

to arrive at the first mover which is moved by no other. And this everyone understands to be God. (Aquinas 1270/1952, p.13)

Aquinas recognised that this kinetological argument did not necessitate a beginning in time; he was relaxed about such movement-inducing movement having no beginning; philosophically he allowed it to go back to infinity. In *Summa Theologica* Bk.1 Question XLVI he deals with ‘Of the beginning of the duration of creatures’, and in Article 2 after canvassing various arguments, he concludes: ‘We hold by faith alone, and it cannot be proved by demonstration, that the world did not always exist’ (Aquinas 1270/1952, p. 253).

All five of Aquinas’s arguments for the existence of God, concludes with the same refrain: ‘And this everyone understands to be God’. This appeals to an antecedent conception of God or such a prime mover or being. The philosopher is making clear something that nevertheless is dimly perceived.

Aquinas elaborates an understanding of motion in terms of potency and actuality, saying: ‘For motion is nothing else than the reduction of something from potency to act’ (Aquinas 1270/1952, p. 12). This is 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; a matter documented by philosopher/theologian John Lamont in a *Science & Education* thematic issue and subsequent anthology (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 the reality of potentials when they speak of ‘students realising their potential’; this is an everyday expression. 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. This was a recurrent theme in Wal Suchting's writings; and also in the work of Bob Cohen and Marx Wartofsky, the Boston University philosophers from whom I learnt so much.

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. The objects or entities with which science deals, scientific objects, are abstracted or idealised versions of real objects and real processes.

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 (both original nineteenth century and current) – science does not deal with the full complexity of nature – misses the point. Science advances precisely by *not* dealing with the full complexity of nature. 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)

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.

Although I had graduated in science, taught science, studied history and philosophy of science, and taught philosophy of education to science undergraduates and graduates – at this stage, I had not engaged with the professional science education research community.

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. When on staff at Sydney 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 suffer distinctive pressures.

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.

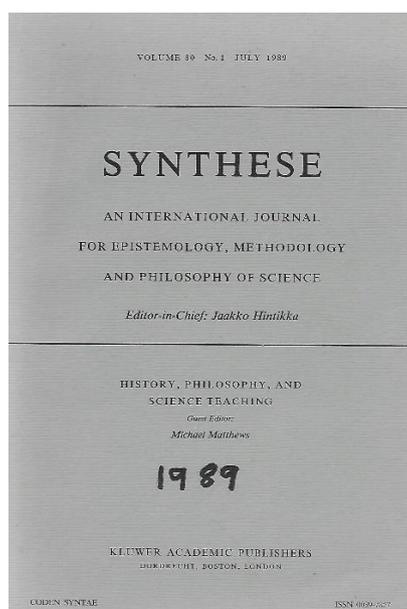
So instead of reading Aristotle, Galileo, Newton, Maxwell, Darwin, Faraday, Dewey, Piaget, Bruner, and related secondary literature, new staff spend their time video-taping lessons, transcribing student interviews, and producing limited, local, uncontrolled and unscientific research that few people will 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.

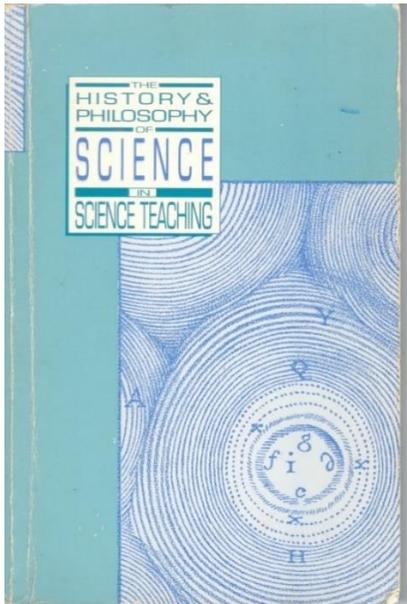
I began writing to a dozen individuals who I knew would be interested in contributing. They in turn recommended others, who recommended still others. In the end I had about 60 excellent manuscripts from scholars all over the world. About ten could appear in *Synthese*, so rather than return the others 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.

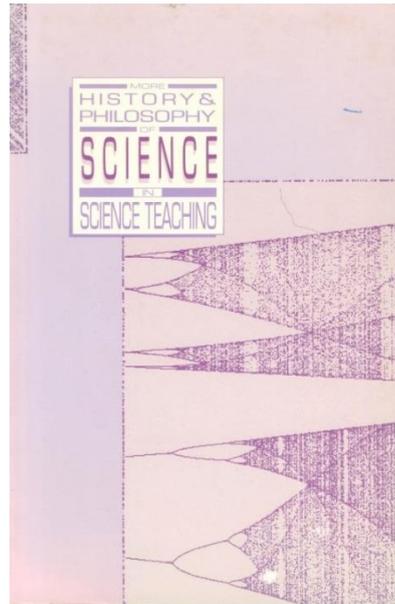
The time was ripe for a concerted international effort to bring the worlds of HPS and science teaching together; something hitherto done only spasmodically, for instance around creation of the *Harvard Project Physics* course and the Biological Sciences Curriculum Study (BSCS) *Web of Life* course. David 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 was an overwhelmingly successful, productive, happy and still-remembered 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. These prominent academics certainly made bold and unorthodox claims.

Steve Woolgar asserted that STS study:

undermines the standard presumption about the existence of the object prior to its discovery. The argument is not just that social networks mediate between the object and observational work done by the participants. Rather, the social network constitutes the object. (Woolgar 1988, p.65)

And:

The relationship between representations (inscriptions) and reality are not simple or direct. ... that which is represented in the inscription is as much a construction of reality as the inscription itself. In other words, the underlying reality of representation is never fixed, but changes with the context of their use (Woolgar 1988). (p.295)

These extra-ordinary claims had influence in science education, especially when presented in his co-authored best-selling book *Laboratory Life: The Social Construction of Scientific Facts* (Latour & Woolgar 1979/1986). This influence is well documented in Peter Fensham's book *Defining an Identity: The Evolution of Science Education as a Field of Research* (Fensham 2004). The book is built around his interviews with 79 leading science educators. Fensham reports that: 'One book stood out as an influence about the culture of science and that was Latour and Woolgar's *Laboratory Life*' (Fensham 2004, p.58).

Laboratory Life is an anthropological study of laboratory research on THR (thyrotropin releasing hormone) where one author, Latour, surprisingly thought it advantageous that he knew absolutely no science. The book argues that all science is 'the construction of fictions', and that scientific success is simply the ability of one group, in this case the Nobel Prize winners Schally and Guillemin, to 'extract compliance' from other scientists (Latour & Woolgar 1979/1986, p.285). They make the outright idealist claim that THR exists only if a certain bioassay procedure is accepted. Just stating this should suffice to set off philosophical alarm bells. The THR claim is peculiar. Acceptance or otherwise of bioassay result might be grounds for believing or not believing in THR, but hardly grounds for it coming into and out of existence

Nevertheless, Latour and Woolgar's philosophical idealism was promoted in science education. Rosalind Driver, a rightly famous and internationally recognised UK science educator, frequently affirmed the idealist position. For instance:

science as public knowledge is not so much a "discovery" as a carefully checked "construction" ... and that scientists construct theoretical entities (magnetic fields, genes, electron orbitals ...) which in turn take on a "reality" ' (Driver 1988, p.137).

A decade later, a prominent US science educator, John Staver, wrote:

.... 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)

These two science educators are, at face-value, saying that the earth does not have a structure until geophysicists impose it; there is not an evolutionary structure in the animal world till biologists impose such structure; atoms have no structure until such is imposed by physicists; and so on. One might ask: If gravity waves are our creation, why spend so much time and money looking for them?

The fact theories and their posits are humanly constructed, and that natural objects are considered in science only in their theoretical dress – apples as point masses in physics, as exchange values in economics as calories in biochemistry – does not imply that the real objects are human creations, or that the real objects have no part in the appraisal of the scientific worth of the conceptual structures brought to bear upon them.

The Science Wars, Postmodernism, and Realist versus Constructivist debates about ontology and epistemology were played out at the conference. Ernst von Glasersfeld, the self-styled 'radical constructivist' (Glasersfeld 1995), was an energetic participant.

A plenary session was devoted to the Constructivist debate. It was chaired by Ken Tobin, a champion of constructivism, and contributed to by the Canadian constructivists, Jaques

Désautels and Marie Larochelle, Ernst von Glasersfeld, and Florida State University realist philosopher, David Gruender.

Constructivism bristles with philosophical questions: it explicitly assumes positions in the philosophy of science, the philosophy of mind, and the philosophy of education. This is not surprising. It is at once a theory of science, of human learning, and of teaching; and there is also an ethical element when constructivists write of good teaching and education. It makes epistemological claims about our knowledge of the world, and often makes ontological claims about the nature of that world.

Désautels and Larochelle asserted the common constructivist position that reality is forever veiled:

Scientific knowledge is invented in order to make sense of observations which are themselves theory-laden. There is *no great book of nature* that can be consulted in order to check if the models or theories correspond to an ontological reality. (Desautels & Larochelle 1990, p.236)

Earlier Désautels had co-authored a national Canadian Science Education Report making the contentious claim:

Science as knowledge is an intellectual construct, and what are referred to as the laws of nature are merely the result of this human activity. Nature as such does not have laws. (Nadeau & Desautels 1984, p.19)

Ernst von Glasersfeld in a preliminary paper for the conference wrote:

The fact that scientific knowledge enables us to cope does not justify the belief that scientific knowledge provides a picture of the world that corresponds to an absolute reality. (Glasersfeld 1989, p.135)

And he quite correctly opined that:

If the theory of knowing that constructivism builds ... were adopted as a working hypothesis, it could bring about some rather profound changes in the general practice of education (Glasersfeld 1989, p.135).

It certainly would bring about such a change, and where it has been practised, it has brought about such change. For the worse, as will be detailed later in this account.

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; yet pleasingly the conference was marked by convivial and congenial exchanges on the subject. There was wide agreement about the benefit of

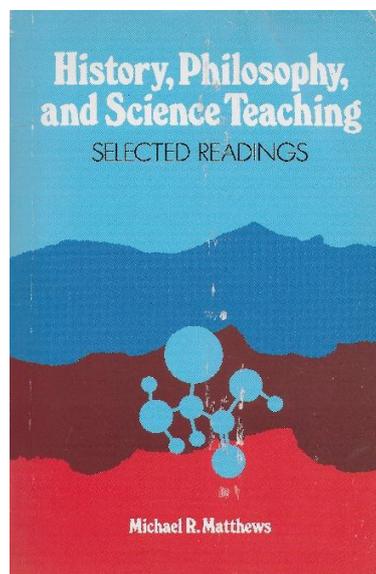
constructivist pedagogy, but disagreement about its commonly related epistemological and ontological claims. This tension has carried through the subsequent history of the group and its soon-to-be-founded journal *Science & Education*.

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 and valued. 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.

Ian Winchester, the Canadian philosopher and educator, was editor of Teachers College Press's philosophy of education book series and also a contributor to the Tallahassee conference. At his 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

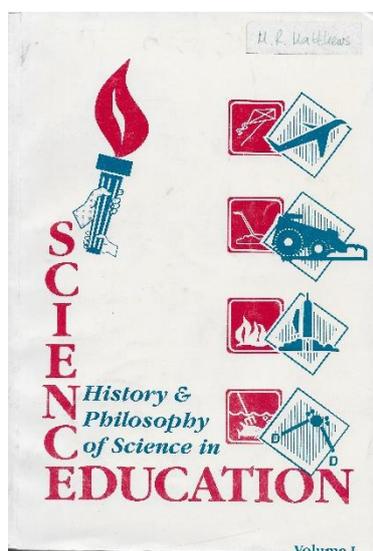
the difficulties may be for human beings to discover on the basis of their limited experience the objective truth, it is, so to speak, ‘there’ to be found out. (Shimony 1991, p.98)

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 where they are not only contested but routinely rejected as delusional. 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:

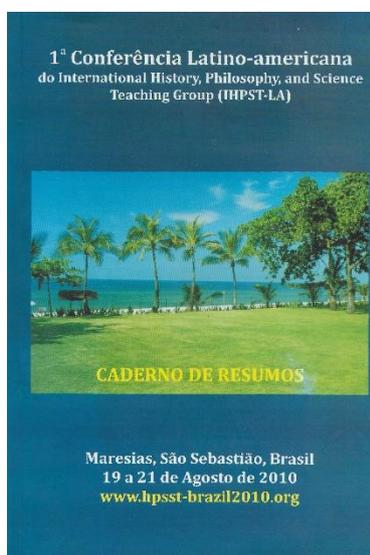
There is a need to struggle to assert the equal validity of Maori knowledge and frameworks and conversely to critically engage ideologies which reify Western knowledge (science) as being superior, more scientific, and therefore more legitimate. (Smith 1992, p.7)

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).

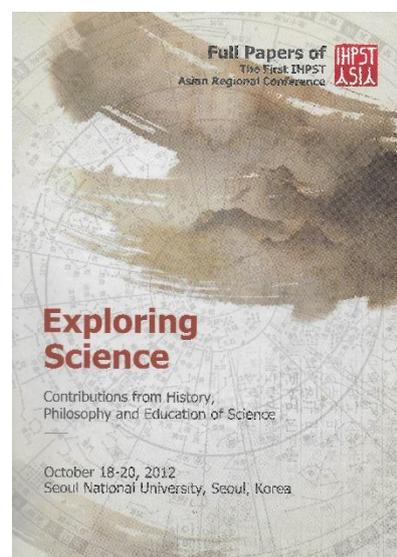
Since the first 1989 meeting, [biennial IHPST conferences](#) have been well attended and successful in bringing philosophers, historians and educators together to address theoretical, curricular and pedagogical issues in science teaching. Regional meetings have been held in South America, Asia and Europe. 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.



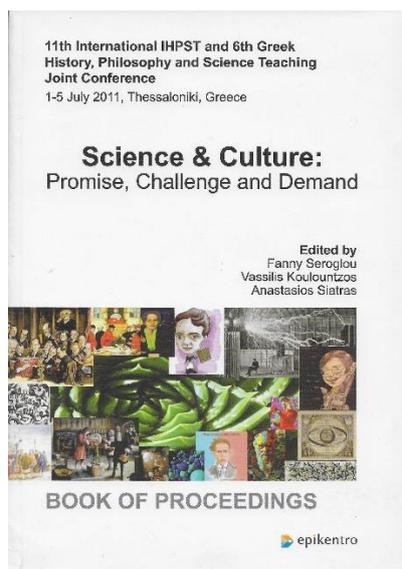
IHPST 1992 Kingston



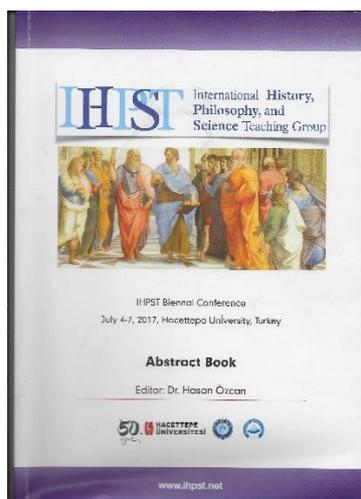
IHPST 2010 Brazil



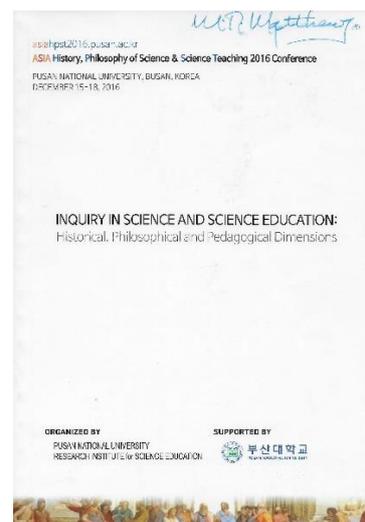
IHPST 2012 Seoul



IHPST 2011 Thessaloniki



IHPST 2017 Ankara



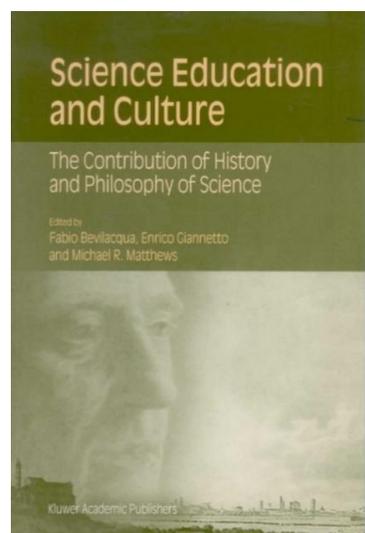
IHPST 2016 Pusan

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.

The conference, attended by about 220 individuals from thirty countries, was a joint venture of the International History, Philosophy and Science Teaching Group (its fifth conference) and the History of Physics and Physics Teaching Division of the European Physical Society (its eighth conference). The magnificent Villa Olmo, on the lakeshore, provided a memorable location for the presenters of the 160 papers and the audience that discussed them. The conference was part of local celebrations of the bicentenary of Alessandro Volta’s creation of the battery in 1799. Volta was born in Como in 1745, and for forty years from 1778 he was professor of experimental physics at Pavia University. The conference was fortunate to have had the generous financial support of the Italian government’s Volta Bicentenary Fund, Lombardy region, Pavia University, Italian Research Council, and Kluwer Academic Publishers.



Vila Olmo



IHPST 1999 Pavia

Among contributors to the Pavia conference were Alberto Cordero, Robert Carson, Peter Machamer, James Donnelly, Ron Good, Norm Lederman, James Rutherford, Edgar Jenkins, James Donnelly, Sibel Erduran, Robert Nola, Olivia Levrini, Cibelle Celestino, Art Stinner, Alexander Levine, 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](#)).

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, formalizing bank accounts, etc).

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

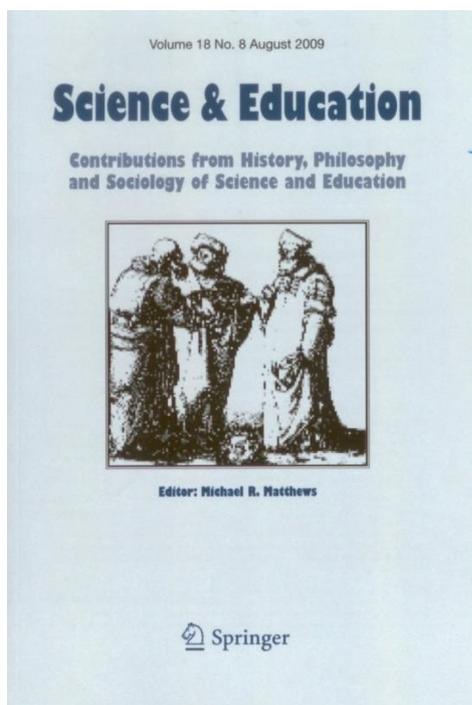
Perhaps the most significant and lasting consequence of the creation of the IHPST Group was the launching of [Science & Education: The Contributions of History, Philosophy and Sociology of Science and Education](#). It was the first ever international journal devoted to HPS&ST research.

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-)

I was very pleased that during my 25 years of editorship I was able to organise the publication of many thematic issues that brought 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)
- ‘Physics and Mathematics: Historical, Philosophical and Pedagogical Considerations’ (2015).

Some of the thematic issues have been published as separate anthologies: *Constructivism* (Matthews 1998a), *Culture* (Matthews, Bevilacqua & Giannetto 2001), *Pendulum Motion* (Matthews, Gauld & Stinner 2005), and *Worldviews* (Matthews 2009a).

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.

Rigorous reviewing, with signed reviews and my final editorial decision and letter being shared among reviewers, was a feature of the journal's editorial process from its beginning. My practice was to send only substantial manuscripts to review (about 60% of submissions), and then to have these reviewed by three, four, five or more scholars drawn from the Editorial Committee and from a large group (950+) of other reviewers. These include over 500 scientists, and science and mathematics educators, and currently about 250 philosophers of science, 120 historians of science and 50 cognitive scientists and psychologists. Informed and careful reviewing is very time consuming yet garners no reward, acknowledgement or

reimbursement. But without such informed examination, the whole scholarly research programme would be rendered worthless; reviewers are the ‘unsung heroes’ of research.

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.

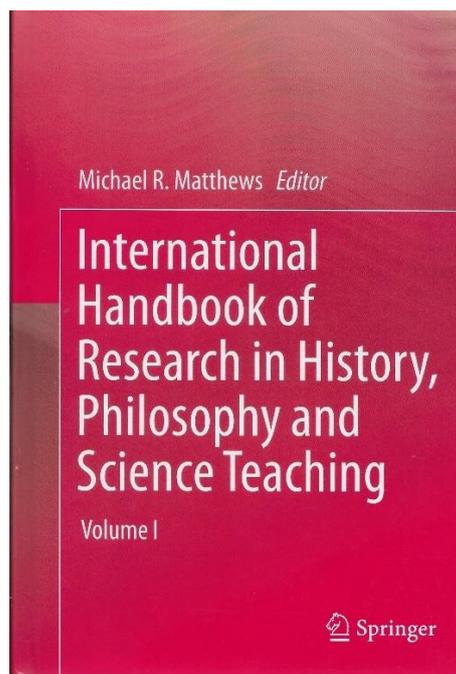
But Suchting was unsparing in his withering [assessment](#) of just what hermeneutics as a methodology contributed to understanding the practice of science. For Suchting, interpreting a text makes perfect sense, and hermeneutics is the science of such interpretation. And scientists wrote, read, and argued 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 the experiences 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.



HPS&ST Handbook (2014)

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 many historical and philosophical questions, it is surprising that such a handbook took so long to appear. But this is more the reason to celebrate its appearance.

The handbook is structured in four sections: pedagogical, theoretical, national, and biographical research. Each chapter sets the relevant literature in its historical context, and engages in an assessment of the strengths and weakness of the research addressed, and suggests potentially fruitful avenues of future research. There are 25 chapters (840 pages) on ‘Pedagogical Studies’ that provide comprehensive information on the classroom utility of HPS-informed approaches to teaching standard curriculum topics in physics, chemistry, biology, earth sciences, cosmology, astronomy, ecology and mathematics.

A host of theoretical issues are covered in the 35 chapters on ‘HPS and Theoretical Issues in Science Education’. Three of these chapters, but only three (Hodson 2014, Lederman, Bartos & Lederman 2014, Irzik & Nola 2014), deal with ‘Nature of Science’ (NOS) research which many have taken to be the entirety of HPS-related theoretical issues in science education. The field is much wider. In the chapter on ‘Cultural Studies in Science Education: Philosophical Considerations’ the philosopher Christine McCarthy examines the cultural studies issues mentioned in the preceding section (McCarthy 2014). Other theoretical chapters deal with Naturalism, Postmodernism, Constructivism, Religion, Inquiry, Laws and Explanations, Thought Experiments, Values, Critical Thinking, Philosophy of Science Education, Scientific Literacy, Argumentation, and so on.

The five ‘Biographical Studies’ discuss Ernst Mach, Frederick W. Westaway, E.J. Holmyard, John Dewey and Joseph Schwab. These are the ‘starting five’ scholars who seriously engaged with the HPS of their time and used the engagement to inform their educational

work. More lives and lessons drawn from them could be added – Thomas Huxley, Gerald Holton, Walter Jung, Arnold Arons, Martin Eger and Stephen Norris come immediately to mind. The eleven ‘Regional Studies’ chapters deal with the different trajectories of HPS-informed educational interventions in European, Asian, North America and Latin American countries; and the educational and political lessons learnt from these interventions. Again more countries could be added; beginning with France, Spain, Turkey, Finland and India where in each of which there has been significant engagement between HPS and national and provincial science education.

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.

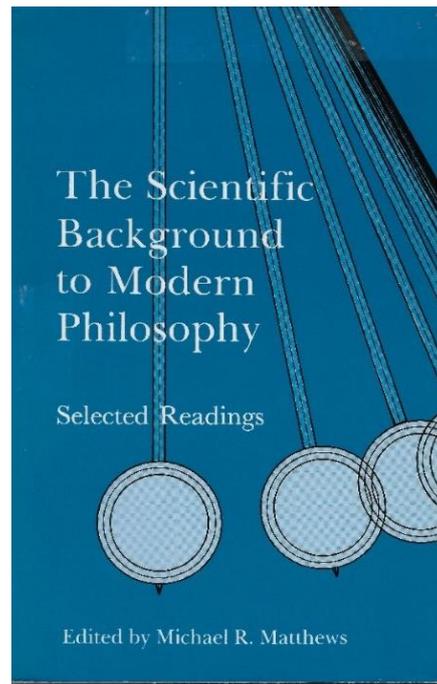
The Scientific Background of Modern Philosophy (1989)

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)

Pleasingly, after 30 years of constantly good sales, Hackett have invited me to edit an expanded version of the book dealing with the impacts of 18th and 19th century science on philosophy of the time.

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, Mausekopf & 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.

The proper relation between the history and philosophy of science is much debated, with experts disagreeing on just how necessary the former is for the latter. Hilary Putnam at one point exclaimed that the history of science is 'irrelevant' to the philosophy of science (Suppe 1977, p.437). Willard van Orman Quine had the same opinion. His influential epistemological corpus is devoid of any historical reference.

Conversely, some have maintained that philosophy is irrelevant to history of science. This is an impossible position. How do we identify the history of science without some philosophical presuppositions? How do we separate useful history of science from useless history of science without some prior conception of proper method? We need to know in advance of writing a history of science what will count as science; if we do not have such a view then we could presumably set off researching astrology, numerology and stamp collecting, rather than chemistry or geology.

As with many either/or questions, the answer lies somewhere between. The relationship between history of science and philosophy of science has to be interactive. There is ample evidence of history of science being written in the service of philosophical, political and religious commitments. It is notorious that Galileo has become a ‘Man for all philosophical seasons’ (Crombie 1981) with every methodologist seeing their own favoured methodology being followed by Galileo. Here history is at best cherry-picked, and the opportunity for history of science to refine or change philosophical commitments is lost. Thomas Kuhn's story of his philosophical transformation, occasioned by having to teach a Harvard General Education course on the history of science, is a well-known recent example where history transformed philosophy. Philosophy is required to begin writing history, but it should be capable of being transformed by historical study.

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 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.

On anyone's accounting, [George Berkeley](#) (1685-1753) was an exceptional scholar and philosopher. His still-read works *An Essay towards a New Theory of Vision*, *Principles of Human Knowledge* and *Three Dialogues between Hylas and Philonous* were all published before his 30th birthday; and his anti-Newtonian *De Motu* only a few years later. Berkeley's idealism, his phenomenalism, his opposition to Newtonian science, his theory of perception and ideas, are standard topics in beginning years of philosophy.

David Stove, at University of Sydney, used comment that: 'An undergraduate philosophy course without Berkeley is like a zoo without elephants'. David Armstrong wrote a book on *Berkeley's Theory of Vision* (Armstrong 1960) and edited a collection of his philosophical works (Armstrong 1965). Understandably, the Bishop featured in Armstrong's first year philosophy class at University of Sydney. Berkeley's arguments do not warrant cheering, but rather attention to their details, and ultimately to their fundamental weakness (Popper 1953/1963). And for science educators especially, attention to the roots of his opposition to Newtonian science.

Isaac Newton (1642-1727) was a realist in the tradition of Aristotle and Galileo. He proposed a mechanism (gravitational attraction) that moved the planets and that underwrote the celestial laws of planetary motion uncovered by Kepler, and the terrestrial laws discovered by Galileo. His realism underlies his insistence on the reality of absolute space and time in contradiction to those who maintain that only relative space and time exist, the space and time of our experience. In his Scholium on 'Space and Time', Newton says:

But because the parts of space cannot be seen, or distinguished from one another by our senses, therefore in their stead we use sensible measures of them. . . . And so, instead of absolute places and motions, we use relative ones; and that without any inconvenience in common affairs; but in philosophical disquisitions, we ought to abstract from our senses, and consider things themselves, distinct from what are only sensible measures of them. (Newton 1729/1934, p.8)

Newton was also a realist about forces: when a body accelerates, including moving steadily in an orbit, there was a *real* force acting upon it, something is making the body accelerate or change direction. Forces were not just mathematical conveniences or conventions useful in linking together successive locations of a moving body. Force was responsible for the body moving; it had the same ontological status as the body moved. Although, in free fall and planetary motion for instance, only the accelerating body could be seen, Newton believed that a real, unseen, force is responsible for the acceleration.

Famously, the mechanical philosophers Huygens and Leibniz rejected such forces; for them, forces only arose from contact, from the collision of bodies. In contrast, Newton remained realistic about these non-contact forces; for him, force is a theoretical construct postulated to explain observational occurrences (Cohen 2002).

Berkeley, in his 1721 *De Motu*, developed this empiricist critique of the reality of gravitational attraction, but in addition he argued against the reality of forces more generally, writing:

Force, gravity, attraction and similar terms are convenient for purposes of reasoning and for computations of motion and of moving bodies, but not for the understanding of the nature of motion itself. (Berkeley 1721/1901, p.506)

This is an extension of his earlier 1710 *Principles of Human Knowledge* idealist argument for the non-reality of extrasensory existence. There he had said:

All the choir of heaven and furniture of the earth, in a word all those bodies which compose the mighty frame of the world, have not any subsistence without a mind - that their *being* is *to be perceived* or known . . . let anyone consider those arguments which are thought manifestly to prove that colours and tastes exist *only* in the mind, and he shall find they may with equal force be brought to prove the same thing of extension, figure, and motion. (Berkeley 1710/1962, pp.67-71)

If you have not studied philosophy, then Berkeley is certainly a novel and engaging figure. Countless senior, and not so senior, science educators along with graduate students, followed von Glasersfeld's Berkeley-paved 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)

In the early 1990s an Editorial in *The Journal of Teacher Education* announced that:

Constructivism is the new rallying theme in education. Its popularity derives from its origins in a variety of disciplines, notably philosophy of science, psychology, and sociology. The implications of a constructivist perspective for education differ depending on its disciplinary foundation, but professional education groups as diverse as the National Association for the Education of Young Children and the National Council of Teachers of Mathematics have based revisions of their standards for practice on the constructivist assumption that learners do not passively absorb knowledge but rather construct it from their experiences. (Ashton 1992, p. 322)

In a review article at the time, Peter Fensham claimed that: 'The most conspicuous psychological influence on curriculum thinking in science since 1980 has been the constructivist view of learning' (Fensham 1992, p. 801). A former president of the US National Association for Research in Science Teaching (NARST) wrote:

A unification of thinking, research, curriculum development, and teacher education appears to now be occurring under the theme of constructivism ... there is a lack of polarised debate. (Yeany 1991, p.1).

Dick Yeany was correct; there was no debate about constructivism at science education conferences or in the literature. At one conference, someone commented: 'if "constructivism" is not in the title, your paper does not get on the programme'. A particular worry was the near unanimous assumption that constructivism had triumphed in philosophy. When adherents were pressed, they would look quizzed and say: 'but haven't you heard of Thomas Kuhn?' or 'Don't you know that positivism is dead?'

Wolff-Michael Roth casually wrote:

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)

The ease with which one of the two most prominent (the other being Ken Tobin) constructivists could say that the position was ‘the most mature epistemological commitment’ and so dismiss Suchting, Shimony, Wartofsky, Cohen, Ruse, Nola, Slezak and a roll-call of committed and informed realists, indeed most scientists, as ‘immature’ - was staggering. The more so as Roth frankly admits to having never completed any philosophy courses; physics and education, yes, philosophy, no. But his audience knew no better; with some exceptions, the science education community has been untouched and un-informed by serious philosophy. A point well captured by Rick Duschl in the title of his influential paper of nearly 30 years ago: ‘Science Education and Philosophy of Science: Twenty-five, Years of Mutually Exclusive Development’ (Duschl 1985).

As the Constructivist tide rose, it progressively occupied more and more educational, philosophical and cultural space. Although constructivism began with Piaget, Vygotsky and Bruner as a theory of learning and hence a moderately limited psychological theory it fairly quickly became a theory of teaching, a theory of education, a theory of the origin of ideas, and a theory of both personal knowledge and scientific knowledge. It became education’s answer to physics’ ‘Grand Unified Theory’.

Ken Tobin, perhaps the joint-leading international constructivist wrote:

To become a constructivist is to use constructivism as a referent for thoughts and actions. That is to say when thinking or acting, beliefs associated with constructivism assume a higher value than other beliefs. For a variety of reasons, the process is not easy. (Tobin 1991, p. 1)

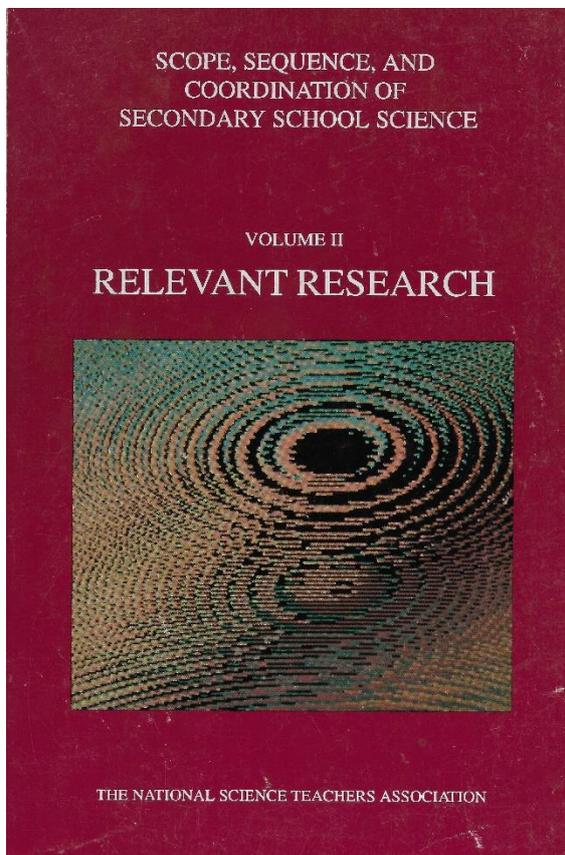
In Tobin’s formulation, Constructivism becomes an ideology. In the fore-going statement ‘constructivism’ can be replaced with ‘communism’, ‘Catholicism’, ‘Islam’, ‘Liberalism’ and most other isms without any necessity to change the structure of the statement.

I felt such views had to be contested; a polarised debate was called for; graduate students and junior staff should not see such views go unchallenged. I made beginning efforts at the 1989 NARST conference, and more effort subsequently.

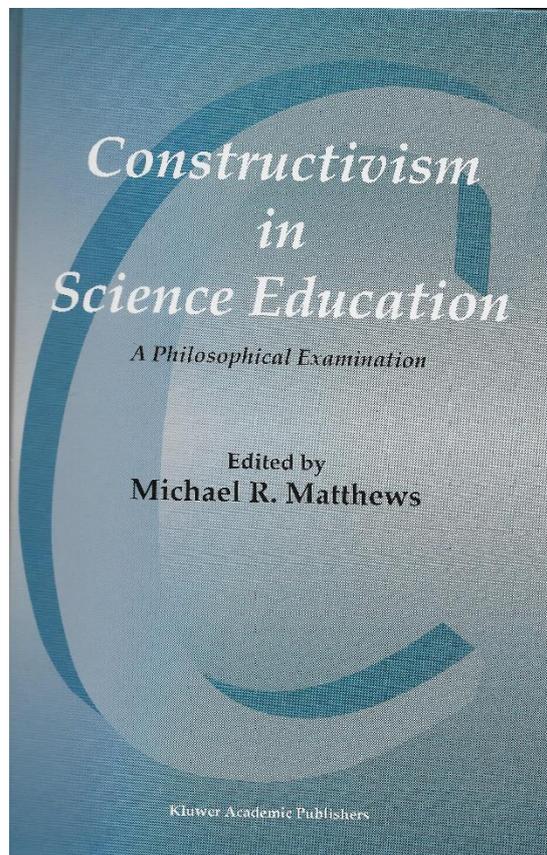
I gave my first anti-constructivist paper at the USA PES conference in 1992, modestly titled ‘Old Wine in New Bottles: A Problem with Constructivist Epistemology’ (Matthews 1993). Denis Phillips, an Australian biology teacher and philosopher of education who moved to Stanford University in the early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

Efficacy of Constructivist Teaching

Initially my concern was with the theory or philosophy of constructivism, I did not attend to constructivist pedagogy or its effectiveness when employed in teaching science. 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? It was a much later family experience that drew my attention to the efficacy, or otherwise, of constructivist pedagogy.

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, with our daughters, 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 endorse 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. It was a significant step for me, and also for New Zealand as this was the country's first professorship in science education. The university handsomely supported the position with a full-time secretary/researcher, library space, offices, and a dedicated fund that I controlled to support visiting lecturers and scholars. Being cautious, I took leave from UNSW when taking up the Auckland position. This suited the UNSW School of Education as it effectively kept a position on its books, without costing it anything. As will be detailed below, my caution was wise.

Going to Auckland brought me into immediate contact with New Zealand's Philosophy of Education Society of Australasia (PESA) colleagues Jim Marshall, Michael Peters, Ivan Snook, Colin Lankshear and others. 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. In a comparable fashion, Henry Giroux, a critical theorist much admired among New Zealand educators, and who I had met at Boston University in 1978 when he was a faculty member of the School of Education, wrote and managed to 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 about equality, a fair society, and the need to respect different opinions, but he is not succeeding. That someone of his education and standing cannot write clearly is a mark against the profession.

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, a problem extending far beyond the shores of New Zealand, is that such obscure, if not unintelligible, writing has become the norm in education programmes. Incomprehensibility - ‘educobabble’ - is becoming the disciplinary 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, in an article on ‘The Crisis of Readership in the History 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, pp.239-240)

Isaiah Berlin (1909-1997) lamented:

Pretentious rhetoric, deliberate or compulsive obscurity or vagueness, metaphysical patter studded with irrelevant or misleading allusions to (at best) half-understood scientific or philosophical theories or to famous names, is an old, but at present particularly prevalent, device for concealing poverty of thought or muddle, and sometimes perilously near a confidence trick. (Berlin 2000, p.221)

George Orwell, 75 years ago, well nailed the problem:

[language] becomes ugly and inaccurate because our thoughts are foolish, but the slovenliness of our language makes it easier for us to have foolish thoughts. ... to think clearly is a necessary first step towards political regeneration: so that the fight against bad English is not frivolous and is not the exclusive concern of professional writers. (Orwell, 1945, in Locke *et al.*, 1962, p.126)

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. When signing in, all those enrolled received one sticker that they could put on any book in the publisher’s display. I thought I would have missed all the best books. It was revealing that the only two books out of perhaps 200 not ‘ticketed’ for later collection 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's Science and Mathematics Education Research Group (SMER) was the beating heart of the constructivist operation. Academics there, notably Beverley Bell, had studied at, and been mesmerised by, the then powerful Leeds University Science Education Department headed by the late Rosalind Driver.

The Waikato group had brought the true constructivist 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's Education Unit, in order to have control over the nation's science education. This they did. A key element was their government funded Learning in Science Programme (LISP).

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, in a popular publication, that 'the criterion for truth lies in each of us'. Just a moments 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 and constructivist, 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)

Grayson Wheatley, a prominent US mathematics educator and constructivist, unapologetically and clearly states the idealist position:

From a constructivist perspective, knowledge originates in the learner's activity performed on *objects*. But objects do not lie around ready made in the world but are mental constructs. (Wheatley 1991, p.10)

Charitably, these statements might be seen as just lazy writing; neither Staver nor Wheatley can literally mean what they say. Clearly there are no observations, data or theories without observers; nor named objects 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). Heart surgeons cannot work in a lazy and casual way, nor should academics so write.

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 Opinion Piece to the newspaper titled 'Curriculum Reform Degrades Sciences' (*NZH*, 26 August 1993). This article was reproduced the same year in Christchurch's *The Press* (27 September 1993), and Wellington's *The Dominion* (12 October 1993). Though written thirty years ago, I still stand by each of its claims. Different of the claims and related arguments were developed in my subsequent writing.

The *New Zealand Herald* has done a valuable service to the country in publishing the recent articles of Martin Hanson (10 August) and Max Thomson (18 August) on the sorry state of New Zealand science education 'reforms' and the associated changes to school assessment procedures. Hanson and Thomson are right in suggesting that the country is being led into an educational and scientific abyss.

However neither author has identified the doctrinal engine powering the supposed reforms: this is the theory of Constructivism which has been enthusiastically embraced by the official science education establishment in New Zealand. The country is small and thus, unfortunately, only a few key people need convert to a loony doctrine for it to have national influence.

These are exceedingly contentious claims. Not just contentious but many, myself included, would say down-right silly. The mystery is that there seems to have been no criticism of officialdom's wrapping of itself, and New Zealand's science education, in this Constructivist cloak.

The Draft Forms 1-5 Science Syllabus was explicitly based on Constructivist principles. So also is the 1993 Science in the National Curriculum statement. The refrain 'children construct their own knowledge' is repeated mantra-like in these documents. But like most mantras the meaning of the refrain is never examined or defended.

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.

The same document lists a number of possible learning experiences that are supposed to develop the above version of scientific thinking. These include asking questions about the observed changes during the cooking of pikelets, clarifying ideas on an environmental issue, clarifying ideas about what an animal is, guessing the reason for the distribution of crabs on a rocky shore.

This is scientific thinking made easy, it is scientific thinking without the hard work of conceptual mastery.

One fears for students subjected to this regime. The only opportunity most of them will have to be introduced to the hard-won, culturally significant, world of scientific thought and its disciplines will have been squandered. Scientific thinking is so degraded in the official documents that anything counts as science. Unfortunately for New Zealand students, most of the world, including the best research institutes, do not share this delusion.

Along with this degrading of the subject matter of science, or ‘dumbing of the curriculum’ as Thomson and Hanson call it, goes a degrading of the profession of teaching. Constructivism fundamentally asserts that knowledge has to be individually constructed, the transmission of knowledge is in principle ruled out.

The Draft Forms 1-5 Syllabus devotes one page to ‘the role of the teacher’. Included in its ten-part characterisation of the teacher’s role are: ensuring equity for all students, creating a friendly learning environment, listening to students, ensuring students communicate, challenging sensitively the ideas of students and providing resources. A teacher’s role is to do everything but teach; instead of teachers we now have facilitators.

This democratising of the teaching profession might give many a warm feeling, but soon the economic penny will drop: if teachers are just facilitators, then why spend money ensuring they have a science degree, and why pay them high salaries when lots of good but untrained people could equally listen, encourage, support, provide, and challenge students.

What replaces truth and knowledge in constructivist wonderland is ‘making sense’. The draft syllabus says that ‘Science is about people exploring and investigating their biological, physical, and technical worlds, and making sense of them in logical and creative ways’.

The curriculum opens with a restatement of this sensism doctrine. ‘Sensism’ appears in nearly all Ministry documents relating to science education.

I believe this is a fundamentally erroneous and dangerous conception of the nature and goals of science: science does not strive to make sense of the world, it strives to find out the truth about the world. These truths when found, normally do not make obvious sense; rather they require the overturn and reconstitution of common sense. As many people have observed, if it makes sense it is probably not scientific.

Most scientific advances have entailed commitment to propositions that literally defied sense – Copernicus’s rotating earth, Galileo’s point masses and colourless bodies, Newton’s inertial systems that in principle cannot be experienced, Darwin’s gradualist evolutionary assumptions so at odds with the fossil record, Einstein’s mass-energy equivalence etc.

Constructivist and relativist ideas have unhappy consequences for culture and social life that are seldom examined. It is notorious that people have for centuries thought that the grossest injustices, and the greatest evils, have all made sense.

The subjection of women to men has, and still does, make perfectly good sense to millions of people and to scores of societies; explaining illness in terms of possession by evil spirits

makes perfectly good sense to countless millions; the intellectual inferiority of particular races is perfectly sensible to millions of people including some of the most advanced thinkers. It is clear that the appeal to sense is not going to be sufficient to refute such views; but the appeal to truth which is independent of human desires or power, may be able to overturn such opinions.

Science, and science education, can play a powerful role in the general improvement of culture. But it can only do this if it is seen as seeking the truth about the world, and as being partially successful in its efforts. It can play its much-needed role if it inculcates an attitude of humility before the world: The world judges our claims to knowledge of it, we cannot just construct whatever suits our fancy, our interests, or our culture, and call it knowledge.

The controversy – ‘Professors Divided’ - was picked up in radio interviews, and many newspaper feature-writers up and down the country contributed their bit.

There was a lot at stake. Beverley Bell and other Waikato staff confidently said:

In taking into account the findings of the Learning in Science Projects [LISP], most teachers are challenged to change their implicit theories of students, schools, how children learn, the nature of knowing and knowledge, and the implications of these for teaching and learning activities in their classrooms. (Bell, Kirkwood and Pearson, 1990, p.32)

The extent to which New Zealand constructivism had blossomed beyond its initial concern with children’s learning could be seen in an article by Beverley Bell, which made immodest pronouncements upon: ‘A constructivist view of learning’, ‘A constructivist view of teaching’, ‘A view of science’, ‘Aims of science education’, ‘A constructivist view of curriculum’ and ‘A constructivist view of curriculum development’ – to quote just the sub-headings of the single article (Bell, 1991).

The LISP project picks out the critical theorists Michael Apple, Stanley Aronowitz and Henry Giroux as being particularly important thinkers. Apple’s first book *Ideology and Curriculum* (Apple 1979) had great merit; subsequent books, less merit. Giroux has been cited above as an exemplar of ‘should do better’ writing. Jane Gilbert, a Waikato University constructivist, had correctly drawn attention to the ‘many parallels between the literature on the development of critical pedagogy [and] the literature on constructivist learning’ (Gilbert, 1993, p.35). And she rejoiced that:

Critical theorists question the value of such concepts as individualism, efficiency, rationality and objectivity, and the forms of curriculum and pedagogy that have developed from these concepts. (Gilbert, 1993, p.20).

When university educators proclaim that rationality and objectivity are, *per se*, undesirable, then there truly has been a profound change in the educational climate; and one that prefigures a profound change for the worst in New Zealand culture, and the cultures of any other society adopting such educational programmes. It is difficult enough to separate Fake News from Genuine News; it is more difficult, if not impossible, to make the separation when the very idea of objectivity and rationality is abandoned. This deleterious cultural consequence was well recognised sixty years ago by Karl Popper when he wrote:

The belief of a liberal - the belief in the possibility of a rule of law, of equal justice, of fundamental rights, and a free society - can easily survive the recognition that judges are not omniscient and may make mistakes about facts. . . . But the belief in the possibility of a rule

of law, of justice, and of freedom, can hardly survive the acceptance of an epistemology which teaches that there are no objective facts; not merely in this particular case, but in any other case. (Popper 1963, p.5)

But critical theorists and constructivists have been relaxed and comfortable about denying not just knowledge of reality and the existence of facts but have ‘officially’ embraced a ‘many truths’, that is thoroughly relativist, epistemology.

One participant in the fourth LISP project on Teacher Development spoke of her understanding of teaching prior to exposure to Waikato constructivism:

... those teachers I thought were effective at school were those who seemed ... very knowledgeable and put it across in the form that I could understand. And so I always strived in my teaching to try and put things across in a nicely structured form that made sense and had easily followed steps. I thought that was what a good teacher was. (Bell, 1992, p.7)

She was in for a surprise.

It so happened that the very public 1993 debate that I was involved in, was an amplification and re-run of a comparable 1989 debate occasioned by the preparation of the *Draft Forms 1-5 Science Curriculum* which had also been overseen by the Centre for Science and Mathematics Education Research at the University of Waikato. Beverley Bell, who directed the development of the draft, acknowledged that ‘my promotion of the constructivist view of learning and of the curriculum is well known’ (Bell, 1986, p.9).

Unfortunately, the 1989 debate was contained within ‘official channels’ and surfaced publicly only in provincial papers: it did not engage a wide cross-section of the country; it happened under the public radar. It did, however, raise substantial educational and philosophical concerns that were still unresolved four years later.

The Education Committee of the Royal Society of New Zealand commented adversely upon the 1989 *Draft*. The Society said of the *Draft's* definition of science, that:

Science is based on observation, organisation of observations, and devising explanations. It is regrettable that there is no emphasis on the need to learn how to reason scientifically. It is not an innate process, but one that we struggle to acquire through learning. (Wells, 1989, p.3)

Of the *Draft's* purported aims of science education, the Royal Society said:

The aim of ‘making better sense of their world’ is judgemental and should be replaced by ‘achieve a better understanding of their world’. (Wells, 1989, p.4)

Of the section on Girls and Science, the Society commented that:

This section is offensive to many scientists, including women. It is a sexist connotation that girls do not understand disciplines such as physics. (Wells, 1989, p.6)

About the Learning in Science section, the Society observed:

This section appears to be written for educationalists and is almost unintelligible to scientists. In most areas of science there are right answers and the authors should not encourage erroneous views. ... Little science can be learned by *watching* a laser show. (Wells, 1989, p.6)

Concerning the Role of the Teacher section, the Society noted that:

Listed are all the aspects of teaching that *any* good teacher has. ... [however] the duty of a teacher is to be knowledgeable in what he or she teaches. Most scientists believe that teachers do not have the scientific knowledge to do the job. The deficit in, for example physics, is cause for real concern. (Wells, 1989, p.7)

On the important matter of Maori Science, the Society asked:

Do the authors really claim that an alternative body of science (Maori Science) exists, is documented, is available to be taught as an alternative to Western science, and that the Department of Education has the people, knowledge, skills, and resources to teach this as an alternative? (Wells, 1989, p.1)

And on this matter the Society believed that:

The general tones in the syllabus are condescending and insulting. The statement, 'Maori people do not see science as something separated from everyday skills, knowledge, attitudes, and values' reflects a child's holistic view. ... We do not want to introduce mysticism into science, but try to teach a base for science. (Wells, 1989, p.5)

Dr Gwen Struik, a marine biologist, ecologist, school teacher, university lecturer, member of the Nelson Education Board, and incidentally daughter of the renown Marxist historian of mathematics, and member of the Government's Syllabus Advisory Committee, made submissions in 1988 and 1989 on the *Draft* syllabus, saying, among other things:

Science is NOT about 'growing plants', 'making toffee', 'making concrete' etc. All these examples are technology or hobbies, not science. They could be introductory to a science activity, but only if they are linked into an investigation which asks questions, hypothesises, organises and makes a logical summary. ... Science is NOT about 'people' – there are other disciplines which specialise in people, eg. social studies, history. (Struik, 1989a, p. 3)

In one submission of May 1989 Struik wrote:

I continue to be very unhappy with it [the draft document] for many of the reasons I outlined in my August 1988 letter ... The total impact of page 7 is one long trivialisation of science, as in paragraph 4 'We are all scientists'. This is not true. Scientists are those who contribute to scientific knowledge. Would you say everyone who made a noise is a musician? ... Scientific knowledge can be gained by non-professionals, but such knowledge becomes science only when it is incorporated by formal and recognised methods. (Struik, 1989b)

After three years of frustration, and having numerous submissions ignored, she resigned from the Syllabus Advisory Committee.

Dr Warwick Don, a senior lecturer in Zoology at the University of Otago, made a submission criticising, among other things, the *Draft's* statement that 'Teachers need, in their teaching and learning activities, to acknowledge the beliefs, values and heritage of Maori students'. He wrote:

... science is conducted irrespective of the cultural milieu of its participants. The recognition of any 'cultural context' in a science syllabus only introduces an irrelevance which will

inevitably distort and could even destroy the very fabric of science education. Lysenkoism [in the former USSR] and ‘scientific creationism’ graphically illustrate what can happen when non-scientific ingredients permeate the process. (Don, 1989)

And concluded:

It is most regrettable that for the sake of satisfying certain political or social requirements, the integrity of science education at Forms 1-5 level is being compromised. An aim of science education is surely to produce an informed student body, not add to the high level of misunderstanding already rife in the community where science is concerned. (Don, 1989)

Professor Jack Dodd, the national president of the Royal Society, said in a statement to the Society, that:

Parts of the draft can only be written by people who do not understand what science is, let alone what science is about ... there are patronising remarks about Maori and girls ... science is universal. The observations and laws are the same whether you live here or on the moon ... whether you are male or female, rich or poor, Jew or Gentile, black or white, Maori or Pakeha [non-Maori, whether European or Asian]. (Dobson, 1989)

The important questions about what was labelled ‘Maori science’ were not resolved in 1989 and remained unresolved in 1992 when I arrived in Auckland. An item on the first Faculty of Arts meeting I attended was a motion to have completion of the Anthropology Department’s ‘Maori Science’ course meet the ‘one science course’ requirement for trainee primary teachers. The motion brought the educational, cultural and philosophical issues into clear focus. I argued that the Anthropology course was of great importance in New Zealand, but it was not science. Further, that course could itself be made compulsory along with having also to complete a science subject, but the latter was crucial. My arguments failed to convince and the motion was carried. Thereafter both Maori and Pakeha primary teachers need not have completed any science subject in their degree. A travesty for New Zealand primary education, and beyond.

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 (Maori science) in their research. There are Australian and Canadian equivalents of this policy. A 2020 advertisement for a lecturer in Zoology at Otago University requires:

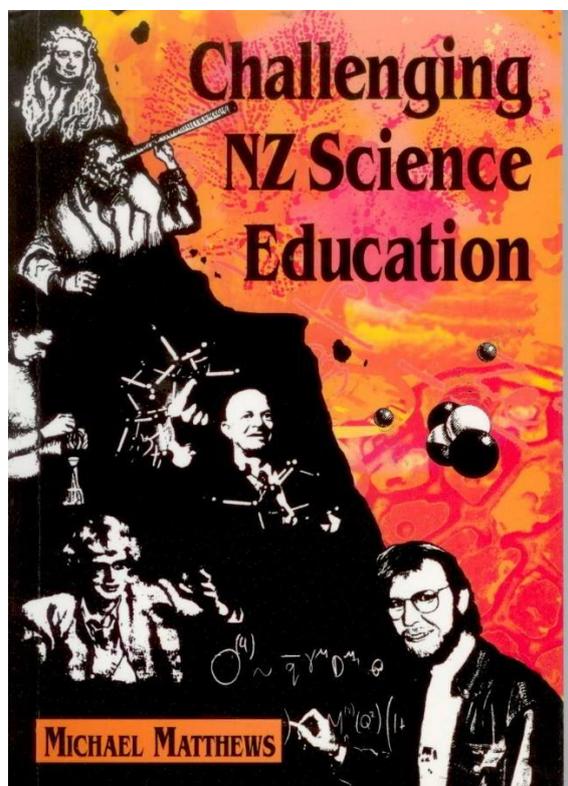
advancing Mātauranga Māori/Te Ao Māori perspectives in the study of Zoology with the position affording an exciting opportunity for an emerging scholar to research and teach from a kaupapa Māori perspective (Corballis, Rata & Nola 2020).

Such acceptance of Maori science as being science is now just part of mainstream New Zealand thinking, all the way up to university departments of zoology. It is not remarked upon. A comparable advertisement in a state university in Tennessee giving preference for someone who could incorporate Creationist Science into their biology classes would surely draw attention, if not immediate outrage. New Zealand is closer to Pakistan, Turkey, Indonesia and other Muslim countries where such advertisements seeking staff who can incorporate Koranic Science into their classes are not remarked upon, except by the minority of liberals who believe that culture and politics should be kept out of scientific research, decision making and teaching.

At the end of 1993 the UNSW School of Education wanted to ‘cash in’ their held-vacant staff position. I had the alternative of continuing on with my struggles in New Zealand or returning to Australia. I chose the latter.

I wrote up the New Zealand episode 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)

Of lasting value to wider HPS&ST research community, was the contact I made with Robert Nola the Auckland philosopher of science who joined in the local debates, contributed to public meetings, and who has since been a regular contributor to IHPST conferences and to *Science & Education* journal during my editorship (Nola 1997, 2000, 2003, 2004; Irzik & Nola 2011). All of his papers are model examples of how philosophers of science can productively engage with, and inform discussion and research in, science education.

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

A milestone in my own development was a contract offered by Israel Scheffler to write a book for his Routledge ‘Philosophy of Education Research Library’ series. In 1989, in the process of organising the Tallahassee conference, I met Scheffler at Harvard and finalised the contract. It was consciously a cross-over book between philosophy of education and science education.

The book’s title was *Science Teaching: The Role of History and Philosophy of Science*. I spent four years extensively 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 book gave a brief history of efforts to engage HPS in science teaching; it pointed to contemporary theoretical issues engaging science teachers and that

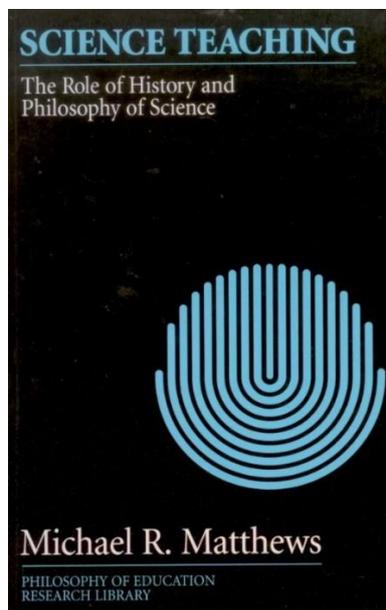
required HPS for their illumination (constructivism, multiculturalism and religion); it indicated how curriculum and pedagogy in certain areas (air pressure and pendulum motion) might be better served by attention to the relevant history and philosophy of the topics. It had 700 references, which reflected 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:

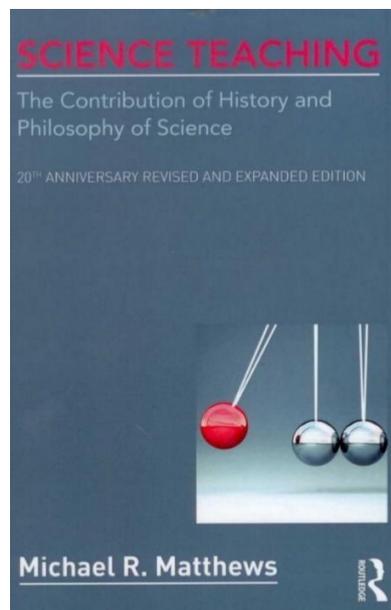
For all its faults, the scientific tradition has promoted rationality, critical thinking and objectivity. It instils a concern for evidence, and for having ideas judged not by personal or social interest, but by how the world is; a sense of ‘Cosmic Piety’, as Bertrand Russell called it. These values 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. On account of sales and citation, [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.



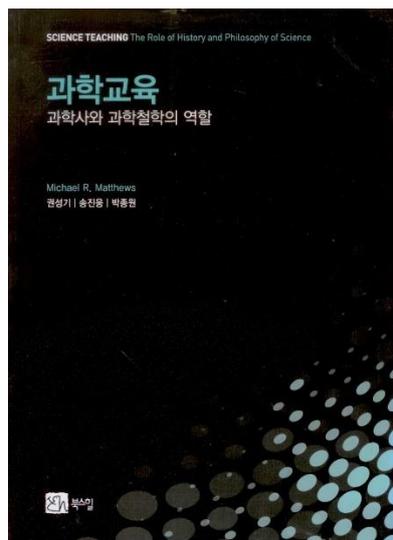
Science Teaching (1994)



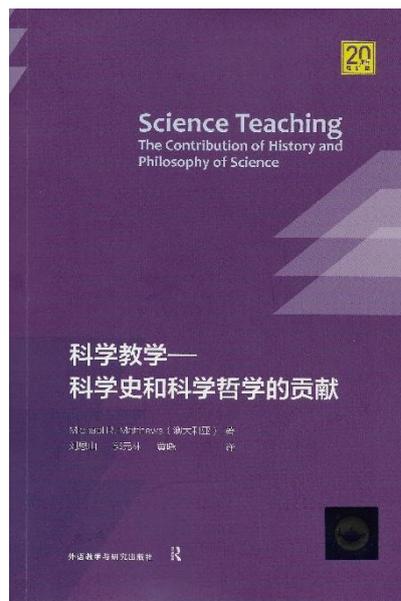
Science Teaching (2015)



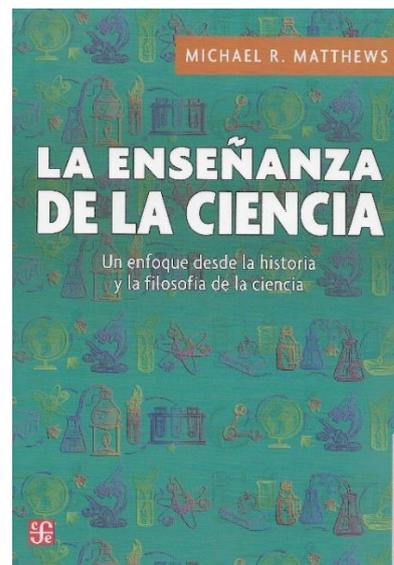
Turkish edition (2017)



Korean edition (2014)



Chinese edition (2017)



Spanish edition (2017)

The basic conviction of the book was that there are many fundamental philosophical issues raised by science that can also be raised with students in science classrooms. Pleasingly philosophy does not have to be brought into science classrooms as it is already there; it just needs to be identified and discussed in a way whereby students can themselves begin to appreciate the philosophical dimension of science and to take beginning steps in thinking philosophically; philosophy is not an added burden for teachers, it is part of the subject they teach.

Any philosophy of science textbook, anthology or encyclopedia will, for example, have chapters on: theory change, experimentation, idealisation, scientific revolutions, laws, reduction, metaphor, analogy, models, causation, explanation, values, methodology, observation, truth, approximate truth, and so on. These philosophical features can be identified and elaborated in the classroom when teaching routine topics such as evolution, genetics, oxidation, mechanics, relativity, electricity, palaeontology, photosynthesis and so on. The features or aspects can appropriately be pointed to when students make inquiries, conduct experiments, collect data, propose and appraise hypotheses, and so on.

Likewise, philosophy is present in most of the theoretical issues that engage teachers, curriculum writers and administrators: religion, multiculturalism, pseudoscience, discipline structure and so on. One such theoretical issue, constructivism, has already been discussed. That issue leads naturally into discussion of a central philosophical topic that has echoed through the history of science, and that bears significantly upon what is taught about the nature of science: namely, the debate between realists and anti-realists over the aims of science and the reality and knowability of theoretical entities postulated in scientific theories.

The book, in some detail, elaborated the fundamental arguments between realism and antirealism illustrating them from episodes in the history of science that are commonly found in science curricula: Copernicus and the heliocentric solar system, Newton and gravitation, phlogistic account of combustion, genetic mechanisms for evolution, and others.

The basic realist conviction is that the world and our knowledge of it are two different things; how we learn about something and the thing itself are not identical. Man is not the measure

of all things, as Protagoras might not have said. There are a variety of realisms (Agazzi 2017) but they share the following commitments:

- * An *ontological* commitment to the reality and independence of the world; external things and events, including unobservable and inferred entities, exist independently of cognising subjects.
- * A *semantic* commitment to the linkage of scientific claims to external things and events; science makes claims about the world.
- * An *epistemological* commitment; namely that science has made some truthful, or approximately truthful, claims about entities and processes in both the observed and unobserved world. The observed or experienced world being the everyday world revealed by ordinary vision (billiard balls, fish, clouds, etc.), the unobserved world is that indicated by instruments and about which inferences are made (molecules, atoms, magnetic fields, proteins, gravity waves, etc.).
- * An *axiological* commitment that the aim and purpose of science is to produce statements and theories about the world that are true; other purposes such as utility, economic gain, professional advancement or national pride - are secondary, or merely by-products of truthfulness.

Counterwise there is a family of anti-realist positions that are united by their rejection, sometimes for different reasons, of one or all of the realist's ontological, semantic, epistemological and axiological claims. The anti-realist family includes positivism, empiricism, instrumentalism, constructivism, constructive empiricism, idealism and of course the whole gamut of postmodernisms.

Anti-realists believe that scientific knowledge is confined to the world of experience or sensory phenomena; that any postulated theoretical entities that go beyond such experience have to be treated only as aids, tools, models or heuristic devices for coordinating sensory or observable phenomena, but they do not have any existence. And further, the aim of science is to produce theories that predict phenomena and connect them economically - usually mathematically - to items of experience.

The three most powerful arguments that empiricists urge against realists are: first, the 'idleness' argument; second, the 'graveyard' argument; and third, the 'underdetermination' argument. Arguably Larry Laudan (1984) and Bas van Fraassen (1980) have provided the most wide-ranging critiques of realism, while van Fraassen has given the most sophisticated restatement of empiricism and instrumentalism as a viable philosophy of science. Van Fraassen says that:

To be an empiricist is to withhold belief in anything that goes beyond the actual, observable phenomena, and to recognize no objective modality in nature . . . [it] involves throughout a resolute rejection of the demand for an explanation of the regularities in the observable course of nature, by means of truths concerning a reality beyond what is actual and observable. (Fraassen 1980, p.202)

The first 'idleness' argument was stated by Mach and was succinctly expressed by Carl Hempel (1905-1997) in his famous paper 'The Theoretician's Dilemma' (Hempel 1958). Hempel states that empiricists (Braithwaite, Carnap, Feigl and others) regarded all scientific terms as belonging to either of two realms; the observable or the theoretical. The function of theories was to deductively explain or inductively enjoin observations, so that given one set of observations a second set could be predicted. Realists believed that these explanations

worked because of connections in the world between the theoretical entities and processes they postulated and visible events. The postulated theoretical entities behaved in a lawlike manner (hence excluding angels and spirits from the class of scientific theoretical entities). After quoting the behaviorists Hull and Skinner on the subject, he then poses the theoretician's dilemma as follows:

If the terms and principles of a theory serve their purpose they are unnecessary . . . if they do not serve their purpose they are surely unnecessary. But given any theory, its terms and principles either serve their purpose or they do not. Hence the terms and principles of any theory are unnecessary. (Hempel 1958/1965, p.186)

The theoretical terms – ‘force’, ‘field’, ‘caloric’, ‘intelligence’, ‘class’, ‘gene’ and so on – occupy scientific space but pay no rent. After due elaboration, Hempel criticises and rejects this argument saying that the supposed observational bed-rock is ‘a fiction’ (Hempel 1963, p.701); and that as well as deductive explanations of phenomena, theories have to provide for inductive expansion of claims and this cannot be done using just observational terms (Hempel 1963, p.700).

The second ‘graveyard’ argument against realism has traditionally been most convincing. It was given sharp formulation by Larry Laudan (Laudan 1984) who points out that the history of science is littered with discarded theoretical entities which earlier were firmly ensconced in the best and most successful science of their time – crystalline spheres, caloric, phlogiston, humors, the ether, and so on – all these theoretical terms were assumed to be referential. It turns out they were not. And Laudan adds that there is no reason to think that our best current candidates for truth will have a different fate. This is his widely-endorsed ‘pessimistic meta-induction’ (PMI) argument against realism (Laudan 1984).

The third ‘underdetermination’ argument appeals to the fact that theoretical terms are always underdetermined by the evidence available, and consequently the same evidence will also support other extant or potential, theoretical entities. So the evidence provides no special basis for any particular referential claim.

In the book, marshalling the work of authors such as Boyd (1984), Hooker (1985, 1987), McMullin (1984), Musgrave (1996), Psillos (1999), Schlager (1986) and Snyder (2005), I offered defences against the empiricist arguments outlined above, and the thrust of these can be readily understood and utilised in classroom discussion and elaborations. One widely endorsed defence is Hilary Putnam’s ‘no miracles’ argument:

The positive argument for realism is that it is the only philosophy that doesn’t make the success of science a miracle . . . [realism] is part of any adequate scientific description of science and its relations to its objects. (Putnam 1975, p.73)

Laudan’s Pessimistic Meta-Induction (PMI) can be countered. First, by making burial conditions more stringent, and hence reducing the number of tombs in the scientific graveyard; not just any old discarded theory is allowed burial, but only well confirmed theories whose confirmation came from prediction of novel facts. Empirical adequacy is not just passive agreement with facts or phenomena - astrology and natural theology are both capable of that – but to be buried in the scientific section of the cemetery requires that the theory has made novel confirmed predictions that result from its recourse to its postulated theoretical entities. This step thins out the number of graves on which to base the pessimistic induction.

Second, by checking whether the buried theories are indeed dead. The realist assuredly needs to acknowledge theory change even for substantial and successful theories. But it is always an open question as to what degree the new theory retains elements or entities from the old theory it replaced. To the degree in which there is continuity in theory change, then to that degree the grounds for PMI are further diminished (Cordero 2013).

Fresnel's theory of light warranted burial in the scientific cemetery (it was widely endorsed, successful and made confirmed predictions), but although buried, parts of the theory did live on and inform subsequent nineteenth century optics so it could be exhumed and not take up so much cemetery space. Laudan has an argument, but it is not the lay down *misère* that it is oft taken to be.

Ian Hacking (1983) has cautioned that if science is conceived as simply a representation of the world, then the empiricist arguments are so strong that realism has no satisfactory reply; realism has to look to new forms of justification. He finds these in the success of scientific intervention and experimentation; a sort of pragmatic, but not utilitarian, justification of realism. On the reality of electrons, Hacking endorsed a scientist's observation: 'So far as I'm concerned, if you can spray them, then they are real' (Hacking 1983, p.23). Hacking provides philosophical support for this practitioner's intuition.

Allan Franklin, a philosophically informed physicist, also argues that the on-going success of experimental practice confirms modest realism:

Supporting a realist position does not, however, mean that I believe in either the absolute truth of the laws or in the 'real' existence of the entities. It means only that I think we have good reasons for believing in the truth of the laws and in the existence of the entities. (Franklin 1999, p.160)

The modest realism that I supported in the book maintains that:

- * Theoretical terms in a science *attempt* to refer to some reality.
- * Scientific theories are to whatever degree successful in their attempts at reference.
- * Scientific progress, in at least mature sciences, is due to their being increasingly true.
- * The natural world that science investigates is independent of our thoughts and our minds.

Pendulum Studies (1995-2005)

In 1994, returning to UNSW from Auckland, I was able to turn back to my Shimony-inspired pendulum studies. Utilising the wonderful resources of the UNSW library (in the days before everything was available on-line), I wrote a comprehensive book on the history, philosophy and pedagogy of pendulum motion. The book - [*Time for Science Education: How the History and Philosophy of Pendulum Motion can Contribute to Science Literacy*](#) - had 1,300 references and was published in 2000. All references were available in the wonderful UNSW library, and without the relentless pressure to publish, I was able to read them all. It is often asked: How could 1,300 papers be written about the pendulum? The answer I give is: 'read the book and see'.

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 significance 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 a science education course. There is a lesson to be drawn from this.

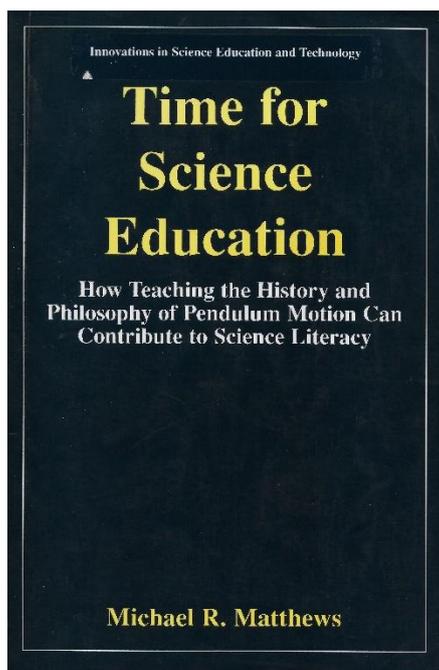
International Pendulum Project

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* (2004 [Vol.13 nos.4-5](#), and [Vol.13 nos. 7-8](#)) and on two conferences held at UNSW in 2002 and 2005. These activities and publications resulted in 2005 in a 31-chapter, 540-page anthology co-edited with Colin Gauld and the late [Art Stinner](#) (1934-2014) ([*The Pendulum: Historical, Philosophical and Pedagogical Dimensions*](#)).

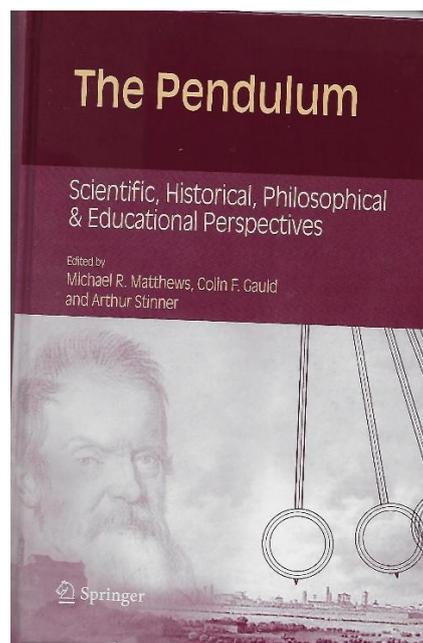
Colin had graduated with a PhD in physics, then became a school science teacher, lecturer in science education at UNSW, a science education researcher, and chief examiner for physics in the NSW Education Department. He published significant research on history of physics and physics pedagogy (Gauld 1998, 2014).

Art was a professor of science education at the University of Manitoba where he inspired a vigorous HPS&ST research programme. He received his early education in Hungary and Germany, and his secondary and university education in Canada. He took undergraduate degrees in physics, modern languages and education, an MSc in physics, and a PhD in science education from the University of Toronto supervised by Ian Winchester. He published important work in the HPS&ST field (Stinner 1990, 2001).

The anthology was multi-national, with contributions from USA, Canada, Japan, Korea, New Zealand, Australia, Germany, Brazil, Argentina, Israel, Cyprus and Greece. And it was multi-disciplinary with contributions from physicists, historians, philosophers, psychologists and educators. The benefit of science educators studying and researching outside the science education field and bringing what they learnt back to science education was made obvious.



Time for Science Education (2000)



The Pendulum (2005)

The pendulum played more than a scientific role in the formation of the modern world. The pendulum was central to the horological revolution that was intimately tied to the scientific revolution. [Christiaan Huygens](#) (1629-1695) in 1673, following Galileo's epochal analysis of pendulum motion, utilised the pendulum in clockwork and so provided the world's first accurate measure of time (Yoder 1988).

The accuracy of mechanical clocks went, in the space of a couple of decades, from plus or minus half-an-hour per day to a few seconds per day. This quantum increase in accuracy of timing enabled hitherto unimagined degrees of precision measurement in mechanics, navigation and astronomy. It ushered in the world of precision characteristic of the scientific revolution (Wise 1995). Time could then confidently be expressed as an independent variable in the investigation of nature; a variable against which other mechanisms, changes and properties could be measured.

Accurate time measurement was long seen as the solution to the problem of longitude determination which had vexed European maritime nations in their efforts to sail beyond Europe's shores. If an accurate and reliable clock was carried on voyages from London, Lisbon, Genoa, or any other port, then by comparing its time with local noon (as determined by noting the moment of an object's shortest shadow or, more precisely, by using optical instruments to determine when the sun passes the location's north-south meridian), the longitude of any place in the journey could be ascertained. As latitude could already be determined, this enabled the world to be mapped. In turn, this provided a firm base on which European trade and colonization could proceed. The chances of being lost at sea were greatly decreased.

This story has been well told by Dava Sobel (1995) in her best-selling *Longitude* book translated into numerous languages (Sobel 1995). A common reaction of readers would be: 'Where was all this social history in my physics course?' But conversely, Sobel's engaging social history makes no mention of the methodology and physics that enabled creation of the seconds pendulum. In a competent liberal education, both would be done together.

The clock transformed social life and customs: patterns of daily life could be ‘liberated’ from natural chronology (the seasonally varying rising and setting of the sun) and subjected to artificial chronology; labour could be regulated by clockwork and, because time duration could be measured, there could be debate and struggle about the length of the working day and the wages that were due to agricultural and urban workers; timetables for stage and later train and ship transport could be enacted; the starting time for religious and cultural events could be specified; punctuality could become a virtue; and so on. The transition from ‘natural’ to ‘artificial’ hours was of great social and psychological consequence: technology, a human creation, begins to govern its creator.

Huygens, as well as working on the longitude problem and on the perfecting of pendulum clocks, also argued for a new international standard of length. Undoubtedly this would have been a major contribution to science and to everyday life. In parallel to Huygens, the Royal Society at its inception was asked to investigate the same subject, and Christopher Wren proposed, as did Huygens, the length of a pendulum beating seconds (that is, having a two-second period) as the international length standard.

Concerning the long-sought natural standard of length, Huygens wrote:

A certain and permanent measure of magnitudes, which is not subject to chance modifications and which cannot be abolished, corrupted, or damaged by the passage of time, is a most useful thing which many have sought for a long time. If this had been found in ancient times, we would not now be so perplexed by disputes over the measurement of the old Roman and Hebrew foot. However, this measure is easily established by means of our clock, without which this either could not be done or else could be done only with great difficulty. (Huygens, 1673/1986, p. 167)

In brief, Huygens says that first a seconds clock is built and tested against the rotation of the fixed stars (as described on pp. 23-25 of his book), then a pendulum is to be set swinging with a small amplitude and its length adjusted until it swings in time with the seconds clock, then

... measure the distance from the point of suspension to the center of the simple pendulum. For the case in which each oscillation marks off one second, divide this distance into three parts. Each of these parts is the length of an hour foot By doing all this, the hour foot can be established not only in all nations, but can also be re-established for all ages to come. Also, all other measurements of a foot can be expressed once and for all by their proportion to the hour foot, and can thus be known with certainty for posterity. (Huygens, 1673/1986, p. 168)

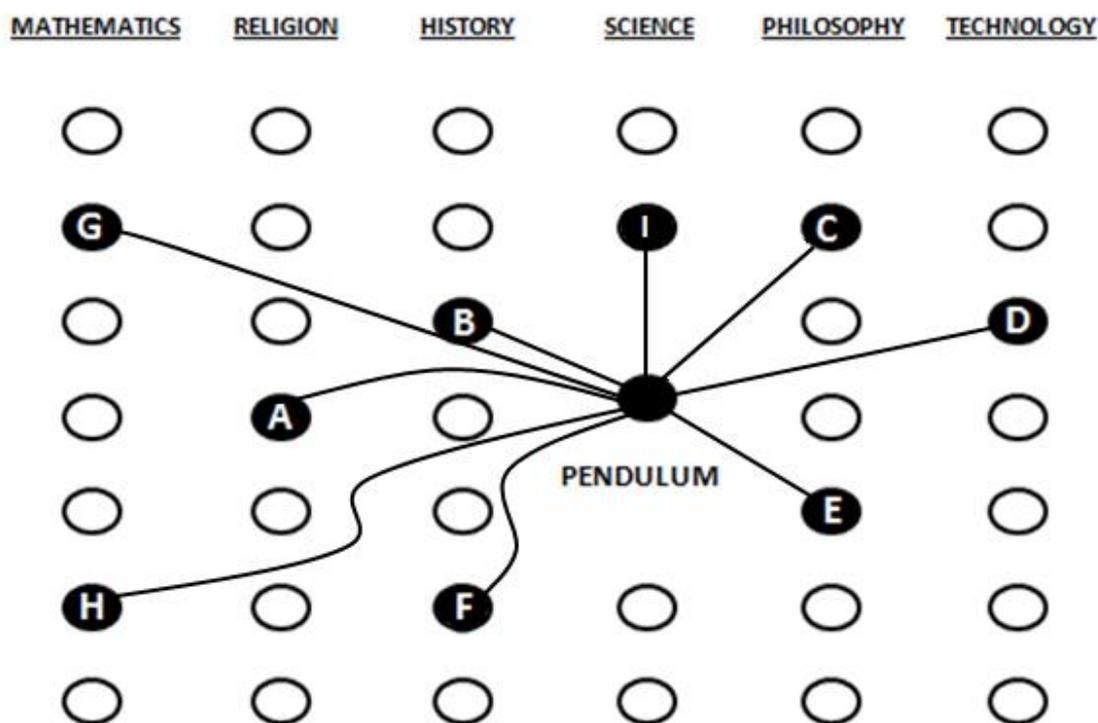
His basic unit of length was thus to be 3 horological feet (0.9935m), less than a millimetre short of what would become, after a considerable amount of political struggle, the original metre (Heilbron, 1989; Alder, 1995).

This is the sensible and understandable standard lying behind the seemingly incomprehensible and arbitrary length standard of modern textbooks: ‘the distance travelled by light in $1/299,792,458$ of a second’. For many students, reading this is their introduction to physics!

The pendulum project, and its anthology, established that pendulum motion is taught from a historical and philosophical perspective it allows connections to be made with topics in

religion, history, mathematics, philosophy, and literature, as well as other topics in the science program. And such teaching promotes greater understanding of science and its methodology, and an appreciation for the hard-earned achievements of scientists in understanding the world.

The figure below indicates a multidisciplinary or liberal education approach to teaching about the pendulum in a school programme.



A design argument; **B** European voyages of discovery; **C** Aristotelian physics and methodology; **D** pendulum clock; **E** idealisation and theory testing; **F** time-keeping and social regulation; **G** geometry of the circle; **H** applied mathematics; **I** measurement and standards; **J** time; **K** energy; **L** geodesy

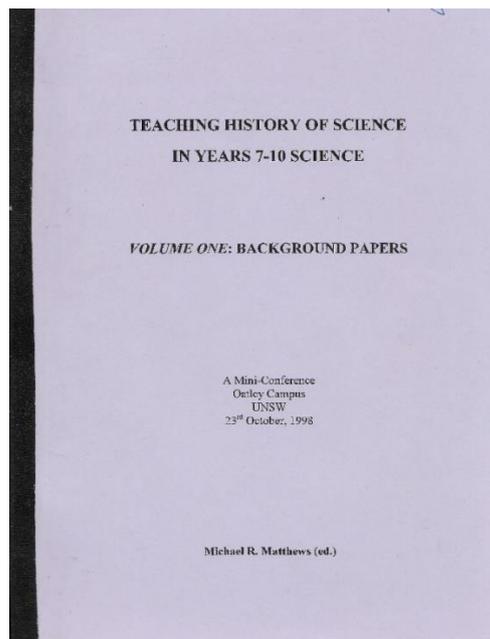
In-Service Courses for Science Teachers (1996-2003)

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)

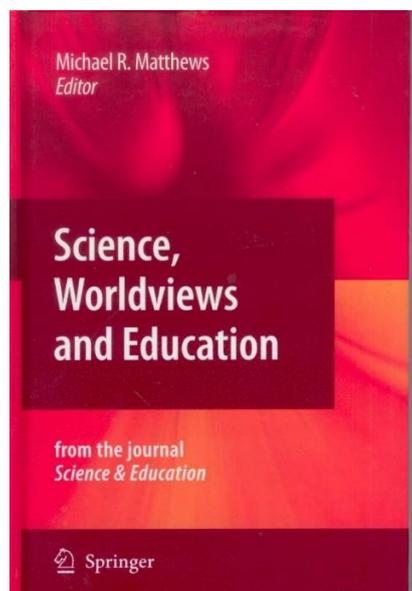
And,

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](#)’.



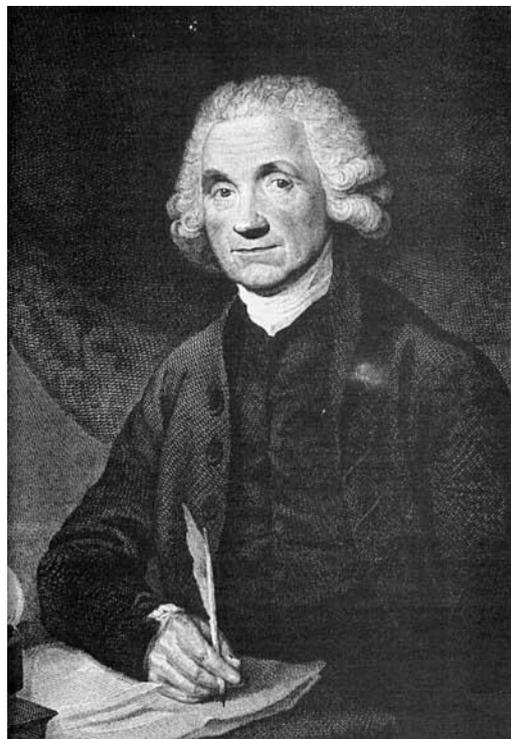
Science, Worldviews and Education (2009)

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.

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 2009b).

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)

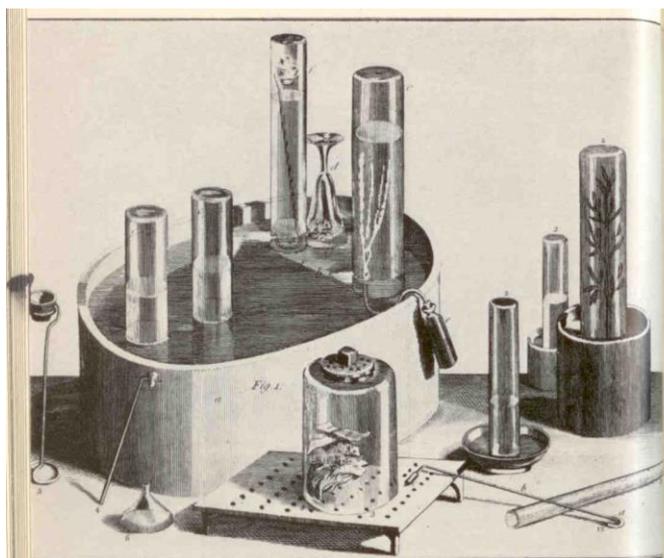
Modern appreciation of Priestley has been significantly influenced by the harsh judgement of Thomas Kuhn in his best-selling *Structure of Scientific Revolutions* (Kuhn 1970). In a famous (that should be seen as infamous) passage Kuhn writes of the irrationality of paradigm change and of old paradigms 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)

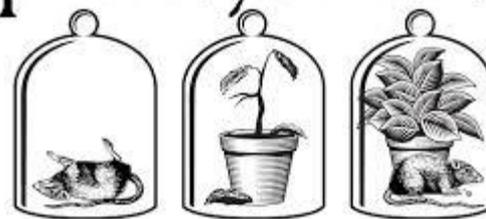
Priestley is an under-utilised figure in science education. Although his contribution to the discovery of oxygen is recognised, it is usually glossed by a Kuhnianesque comment that he was an obscurantist concerning Lavoisier’s new chemistry and a dogmatist concerning his own adherence to the phlogiston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

photosynthesis



Discovered by Joseph Priestly in 1774

© Innovations For Global Warming

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

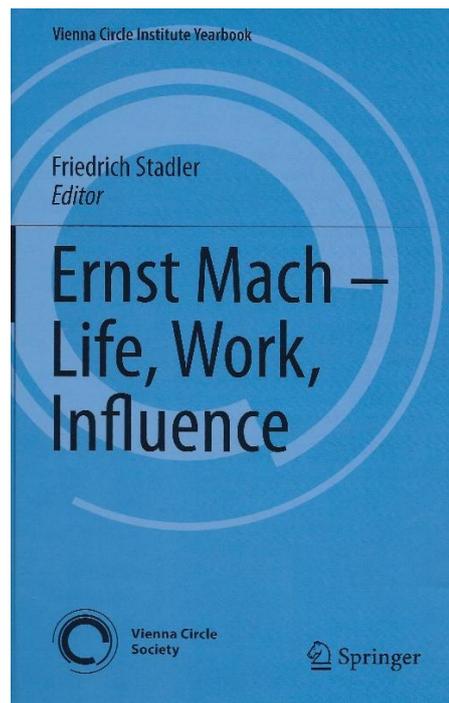
Abner Shimony's 1978 Galileo course at Boston University led to two research interests: first, pendulum studies which have been mentioned above; and second, reading and writing on Ernst Mach. The connection to Mach was through the elaboration of Galileo's thought experiments, something from which Mach 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 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 precepts, 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. 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.

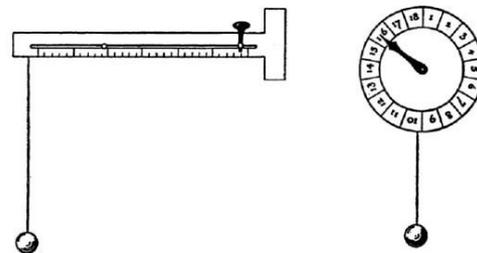
The goal of science is not to ‘make sense’ of the world, but to explain the world and its processes; to identify lawful behaviours and causal relations in a world that exists independently of us. Poets, artists, novelists, theologians, and everyone else can, and do, make sense of things about them, but 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.

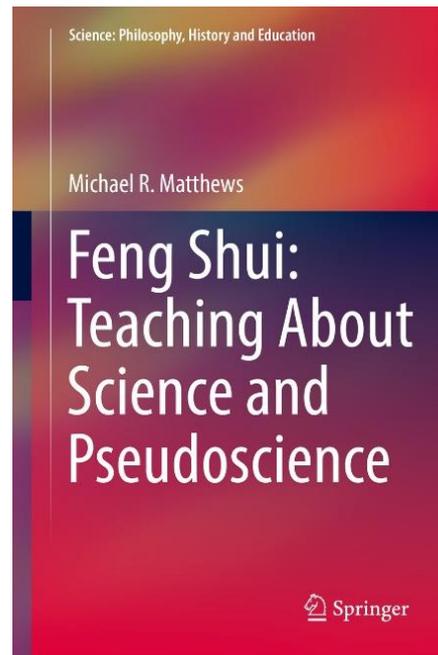
To pursue viability in science, rather than correctness, is to go down the wrong philosophical, and ultimately educational, track. There is little evidence that cultural theorists recognise this; indeed, on the contrary, they have gone full-steam down those rocky tracks.

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.

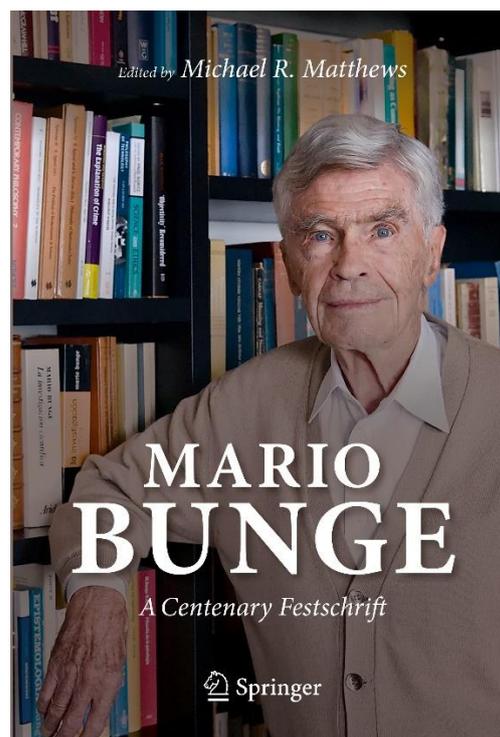
Bangping Ding, Education, Capital Normal University, China:

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.

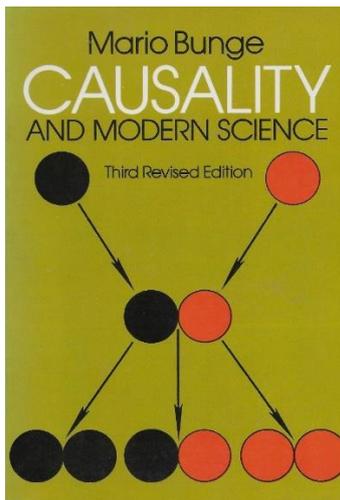
In 2001 Bunge came to UNSW for six months as a visiting professor. The same year he offered a workshop to the then annual ‘HPS & Science Teaching’ conference on “Science and Politics: The Ethical Dilemmas of Max Planck during the Nazi Era’. It was an informed, considered and gripping lecture/workshop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



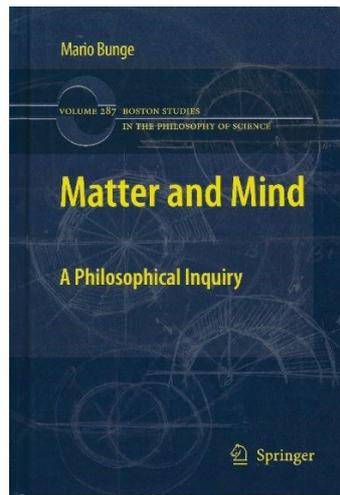
Mario Bunge at 100 years in Montreal

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.

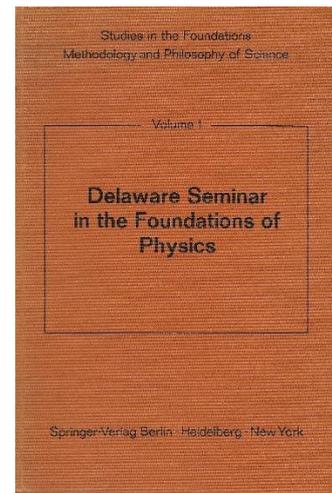
In 2003 Bunge’s article ‘[Twenty-Five Centuries of Quantum Physics: From Pythagoras to Us, and from Subjectivism to Realism](#)’ was published in *Science & Education* journal and was the basis of a special issue on ‘[Quantum Theory, Philosophy and Education](#)’. In 2011 a long article on [science and 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.



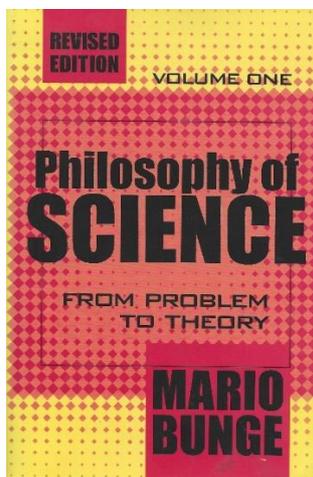
Causality (1956)



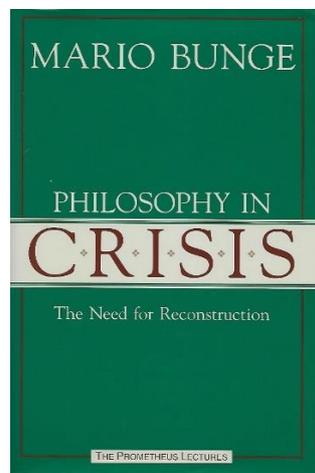
Matter and Mind (2010)



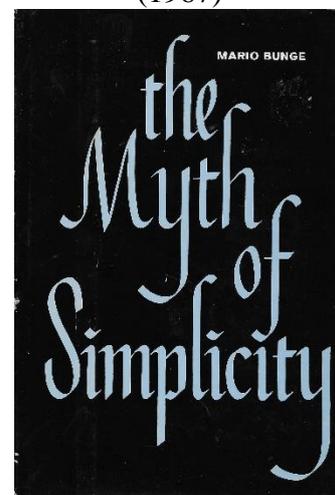
Foundations of Physics
(1967)



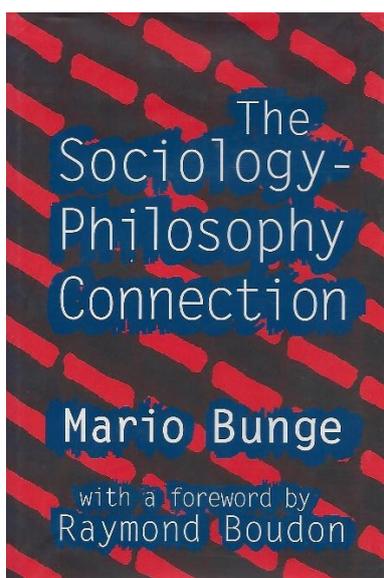
Philosophy of Science
(1967)



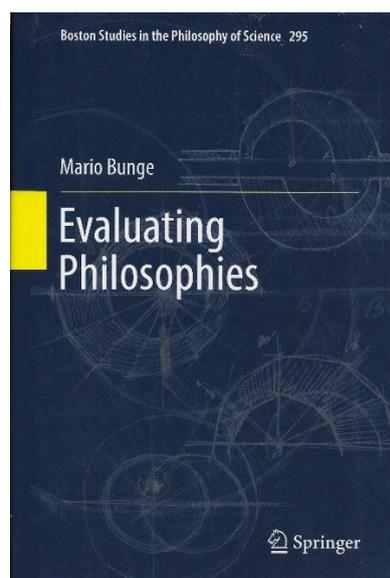
Philosophy in Crisis (2001)



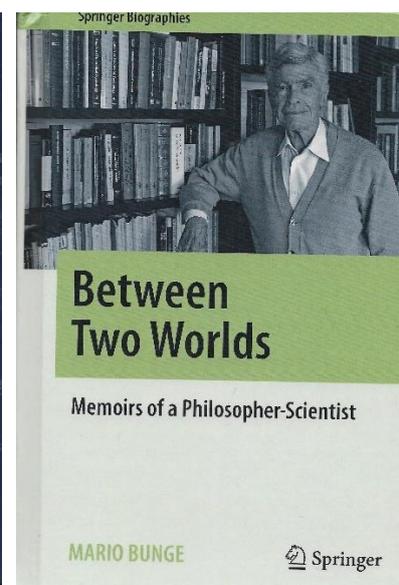
Myth of Simplicity (1967)



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)

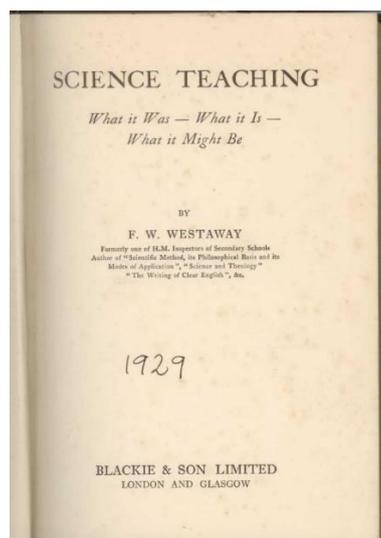
It is noteworthy that no government or private group seriously dealing with the current COVID-19 crisis regards scientific rationality and problem-solving skills as mythical; everyday they utilise both to formulate and refine treatments and policies for the deadly pandemic. But such views were and are 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:

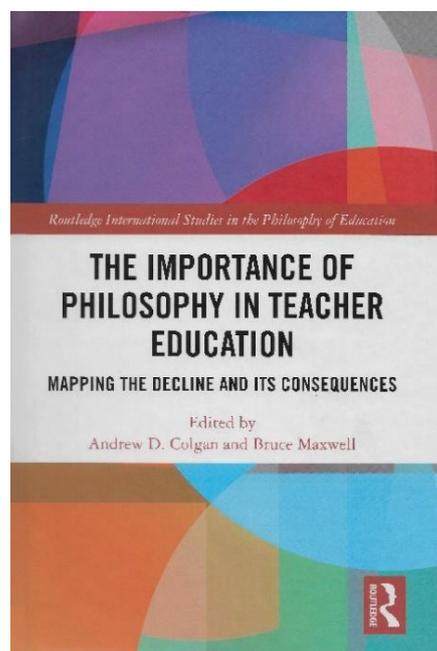
For the most part, the members of the teaching profession are over-trained and undereducated. Teaching is an art and a teacher must be trained, but since the technique is one of communicating knowledge and inculcating discipline, it is not educational psychology and courses in method and pedagogy that 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

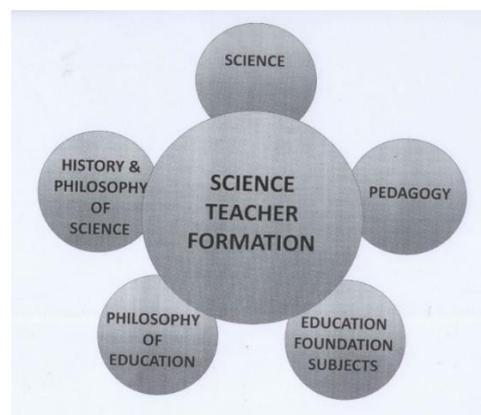
something of the life, times and work of the scientists – an approach that has been labelled ‘Historical-Investigative Teaching’ (Heering & Höttecke 2014).

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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