

Decolonisation of education: further steps

C. K. Raju

Centre for Studies in Civilizations, New Delhi

Abstract

Colonialism brought in Western education by claiming that it is needed for science which is Western in origin. Accordingly, decolonised education must begin by correcting that false history. This understanding led to the development of two decolonised courses: (1) History and Philosophy of Science-1, (2) History and Philosophy of Science-2. I describe my experiences in teaching those courses to diverse groups of students, some doubts they initially had, due to their early conditioning, and how those doubts were eventually resolved.

The claim that science is universal but of Western origin is contrary to the merest commonsense: a universal science would have developed universally; anything that developed only in one culture is bound to be culturally specific. Hence, correcting the false Western history of science also exposes the cultural biases in present-day math and science. Eliminating those cultural biases results in a new and superior math and science. A new pedagogy naturally follows.

For example, the corrected history of math shows that the calculus developed in India and was transmitted to Europe in the 16th c. CE by Cochin-based Jesuits. Europeans blundered in understanding the imported calculus, just as they had earlier blundered in understanding zero, imported from Cordoba (10th c.), or the math they imported through the mass translations at Toledo (12th c.). Those European blunders in understanding Indian infinite series arose because of the Western belief that mathematics involves eternal truths, hence must be “perfect”. This belief was neither universal nor compatible with Indian *ganita* which explicitly accepted both non-eternality and imperfection. The Western belief in the “perfection” of math was grounded on nothing beyond religious faith. [Plato believed math involved eternal truths since he thought it aroused the eternal soul by sympathetic magic (and thus enabled mathesis or the recollection of knowledge from past lives). The post-Crusade Christian theology of reason also believed math contained eternal truths but for the different reason that it was the language (of “reason”) in which God wrote the “eternal laws of nature”.] Hence, the math imported into Europe for its practical value was eventually reconciled with those religious beliefs by coating it with Western metaphysics. The resulting cocktail of practical value and religious metaphysics was returned and globalised during colonialism, just by declaring it to be “superior”. While it still “works”, we cannot accept a package deal and need to separate what “works” (the practical value of non-Western origin) from what does not (the metaphysics of Western origin).

To eliminate that Western cultural superimposition and retain only the practical value, we trace the history of calculus in India to its beginnings with the numerical solution of differential equations, in the 5th c. The related infinite series developed over the next thousand years for the same practical purposes of deriving accurate “trigonometric” values. Those infinite series were summed using a sophisticated (“non-Archimedean”) number system different from the continuum and a different philosophy which I have now recast as the realistic philosophy of zeroism. This naturally results in a new pedagogy of (3) Calculus without limits. That makes calculus very intuitive and simple, for it follows the way calculus historically developed rather than the way it was misunderstood in Europe, a misunderstanding spread by colonial education. This corrected understanding of the calculus *enhances* its applicability to

contemporary science, though the issues concerning infinities arising in general relativity, or classical or quantum electrodynamics are too technical to take up here.

Since science was the bait for bringing in Western education, a decolonised science is a must. At an earlier Multiversity meeting I had outlined a decolonised course on science. Thus, Newton's misunderstanding of the calculus directly led to the conceptual error about time in his physics, which *hence* failed and was replaced by relativity. Newton's conceptual error is masked by the further false history which attributes relativity to Einstein, and hence results in the wrong teaching of special relativity, a first year undergraduate physics course. (This also shows how much science our science teachers and science “experts” actually know; science teaching runs on pitiable faith.) The alternative I suggested was to teach (4) Physics using functional differential equations. This agenda too has moved forward. Incidentally, this results in a non-mechanistic physics contrary to the post-Crusade dogma of “laws of nature” and compatible with the mundane experience of spontaneous human creativity.

To move from spontaneity to chance, the case of probability and statistics highlights the advantages of zeroism over limits. The practical applications of statistics all involve relative frequency. That is connected to probability using the “law of large numbers”. But defining probability as the limit of relative frequency begs the question, for that limit exists only in a probabilistic sense. Hence, zeroism works better than “limits”. Historically, that relates better to the way sampling theory was used to count the number of fruits in a tree in the Mahabharata. Accordingly, a course has been developed on (5) Statistics for social science and humanities (using open source software). Though this course has been formulated, according to the MQA guidelines, it has yet to be tried out. That entails a further (partly tried) course on (6) Open source computing. Though this last course was tried for different reasons, I explain its significance for decolonisation.

These alternative courses are seemingly small steps. However, decolonising science and its history results in such a fundamental change in the world view that a further natural course waiting to be developed is on (7) Ethics. The basic idea is to give a comparative account of ethics to enable a systematic comparison of Western and non-Western ethics, which was as incomprehensible to Hegel as Indian infinite series were to Descartes. My ethical principle, now called the “harmony principle”, resulting from the new world view above, is interestingly close to non-Western ethics. Hence, it also helps mediate the relation of non-Western ethics to contemporary concerns raised by science, technology, and environmental degradation. That helps to provide a counterpoint to Western notions of ethics and law foisted globally on the colonised.

I also briefly describe my experiments with alternative ways of learning (“pedagogical techniques”) such as the *mujawara*.

The very act of conceiving and trying out fundamentally new courses is a major step against the stasis induced by a false belief in TINA (“There Is No Alternative”). Various other “colonial blocks” militate against the wider spread of these courses: the colonially educated are indoctrinated against dissent as strongly as missionaries (for whom that education was initially designed). Hence, it is essential to recognize the existence of these “colonial blocks”, and to devise ways around them.

What should be done for wider dissemination of these courses? An essential step is this: the existing pedagogical material should be consolidated into the more traditional form of texts. Further, the immediate practical advantages of these decolonised courses should be advertised, regardless of ideology. Finally, I suggest that there should be a concerted effort to delink knowledge from certification, by setting up a chain of “knowledge cafes” which provide knowledge, but no certification, and hence cannot be regulated.

Background

The previous Multiversity meetings have resulted in some important initiatives. At the meeting on “Academic imperialism” in Tehran¹ it emerged that since colonisation began with a false history of science, and a correspondingly bad philosophy of science, decolonisation must commence by rectifying that.² A subsequent international workshop at AiU,³ and some sundry public debates,⁴ led to an alternative course in the history and philosophy of science. This was planned to be fundamentally different from any such course being taught in a Western university. I taught this course successfully at AiU for two semesters to an interesting international mix of students from over 50 countries (most of them poor students from former colonies).⁵ Students quickly grasped the emancipatory nature of this course, as opposed to the enslaving nature of courses in their past experience with colonial education. They were greatly enthused by the clarification of their initial doubts, and demanded more. Accordingly, a second course on HPS2 was designed to fill in many gaps in the first course, and this too was successfully taught.⁶ A video interview by Claude Alvares with the students of the course is posted on the Multiversity site.⁷

Now, the beginnings of colonial education are attributed to Macaulay's infamous Minute of 1835.⁸ However, the real reason for spreading Western education were more frankly articulated by Macaulay only in his 1847 speech to the British parliament.⁹ There, he anticipated Marx that a spectre of revolution was haunting Europe. But he said education is the cheapest way to exorcise that spectre and suppress future revolts. How does education suppress revolts? The “education” to which Macaulay referred was church education, for at that time European education was still the monopoly of the church. Beginning with the university of Bologna, during the Crusades, this church system of education was designed to breed indoctrinated missionaries with intense loyalty to and great respect for Western authority. Not surprisingly, those are also the two characteristics that the colonially educated still have. And, by a curious coincidence, which has gone unnoticed, the entry of colonial education in India in a big way coincided with the suppressed revolt of 1857.¹⁰

1 Sue-san Ghahremani Ghajar and Seyyed-Abdolhamid Mirhosseini ed., *Confronting Academic Knowledge*, Iran University Press, Tehran, 2011.

2 C. K. Raju, *Ending Academic Imperialism: a Beginning*, Citizens International, Penang, 2011. Draft at <http://multiworldindia.org/wp-content/uploads/2010/05/ckr-Tehran-talk-on-academic-imperialism.pdf>. Also, <http://www.youtube.com/watch?v=zdvG4gByfk&feature=related>.

3 Curriculum Development Workshop, Albukhary International University, May 2011. See various links at <http://ckraju.net/blog/?p=73>.

4 For example of a public debate in USM over the curriculum with a preacher, trained in divinities, but given a PhD in history and philosophy of science, which enabled him to turn the classroom into a pulpit, see the minutes posted at <http://ckraju.net/usm/Psc-minutes.html>.

5 A photo of the students and links to the curriculum in MQA format are at <http://ckraju.net/blog/?p=89>. The prepared slides for the lectures are also posted online.

6 Details of HPS2 curriculum are posted at <http://ckraju.net/hps2-aiu/HPS-2-syllabus.pdf>.

7 The videos are posted on the Multiversity site in five parts at <http://tvmultiversity.blogspot.in/2014/02/c-k-raju-interviewed-by-claude-alvares.html>.

8 T. B. Macaulay, “Minute on Education”, 1835. The Minute may be found online on many sites, such as <http://www.languageinindia.com/april2003/macaulay.html>.

9 T. B. Macaulay, Speech to the House of Commons, 18 April 1847. *Miscellaneous Writings and Speeches of Lord Macaulay*, vol. IV, Speeches of Lord Macaulay, http://www.gutenberg.org/files/2170-h/2170-h.htm#2H_4_0031.

10 C. K. Raju, “Education as counter-revolution” Comment published in *Frontier Weekly*, 1 Aug 2013. A slightly edited version was later republished as “Church and Education: Decolonising the hard sciences”. <http://frontierweekly.com/articles/vol-46/46-7/46-7-Decolonising%20Hard%20Sciences.html>.

However in his 1835 Minute on Education, Macaulay said not a word about the counter-revolutionary nature of Western education. Instead he harped only on the “immeasurable superiority” of the West in sciences as the reason to bring in Western education. Curiously, that (Western) science actually came to India through church institutions. Some of those institutions are prominent to this day in undergraduate scientific education, such as St Stephen's college Delhi, St Xavier's, Mumbai, or Loyola college Chennai etc. That church-state alliance, at the root of colonialism, in Asia and Africa, seems to have gone unnoticed for two centuries. The recognition of the church role in bringing science education in the colonies also presents us with an interesting paradox. Thus, the colonially educated mostly all blindly believe the story that science and religion are at war.¹¹ Why, then, did the church bring science to the heathen? To commit harakiri?

From another angle, post-revolutionary societies whether in Iran or in the Soviet Union, or China came under intense economic and military pressure. The quick development of science and technology seemed the natural answer to both pressures. This required extensive spread of mathematics and science education which was available ready-made only from the West. Just as Macaulay had argued in 1835, and as Malaysians, for example, are still arguing today, education *hence* required the English language. No one doubts that the English language brought along with it a huge cultural baggage. However, it went unnoticed, even in Iran, that even mathematics and science came along with ideological and religious baggage. What is nevertheless manifest is this: Western education, whether in Iran, or China, or India, even in math and science, somehow breeds loyalty to the West. The most pro-Western people are the university educated.

The colonised all fell for the story that mathematics and science are universal. They did not apply commonsense or even raise the obvious doubt: if math and science are universal they ought to have originated universally, and not only or mainly in the West. Conversely, something which developed only or mainly in one culture is bound to be culturally biased.

For example, the very first lesson in school science today (on Newton's “laws”) slips in the belief that science is about “eternal laws of nature”. That belief in “eternal laws of nature” is not a scientific or refutable belief. But it is part of Crusading church dogma: Aquinas who knew God well, claimed in his *Summa Theologica* that God controls the world through “eternal laws of nature”. This dogma is a superstition for it is contrary to our repeated mundane experience that *we* create (a tiny bit) of the future world. This dogma/superstition about “laws of nature” is certainly not universal. Aquinas' theology differs fundamentally from, say, the Islamic belief that Allah continually creates the world afresh at each instant, and creates smoke with fire only out of habit and not causal necessity.

Slipping in this dogma along with the first lesson in science has the following consequence: it permits the authority of science to be used to attack Islam, as analysed in depth in my talk on “Islam and science”.¹² Sadly, the easy (but unconvincing) response of the Western educated is to try to preserve status quo by seeking an apologia which plays on the precise meaning of terms like “law” and “causality”, a meaning easily confounded in translation. Such apologies appeal especially to the gullible who have swallowed the story that mathematics and science are universal and *also* the story that Western mathematics is different but “superior”. The correct way out is to acknowledge the

11 It is amazing how often this claim is based on just one story, that of Galileo, from 500 years ago, and the story-believer is generally unacquainted with the details of the case beyond the story line.

12 C. K. Raju, “Islam and Science”, Keynote address at International Conference on *Islam and Multiculturalism*, Univ. of Malaya. In *Islam and Multiculturalism: Islam, Modern Science, and Technology*, ed. Asia-Europe Institute, University of Malaya, and Organization for Islamic Area Studies, Waseda University, Japan, 2013, pp. 1-14. <http://ckraju.net/hps-aiu/Islam-and-Science-kl-paper.pdf>.

existence of that religious baggage, in Western science, and to get rid of it by constructing a non-mechanistic science, in accord with mundane experience.

Similarly, the ideological baggage in mathematics is present even at the level of $2+2=4$. That ideological baggage works against *all* Indian schools of thought (Nyaya, Samkhya-Yoga, Bauddha, Jaina, Lokayata) as also Islam. Thus, all these schools accept the *pratyaksa* or empirical as a means of proof (*pramana*), like *tajurba* in Islam. Such proofs were also used in non-Western mathematics.¹³ However, empirical proofs are rejected as “inferior” by Western mathematics. That belief dates back to the Platonic deprecation of the empirical, but later came to be grounded in a dogma of Crusading rational theology. On that dogma, God cannot create an illogical world, but can otherwise create the facts of his choice. That is, logic binds even God, but facts do not. Therefore the Western belief that logical proofs are “superior” to empirical proofs. In the characteristically confused way of those steeped in dogma, Western theologians like Aquinas and Kant failed to ask: *which* logic? Kant founded an entire philosophy on the parochial belief that logic is universal, when, in fact, logic is neither culturally universal (e.g. Buddhist logic of *catuskoti* or the Jain logic of *syadavada*) nor empirically certain (e.g. quantum logic).¹⁴

This, incidentally brings out a key difference between metaphysical Western mathematics which rejects empirical proofs, and Indian *ganita* or Arabic *hisab*, which accept empirical proofs. That shows that mathematics is not, in fact, universal, but that one (metaphysical) form of mathematics was wrongly declared “superior”, globalised, and thus made normatively universal. This is a key aspect of the HPS-2 course.

In that globalised (but non-universal) mathematics, even a simple proposition like $2+2=4$ brings in the metaphysics of infinity by the backdoor. Thus, the proof of that simple proposition $2+2=4$ in formal mathematics typically involves Peano's axioms. Those axioms bring in the metaphysics of infinity by the backdoor: that is most easily seen from the fact that a computer can never do Peano arithmetic. That metaphysics of infinity is aligned to church dogmas about eternity, although this connection is difficult to explain to those who know neither.¹⁵

That ignorance is not accidental. Colonial education deliberately kept the vast majority mathematically and scientifically illiterate. This way they cannot even *understand* what dissenters have to say. They are forced to be dependent on authority, and are indoctrinated to trust only Western authority. Lack of understanding on one hand, and fear of Western authority on the other reduces them to silence or apologies. Anyway, the fact is that most people never learnt *why* $2+2=4$ according to the present-day formal mathematics taught in our schools and colleges. Hence, they find it hard to spot that ideological baggage in hard sciences, though it is easier to spot in social sciences.

Since colonial education was brought in by appealing to science, the decolonisation of mathematics and science is a must for decolonisation to succeed. How to decolonise math and science? This was outlined in my talk at the Multiversity meeting in Penang on decolonising our universities.¹⁶ This was also taken up in a preliminary way in the decolonised HPS courses. While the HPS-1 course

13 C. K. Raju, “Computers, Mathematics Education, and the Alternative Epistemology of the Calculus in the YuktiBhâsâ”, *Philosophy East and West*, 51:3 (2001) pp. 325–362. <http://ckraju.net/papers/Hawaii.pdf>.

14 For a quick account, see my article on “logic” in the Springer *Encyclopedia of Non-Western Science, Technology and Medicine*, ed. Helaine Selin. The article is also posted at <http://ckraju.net/papers/Nonwestern-logic.pdf>.

15 C. K. Raju, “Eternity and infinity” (to appear in American Philosophical Association Newsletter). Uncorrected draft posted online at <http://ckraju.net/papers/Eternity-and-infinity.pdf>.

16 C. K. Raju, “Decolonising math and science”, in: *Decolonising the University*, ed. Claude Alvares and Shad Faruqi, USM and Citizens International, 2012, pp. 162–195. <http://ckraju.net/papers/decolonisation-paper.pdf>.

emphasized the falsehoods in the Western history of science, the HPS-2 course took up some of the above issues to point out that the Western philosophy of mathematics and science is culturally loaded, and results in (ideologically) Western math and science which must be changed.

The experience of the HPS courses

A common doubt which emerged in relation to the critique of Western math and science was this: “it works”. The simple answer is to point out about decolonised math and science that “it works better”. This answer, however, is hard to explain to colonised minds who did not notice that the education, brought to them by dangling the carrot of science, in fact miseducated the vast majority into scientific illiteracy, and the rest into blind acceptance of Western authority. But the students of the HPS courses were game to check for themselves the claim that “it works better” by voluntarily taking on the decolonised calculus course outside their normal study hours.

“No package deal”, that was the other answer to “it works”. Western science education serves a dangerous cocktail of practical value and religious propaganda. Therefore, it is necessary to separate what works (the practical value) from what does not (the ideology and metaphysics). Such a critical rejection of Western math and science presupposes a proper understanding of it, blocked by colonial education.

What the experience of the HPS courses brought out is this. The colonially-educated-hence-mathematically-illiterate can better understand the project of decolonising math through corrected history. Thus, almost all school-level math (arithmetic, algebra, trigonometry, calculus, and probability) went to Europe from India, initially via Baghdad (al Khwarizmi's *Hisab al Hind*, and *Al jabr wa'l muqabala*), and Cordoba, then via Toledo (trigonometry) and Florentine merchants (algorismus). Later on calculus and probability were taken direct to Europe from Cochin, by Jesuits who translated Indian texts in the 16th c. in their Cochin college on the Toledo model. This corrected history also points out the non-textual evidence (numerals, calendar) that early Greeks and Romans were mathematically backward, and did little beyond acting as conduits for African mystery geometry.

Certainly, it is important to keep reiterating the true origins of math and science just to puncture Western self-glorification. That is important because it was the soft power derived from that self-glorification which was used to bring in Western education as “superior”, and thus stabilise colonial rule. The HPS-1 course emphasized this aspect by refuting the stock Western formula of Wikipedia that “All science was first done by Greeks, and then in the renaissance”. It pointed out that stories of Greek origins are pure bunkum with nil evidence in favour and plenty of counter-evidence in disfavour, and used by racist historians to cover up the African and Persian origin of Greek knowledge. It also presented arguments that the renaissance is a fake construct (for there was never an earlier naissance), and explained how that fake construct was used to cover up the huge post-Crusade import of knowledge by the West from Arabs, Indians, and Chinese. It emphasized the foolishness of the colonised in believing those stories of Western self-glorification without once checking the facts themselves in two centuries. Indeed, cross-checking the Western history of science is still a taboo, as evinced by the continued absence of any such effort in our universities (except through Western stooges).

However, apart from the issue of false glorification, emphasized in HPS-1, there are important epistemic issues which were taken up in the HPS-2 course. The less obvious aspect of this corrected history is that it highlights the numerous problems that the import of knowledge created for the church-dominated West. This Western “time of troubles” in math started right from pope Sylvester's

import of arithmetic which brought in the mysterious zero. (The very word zero derives from sifr or cypher, which literally means mysterious code.) These specifically Western problems with math lasted for about a thousand years and were exacerbated by the import of the infinite series of the Indian calculus.

Decolonised math

These infinite series were of great practical value (in solving the European problem of navigation, concerning loxodromes, latitude, and longitude). The solution of all these problems required accurate “trigonometric” values, and those infinite series were used to obtain the then-most accurate trigonometric values (accurate to about 9 decimal places). Hence, infinite sums could not just be discarded. However, the idea of an infinite sum created a major problem for the West with its religious view of mathematics as “perfect” or “eternal truth”, since Plato. That belief was based on sympathetic magic, that mathematics contains eternal truths since it arouses the eternal soul (and hence enables mathesis or the soul recollecting the knowledge of its previous lives). The belief was founded on a notion of soul cursed by the post-Nicene church in the 6th c. Curiously, however, despite the later-day curse on that notion of soul, accepted by early Christianity, this view of mathematics as eternal truth was retained by post-Crusade schoolmen to support their theology of reason. They thought mathematics has eternal truths since it is the language (of reason) in which God wrote the supposed “eternal laws of nature”. In sharp contrast, Indian mathematics (*ganita*) accepted mathematics as non-eternal (*anitya*) and imperfect (*savisesa*, with some error) since the days of the *sulba sutra*.

Eventually, the West “understood” those Indian infinite series in a “perfect” way using an elaborate

metaphysics of infinity, closely related to the Western theology of eternity. Of course, this was accompanied by the usual myth-making and distortion of history. The imported infinite series were given names like “Leibniz” series or “Gregory” series. The original mathematics, packaged under a coating of church metaphysics, and fraudulent history, was then returned and globalised during colonialism by the simple artifice of declaring it “superior”. What exactly was “superior” about it?

378 PROLEGOMENA TO CARDINAL ARITHMETIC [PART II

*56101. $\vdash: R \in \dot{2} . \equiv . D^2R, \dot{C}^1R \in 1$
Dem.
 $\vdash . \#5516 . \#1111341 . \supset$
 $\vdash : (\dot{q}x, y) . R = x \downarrow y . \equiv : (\dot{q}x, y) . D^2R = t^2x . \dot{C}^1R = t^1y :$
 $[\#1154] \equiv : (\dot{q}x) . D^2R = t^2x : (\dot{q}y) . \dot{C}^1R = t^1y :$
 $[\#521] \equiv : D^2R, \dot{C}^1R \in 1$
 $\vdash . (1) . \#561 . \supset \vdash . \text{Prop}$ (1)

*56102. $\vdash: \dot{2} = \dot{D}^{\dot{C}1} \dot{\cap} \dot{C}^{\dot{C}1}$
Dem.
 $\vdash . \#56101 . \#37106 . \supset$
 $\vdash : R \in \dot{2} . \equiv . R \in \dot{D}^{\dot{C}1} . R \in \dot{C}^{\dot{C}1} .$
 $[\#2233] \equiv . R \in \dot{D}^{\dot{C}1} \dot{\cap} \dot{C}^{\dot{C}1} : \supset \vdash . \text{Prop}$

*56103. $\vdash: R \in \dot{2} . \supset . \dot{q} \vdash R$
Dem.
 $\vdash . \#56101 . \supset \vdash : R \in \dot{2} . \supset . D^2R \in 1 .$
 $[\#5216] \supset . \dot{q} \vdash D^2R .$
 $[\#3324] \supset . \dot{q} \vdash R : \supset \vdash . \text{Prop}$

*56104. $\vdash: R \in 0 . \equiv . R = \Lambda$ [(#5603)]

*5611. $\vdash: R \in 2 . \equiv . (\dot{q}x, y) . x \dot{+} y . R = x \downarrow y$ [#203 . (#5602)]

*56111. $\vdash: R \in 2 . \equiv . D^2R, \dot{C}^1R \in 1 . D^2R \dot{\cap} \dot{C}^1R = \Lambda$
Dem.
 $\vdash . \#51231 . \#5516 . \supset$
 $\vdash : x \dot{+} y . R = x \downarrow y . \equiv . t^2x \dot{\cap} t^1y = \Lambda . D^2R = t^2x . \dot{C}^1R = t^1y .$
 $[\#13193] \equiv . D^2R \dot{\cap} \dot{C}^1R = \Lambda . D^2R = t^2x . \dot{C}^1R = t^1y$ (1)
 $\vdash . (1) . \#5611 . \#1111341 . \supset$
 $\vdash : R \in 2 . \equiv : (\dot{q}x, y) . D^2R \dot{\cap} \dot{C}^1R = \Lambda . D^2R = t^2x . \dot{C}^1R = t^1y :$
 $[\#1145] \equiv : D^2R \dot{\cap} \dot{C}^1R = \Lambda : (\dot{q}x, y) . D^2R = t^2x . \dot{C}^1R = t^1y :$
 $[\#1154] \equiv : D^2R \dot{\cap} \dot{C}^1R = \Lambda : (\dot{q}x) . D^2R = t^2x : (\dot{q}y) . \dot{C}^1R = t^1y :$
 $[\#521] \equiv : D^2R \dot{\cap} \dot{C}^1R = \Lambda . D^2R, \dot{C}^1R \in 1 : \supset \vdash . \text{Prop}$

*56112. $\vdash: R \in 2 . \equiv . D^2R, \dot{C}^1R \in 1 . \dot{C}^2R \in 2$
Dem.
 $\vdash . \#56111 . \#5443 . \supset$
 $\vdash : R \in 2 . \equiv . D^2R, \dot{C}^1R \in 1 . D^2R \dot{\cup} \dot{C}^2R \in 2 .$
 $[\#3316] \equiv . D^2R, \dot{C}^1R \in 1 . \dot{C}^2R \in 2 : \supset \vdash . \text{Prop}$

*56113. $\vdash: 2 . = \dot{2} \dot{\cap} \dot{C}^{\dot{C}2}$
Dem.
 $\vdash . \#56112101 . \supset \vdash : R \in 2 . \equiv . R \in \dot{2} . \dot{C}^2R \in 2 .$
 $[\#37106 . \#33122] \equiv . R \in \dot{2} . R \in \dot{C}^{\dot{C}2} .$
 $[\#2233] \equiv . R \in \dot{2} \dot{\cap} \dot{C}^{\dot{C}2} : \supset \vdash . \text{Prop}$

This Western metaphysics added nil to the practical value of math, but it made simple math enormously complicated: Russell and Whitehead needed 378 pages to prove $1+1=2$, which proof obviously adds nothing to the practical value of elementary arithmetic. The mere statement of that proof is meaningless gibberish for most people, including trained formal mathematicians (see figure). But, of course, those taught to believe they are

Fig. 1. The perils of "perfection": Whitehead and Russell's proof of $1+1=2$ in Principia.

inferior and to idolise glorified Western figures of authority find it hard to come out and say that what looks like gibberish is, in fact, gibberish, and worth nothing.

From this corrected historical perspective, the simple method of decolonising math is to abandon that Western metaphysics as inferior, since so hopelessly complex and of nil practical value. The simple alternative is just to revert to the way that math actually developed historically. This cleanly separates what “works” (the practical value, which is of non-Western origin) from what does not (the Western metaphysics), while also identifying what “works against” the colonised (false history, bad philosophy). We can therefore avoid the package deal of (ideologically) Western mathematics, with its false claims of superiority, and simply retain the practical value which is non-Western in origin.

While the West has for long crowed about its superiority, the fact is that the West never comprehended the sophisticated philosophy used by Indians to sum infinite series. A reverse racist would say this shows that white-skinned people were intellectually inferior, and harp on it for the next thousand years. However, not being a reverse racist, I will focus on that traditional philosophy, which I have recast as zeroism. One advantage of zeroism is that it allows us to use numbers as in their natural-language understanding through empirical referents. Thus, when we refer to 2 dogs, or 2 cats, or 2 oranges, we do not thereby mean to assert that the two dogs are identical, but only that the differences between them can be discarded as irrelevant to the context. The happy result of zeroism is that everyone overnight becomes mathematically literate!

Decolonised math works better: zeroism also provides an understanding of calculus superior to that provided by the “limits” of university-text calculus or mathematical analysis. For example, that Western technique of metaphysically summing infinite series fails for the case of probability (relative frequency converges to probability only in the sense of probabilistic convergence, or convergence in measure; hence defining probability as the probabilistic limit of relative frequency begs the question of what probability is.) Again, instead of the Western metaphysics of the continuum (or formal real numbers), wrongly regarded as essential for the calculus, the non-Western technique used the “non-Archimedean” arithmetic of unexpressed fractions (rational functions). This improves on university-text calculus especially in applications to science.¹⁷

Thus, physics is today formulated using differential equations. Those equations make sense only if the derivatives they involve make sense. On university-text calculus (or calculus with limits) a differentiable function must be continuous. So, the mere act of writing down the equations of physics presupposes that all variables entering into those equations are continuous. There are, however, many situations where that is manifestly not the case. For example, the explosion of a firecracker or a bomb (or the passage of a supersonic plane) all result in a shock wave, across which there are sudden or discontinuous changes in variables like pressure, temperature etc. representing the state of air. In classical fluid mechanics it is possible to suppose that these continuum variables are statistical averages: however, that way out is not available in the case of general relativistic shocks, for general relativity lacks a statistical mechanics, and does not relate its continuum description of matter to an underlying description of particles of matter. In these situations, “non-Archimedean” arithmetic, like non-standard analysis, works better while the failure of university-text calculus is manifest, as is the failure of the higher mathematics of Schwartz distributions. There are many other areas of physics, where university-text leads to infinities, as in relativistic singularities, the runaway solutions of classical electrodynamics, or the renormalization problem of quantum electrodynamics. However, I do

¹⁷ For a quick account, see C. K. Raju, “Retarded gravitation theory” in: Waldyr Rodrigues Jr, Richard Kerner, Gentil O. Pires, and Carlos Pinheiro (ed.), *Sixth International School on Field Theory and Gravitation*, American Institute of Physics, New York, 2012, pp. 260-276. http://ckraju.net/papers/retarded_gravitation_theory-rio.pdf.

not go into that here: the basic conclusion is that discontinuities arise in physics, and cannot be handled by a calculus based on the continuum, whereas they can be handled with “non-Archimedean” arithmetic, so decolonised math works better.

In pedagogical terms, this means that calculus ought to be studied along the lines of Aryabhata as the numerical study of differential equations. Side by side, zeroism is used to reject as *erroneous* the idealist claim of “perfection” in maths (or anything else). Just as zeroism permits the discarding of insignificant differences between oranges, just as it permits the discarding of infinitesimals (with non-Archimedean “unexpressed fractions”), so also it permits discarding small quantities as irrelevant to the problem at hand. This means doing calculus with floating point numbers used on a computer is acceptable. On the other hand, the symbolic manipulations taught in present-day school calculus courses is actually of nil practical value today with the widespread availability of symbolic manipulation programs like Maxima. This makes math easy since the contents of a fat calculus text of 1250 pages (in three columns and fine print) can be effectively taught in a week as has been demonstrated¹⁸ (now with 8 groups across 5 universities, in 3 countries). The decolonised course on calculus has been called “Calculus without Limits”.

This decolonised math not only enhances the practical value of math, in its applications to science, it not only makes math easy, it enhances the practical abilities of the students since it enables them to solve harder problems, such as the “exact” solution of the simple pendulum using Jacobian elliptic functions.¹⁹

What remains to be done is this. A text must be prepared for this decolonised math course, though pedagogical materials are ready.²⁰ (A similar requirement of preparing a pedagogical text applies also to the HPS1 and HPS2 course, pedagogical materials for both of which are also ready.²¹) While the idea of a fluid course, responsive to immediate student needs, is a good one, it is not appropriate to the wider dissemination of these courses. Educational administrators expect something more solid, and less fluid, which can be held in the hand, and flipped through! Mainstream teachers are not always well-enough versed with the topic, so the inquisitive student needs a ready source as a backup.

Further, the practical advantages of the courses must be advertised. The HPS-1 and HPS-2 act as a balm and restore the self-respect of the exploited which was battered for centuries by Western claims of superiority based on an utterly false history. This helps them to stand up to Western oppression. As for decolonised math, the course is particularly useful for scientists, engineers and social scientists all of whom are utterly unconcerned about the exquisite metaphysics of the *Principia* which needs 378 pages to prove $1+1=2$.

A further point which emerged from the responses of students, and the responses to my articles in *Dainik Bhaskar* was this. Most people blame themselves; they think that the difficulty they or their

18 C. K. Raju, “Teaching mathematics with a different philosophy.” Part 1: Formal mathematics as biased metaphysics. *Science and Culture* 77 (7-8) (2011) pp. 275-280. <http://www.scienceandculture-isna.org/July-aug-2011/03%20C%20K%20Raju.pdf>. Part 2: “Calculus without Limits”, *Science and Culture* 77 (7-8) (2011) pp 281-85, <http://www.scienceandculture-isna.org/July-aug-2011/04%20C%20K%20Raju2.pdf>. Also, “Calculus without limits”, paper for 2nd People's Education Congress, Homi Bhabha Centre for Science Education, Mumbai, in Proc. <http://ckraju.net/papers/calculus-without-limits-paper-2pce.pdf>.

19 C. K. Raju, “Time, what is it that it can be measured”, *Science&Education*, 15(6) (2006) pp. 537–551. http://ckraju.net/papers/ckr_pendu_1_paper.pdf.

20 Since the course was conducted for students at various levels, there are various versions. For a comparison between versions, the pre-test question paper for post-graduates is here. While the course for social scientists is here.

21 Various versions of this are posted online at .

progeny have with math is their fault. That is, they regard it as an individual problem, and seek individual solutions. However, I hope have made clear by now that the problem actually lies with the Western misunderstanding of math (passed off as “superior”). Therefore, the solution being offered is a collective solution. Math can be made better and easier, but the right way to do that is to change the present-day math syllabus.

Colonial blocks

But how to make people understand that? Once again we encounter the “colonial block” which prevents change. To reiterate, colonial education taught faith by enforcing mathematical and scientific illiteracy. People cannot decide of their own knowledge about math teaching; they consult an “expert”. On the other hand, colonial education taught great respect for Western “experts” AND non-faith in the non-West. This principle is built into the structure of Wikipedia today: it forces reliance on secondary sources, as a rule. It posits that one must use a reliable source (or RS as they call it). But the tacit rule is that a reliable source is a Western one. If there is a conflict between a Western and a non-Western source, the non-Western source is declared to be not RS and deleted. The implicit belief of billions in the Wikipedia obviously makes it a superb tool for propaganda and impedes decolonisation. The HPS-1 course demonstrated the problems with Wikipedia, but that is obviously not enough.

For example, in a newspaper article I wrote that mathematics derives from mathesis, a religious term, citing Plato and Proclus. The sub-editor consulted Wikipedia, which cites a Western glorifier-cum-apologist to claim that mathematics derives from mathema. The point of the apology is the claim that the concerns of Greek math were with science and not, as Plato said, with the soul. The sub-editor did not notice the violence that this word play does to Platonic philosophy. He cited that Wikipedia derivation in the “lift” to my article, presuming that I had made made a mistake, and was not RS, compared to Wikipedia. Presumably he thought he was ensuring more authentic information. This colonial blocks of relying on Western authority, exemplified by Wikipedia, is a technique of mind control which impedes and derails any attempt to challenge Western authority. A task force must be set up to expose Wikipedia.

Of course, the methods of controlling the masses, which Wikipedia reaches, are different from the methods of controlling the knowledgeable, just as capital uses the stick for labour and the bribe for the manager. Systems like the ISI norm put in place by OIC countries ensure the subordination of non-Western academics to Western authority. This systematically ensures that “experts” are selected for their pliability and Western connections. This problem of academic corruption, or of Western stooges masquerading as “experts” in the present-day university system, impedes a collective solution. What is curious is that Wikipedia and the ISI norm are both *systemic* techniques of ensuring the persistence of Western authority, widely sold to the gullible. Non-Western people accept the dishonesty of individuals, but widely failed to understand or even imagine systemic dishonesty.

Statistics

To move on to other areas, a course has been designed called “Statistics for social science and humanities”. (This was done along the MQA guidelines.) Social sciences have long used quantitative statistical tools, and these are increasingly used even in the humanities. For example in the use of statistical analysis to identify the true author of a work. Using the philosophy of zeroism, similar to that

used in natural language, together with numerical methods, gets rid of the complicated measure theory and Lebesgue integral underlying conventional statistics. Unlike numerical methods, formal techniques involve a steep learning curve which just recast statistics into metaphysics to make it “perfect” and “exact”, like mathematics. The learning curve is so steep that when, three decades ago, I outlined course as an optional course for postgraduate students in mathematics, in Pune University, most of the students dropped out of the course! Students of social science and humanities will hence appreciate this new course in statistics. (I should add that even the combinatorial problems used by, say, Bhaskara-2 are a lot more colorful, than the dull stuff one finds in present-day texts.) This course, however, has yet to be tried out.

Physics

Recall that science education was and remains the ground for adopting Western education. Recall also the doubt about Western science that “it works”, and the response about decolonised science, that “it works better”. This demonstration in the case of math, must also be carried out in the case of science. The method of decolonising science was outlined earlier, and remains the same. However, some progress has been made.

Explaining that Einstein was a con-man had aroused the wrath of a wog-ish sub-editor earlier, who knew neither history nor science, nor anything about my critique of both. What he had learnt from his early missionary training was this: that a figure once glorified and sainted is beyond criticism, and must be respected for all time. Hence, his knee-jerk reaction to my critique was righteous indignation barked out using Latin phrases. On this principle of propagandism, the history of a glorified person can never be corrected even if it is totally false. At least the inhibitions against correcting it are very strong. Others have reacted similarly about Copernicus and Euclid and so on. Noticeably, none of these propagandized minds ever gave a studied response or countered a single one of my points: it is all about the moral righteousness aroused by the critique of a glorified figure. They have no facts or arguments to support their blind beliefs.

For the purposes of this article, the relevant issue is the pedagogical one: why is special relativity, a first-year undergraduate subject, still taught wrongly? The authority of Einstein, and the false attribution of relativity to him is the obvious cause, for it is Einstein's misunderstanding of relativity which is taught today.

Yet, isn't it true that science is open to criticism? And doesn't that apply also to science teaching? So, shouldn't the critique be immediately either accepted or else refuted by scientists? Unfortunately no. Scientists react in the manner of the church when their high priests are challenged. Can the church accept or refute a critique of its dogmas like virgin birth? No. Refuting it is not possible. Accepting the critique would be catastrophic for the dogma, and for church authority. Therefore, the usual church reaction is silence. That is also the reaction of scientists when their high priests are challenged. Certainly no one has responded so far to my critique of the teaching of relativity. Basically, there is no question about academics in colonised countries changing the teaching of science. They lack the authority and fail to apply their own mind and change any part of the teaching of science. The governments of OIC countries endorse this principle of inferiority, as does the Indian government by officially declaring their own scientists as inferior. This inferiority was the result of two centuries of Western education brought in with bait of teaching science.

A point which probably needs to be explained again. What has Einstein or the teaching of relativity got to do with the decolonisation of science? To reiterate for the umpteenth time, the theory of relativity

arose due to a conceptual error in Newtonian mechanics, concerning the measurement of time. Because Newton made time metaphysical, and did not define the meaning of “equal intervals of time”, there was no way that the Michelson-Morley experiment could have measured the speed of light. The constancy of the speed of light is a postulate, not an experimental fact, as is wrongly taught. Attributing relativity to its correct source, Poincare, clarifies the conceptual issues involved, and very clearly brings out Newton's conceptual error.

So, what does that have to do with decolonisation? There is both a historical and a pedagogical connection. The historical connection is this: Newton made failed to understand the Indian calculus, and how it summed infinite series. (That is, Newton not only did not invent the calculus, he failed to understand it.) Further, he made time metaphysical just because he thought that doing so provided a “perfect” way to understand the derivative needed for his formulation of the “universal laws” of motion. (Note the religious predilection that math must be “perfect”.)

The pedagogical connection is this. Poincare understood what Einstein never did: that with the new definition of equal intervals of time provided by relativity, the equations of relativity must be functional differential equations. After relativity, interactions do not propagate faster than the speed of light (at least if restrict ourselves to interactions propagating in one direction in time). This was exactly what the paper on decolonisation of science advocated: that, after relativity, physics must be done using functional differential equations. This “works better” and leads to a better science.

For example, if we proceed along the above lines, then correcting Newton's “laws of motion entails a necessary correction to Newtonian gravitation. General relativity is over-reach, and so complicated that one no longer knows the meaning of a single body. The minimal correction is to do gravitation via functional differential equations, taking into account that gravitational interactions can travel at most at the speed of light. Retarded gravitation theory²² shows that doing this account for the flyby anomaly of NASA spacecraft as a v/c effect due to the rotation of the earth. Though this case of “it works better” entails very tiny corrections, the corrections are huge if we move beyond the solar system to the galaxy. Newtonian theory is completely unable to account for the rotation curves of spiral galaxies except by accumulating hypothesis like dark matter and its strange distribution in the form of halos. But before moving on to those more complicated matters, the minimal requirement is the correct teaching of relativity at the undergraduate level.

To this end I have commenced a series of articles in *Physics Education* on Functional Differential Equations (FDEs).²³ The third and latest (but not last) article explains how recasting Maxwellian electrodynamics to use FDEs helps to resolve the long-standing problem of infinities and runaway solutions in classical electrodynamics.

At a more fundamental level, FDEs are interesting because they (mixed-type FDEs) provide a model of non-mechanistic science, different from the one provided by “laws of nature”. Our undeniable mundane experience is that *we* somehow manage to bring about a certain future that we want, at least sometimes, and for modest objectives. On the laws-of-nature model of the cosmos that experience is dismissed as an illusion, a collective hallucination, the right treatment for which is to be drowned in the tons of ink spilt on the theology of free will. So much for the idea that science relies on empirical

22 C. K. Raju, “Retarded gravitation theory” in: Waldyr Rodrigues Jr, Richard Kerner, Gentil O. Pires, and Carlos Pinheiro (ed.), *Sixth International School on Field Theory and Gravitation*, American Institute of Physics, New York, 2012, pp. 260-276. http://ckraju.net/papers/retarded_gravitation_theory-rio.pdf.

23 C. K. Raju, “Functional differential equations.1: a new paradigm in physics”, *Physics Education* (India), 29(3), July-Sep 2013, Article 1. <http://physedu.in/uploads/publication/11/200/29.3.1FDEs-in-physics-part-1.pdf>. “Functional differential equations 2: The classical hydrogen atom”, *Physics Education* (India), 29(3), July-Sep 2013, Article 2. <http://physedu.in/uploads/publication/11/201/29.3.2FDEs-in-physics-part-2.pdf>. “Functional differential equations. 3: Radiative damping” *Physics Education*(India), 30(3), July-Sep 2014, Article 8. <http://www.physedu.in/uploads/publication/15/263/7.-Functional-differential-equations.pdf>.

experiments and not dogma! Western science persistently refuses to take into account even the most basic experience of people repeated thousands of time each day. Real science must take that mundane experience into account and provide a model for it. By a model, I decidedly do not mean a causal or mechanistic model which allows us to control; what I mean is a scientific model which at least accepts the most fundamental aspect of our experience as real and describes it.

Such models using mixed-type FDEs involve no fresh physical hypothesis, just a rejection of the dogmas of “laws of nature” and “causality” found in (ideologically) Western science.

This naturally has implications for biology at various levels: for example mixed-type FDEs involve spontaneity as distinct from chance.²⁴ Spontaneity provides a model for mutations which differs from the Darwinian model of chance. This is a subtle point which escaped Darwin who had only the model of chance before him. Even today it is doubtful that most biologists understand the difference. However, those are issues at the research level rather than the pedagogical level, so I won't discuss them further.

Ethics

The most interesting implications of decolonised science are for ethics. In the first place, Hegel's failure to understand Indian ethics is due to the Western belief that ethics is deontic and pure metaphysics. That is contrary to commonsense. In a truly mechanistic world there would be no need of ethics and no possibility of it. Therefore, physics does have a bearing on ethics.²⁵

Of course, there is a long Western tradition of debate on “determinism” vs “free will” which seeks to reconcile all the fantastic Western claims about God with the doctrine of sin. While theology can reconcile anything with anything, howsoever incompatible, the question here is one of science: the long-held Western belief in science as mechanistic is not compatible with the mundane experience that we create a bit of the future. This has to be discussed as science, and by scrupulously avoiding the slightest reliance on theology. Trying to resolve this incompatibility between (ideologically) Western science and mundane experience by appealing to the Western theological debate on “free will” amounts to reducing science to theology. It hardly matters that those arguments may be wrapped in scientific jargon, and appeal to chance, chaos, complexity or quantum indeterminism.²⁶

Apart from laws of nature, there are also the ordinary laws—civil and criminal law—which are an integral part of human society today, and where the notion of “cause” is used in a different, mundane sense: punishing a criminal the cause of a crime denies mechanistic causality. Laws are, of course, different from ethics, but the difference between ethics and law is not always so clear as it was in the case of Gandhi ji's Dandi march which was illegal but recognized as an ethical struggle against an oppressive state. Waters become especially muddy when, apparently motivated by the spirit of “social reform”, laws are used to collectively criminalize vast populaces by declaring their traditional practices as illegal. Even where the “social reform” may be fully justified, why should it be carried out by coercive fiat instead of collective persuasion? Changing the means changes things: a concrete example here is that of land ceiling vs Vinoba Bhave's bhudan. Is it ethical to ignore the means?

Further, considering that a large number of lawmakers today are themselves criminals, how can one ignore the possibility of a hidden agenda in laws which masquerade publicly as “social reform”. For example, as I argued in anticipation, a decade ago, the cyber laws are being used in India to criminalise dissent and criticism on the Internet and on social media sites.

24 C. K. Raju, “Time Travel and the Reality of Spontaneity”, *Found. Phys.*, **36**(7) 2006, pp. 1099-1113.

25 More specifically, as I have long argued, all systems of religious ethics are based on notions of time. C. K. Raju, *The Eleven Pictures of Time*, Sage, 2003.

26 For a detailed analysis of these arguments and their futility, see *The Eleven Pictures of Time*, cited above.

Indeed the very idea of “rule of law” where the law must be *written* down comes from a scriptural tradition foreign to India, where there is the notion of *dharma* and *rita* as distinct from the notion of law. There is not the slightest doubt that the imposition of a written constitution has led to the delay and hence denial of justice, in a system where cases keep pending across the lives of litigants, and lawyers and judges keep making money out of it like ghouls. These facts contradict the myth of “superiority” on the basis of which that system was adopted. Hence the myth must be rejected in favour of the facts.

In any case colonised countries adopted the Western system without ever making a systematic comparison. Even today, when new laws are introduced, say on intellectual property, they are blindly adopted, regardless of traditions which revere knowledge and do not regard it as property. Indeed, I am not aware of any university course today which carries out a systematic course on comparative ethics. This continues the homogenisation of the world commenced by colonialism.

It is interesting that the new concepts involved in decolonised science are relevant to the new needs, for example to concerns about environmental degradation.²⁷

Since values are central to education, an alternative course which at least outlines various systems of ethics without the present gross over-emphasis on Western view is an absolute must. This way at least the next generation would be able to do the systematic comparison so neglected by the previous generation. This naturally requires some understanding of the concepts underlying alternative systems of ethics such as my harmony principle based on a non-mechanistic physics.²⁸

Open source computing

The course on open source-computing seems, at first sight, the odd man out. The arguments for open source computing are all well laid out. But the main point to explain here about open-source computing is this: what does it have to do with decolonisation? The course was partly tried out in AiU for two reasons. First, there is the point that Munir Fasheh has long been making that novel pedagogical content is not enough, the pedagogical techniques too ought to be changed.

Hence, this course was tried out in the form of a *mujawara* outside the existing curriculum. As I have long emphasized to students even in conventional computing courses, in computing actual knowledge is far more important than certification. So, gaining knowledge, even without certification, is a good idea. It is certainly a better idea than gaining a certificate without knowledge! (That is what the present system usually provides.) The students who joined the *mujawara* in AiU broadly agreed with that. They were hungry for knowledge and complained that the existing system did not provide it.

The idea in AiU was that if the poor students there were to go back and function within their communities, as envisioned, then they needed open-source skills, and not corporate skills which would only divorce them from their communities. A simple issue is the cost of proprietary software as in IBM's SPSS vs PSPP or R: the cost puts it out of the reach of non-corporates. A related issue is the mass criminalization which results from trying to bypass that cost. At a less technical level (and with a lower cost difference) an example is that of Microsoft Windows and .NET vs LAMP stack, perhaps in the cloud (perhaps even Azure!). Because of the cost-difference of proprietary vs open source software this course was perceived as a threat. It was offered as a contribution of students to AiU community by selecting a new LMS/CMS over the existing one. While Tan Sri Dzul strongly encouraged it, after he left, this was strongly opposed by vested interests, with whom Omar Farook unfortunately sided, and it

27 E.g., C. K. Raju, “Entropy, economics, environment and ethics”, *Frontier Weekly*, Jan 2014.

<http://www.frontierweekly.com/views/jan-14/20-1-14-Entropy-economics-environment%20and%20ethics.html>.

28 C. K. Raju, “Harmony principle”, in *Philosophy East and West*, **63** (4) 2013, pp. 586-604.

<http://www.ckraju.net/papers/Harmony-principle-pew.pdf>. A similar paper with the same title to appear also in an edited volume *Svaraj and samvad*, ed. Shail Mayaram, Sage, 2013.

was hence abandoned half-way.

Now, colonial education used both carrot and stick. The carrot which colonial education initially dangled was the dream of a government job and related perks. Today that dream has changed slightly: the carrot is now a corporate job. This change merely reflects the realities of increasing corporate control over the state. However, the aim of education is still the same, viz., that education should produce good slaves, good for whatever purpose the government or corporates have in mind.

Therefore, to achieve emancipation, there is a great need to challenge that big dream used to sell present-day education, and to provide alternative dreams. For example, knowledge can be provided through a chain of “knowledge cafes” which cannot be regulated in the same way as certificate dispensing colleges and universities. This would put together an alternative pedagogical technique with alternative pedagogical content. It might also help to make the effort self-sustaining and raise resources which dissenters are always short of.