Ganit vs formal math

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Abstract: Here is a 14 word summary of the proposed book: **1. Ganit (गणित) differs from (formal) math, 2. it makes math easy, and 3. makes science better.** But it is hard to communicate this simple thesis, because colonial education made most people mathematically and scientifically illiterate, and blanked out indigenous knowledge. Therefore, most don't understand *any* of the three: गणित, formal math, or science.

The pitch is further queered because colonial education creates insular minds, which blindly reject any critique of the master, even without understanding it. Why? Because colonial (higher) education was church education, *designed* to produce insular missionaries. The church rests on faith; to teach faith it taught ignorance. The ignorant are forced to depend on the guidance of those they trust. Colonial education taught and institutionalised the formula: "trust the West" (and "mistrust the non-West"). To preserve faith, it also taught *negative* knowledge: numerous false myths, plus the trick of using a chain of stories to counter facts.

Contrary to the stock caricature, I do not advocate blanket rejection of the West, but have always advocated a *critical*[1] rejection. This while recognizing that the long Western tradition is to censor,[2] and demonise critics, and that the church brutally tortured and murdered lakhs of critics, whom it was unable to answer.

My first presentation focused on history. Most school mathematics today (arithmetic, algebra, "trigonometry" and calculus,[3] probability and statistics[4]) was imported by Europe, from India, for its practical value, between the 10th and 16th c. CE. Due to cultural dissonance, Europeans failed to understand some features of गणित.[5] They changed normal to formal math by adding a layer of religiously biased metaphysics[6] (which added nil to its practical value and enormously to its difficulty). This transformed math was returned as "superior" through colonial education, and we did not cross-check either its false history (e.g. "Newton invented calculus") or that claim of "superiority", and refuse to do so today.

This talk will explain how to cross-check: it will elaborate on the philosophical difference between गणित (or normal math) and formal math. First, (contrary to the colonial myth) math is *not* universal, but is influenced by culture. E. g., the elementary concept of angle is wrongly translated in our Hindi school texts, just because the concepts of angle in गणित and math are (even instrumentally) different.

The major cultural influence on Western math was obviously that of the church. It taught Western ethnomathematics to teach reasoning to its future priests in Cambridge, on myths about Euclid[7] and related superstitions[8] about the *contents* of the book he purportedly wrote. This resulted in the obvious foolishness[9] of the Cambridge math syllabus, even in the 20th c. Incidentally, we compound that foolishness[10] while officially refusing[11] to provide evidence for "Euclid". During the Crusades, the church created its theology of reason, to persuade Muslims who accepted only reason (as in aql-i-kalam). Because the church aim was persuasion, it declared proof as the objective of math, as in formal math today. Because facts are inimical to church dogmas, it prohibited the use of facts in proofs, exactly as is done in formal math today.[12]

Another false myth is that गणित lacked proof. As a counter-example, I consider an Indian proof of the Pythagorean theorem.[13] The proof involves the empirical, but *there is no formal proof of the theorem prior to the 20th c.*, contrary to the false myths in our school texts that Pythagoras or "Euclid" gave such proofs. Anyway, **गणित accepts empirical proofs, formal math prohibits them.** Acceptance of empirical proof is often foolishly caricatured in the West as rejection of reason. I give counter-examples to show this is false. Indians used *both* empirical proofs and reasoning, in philosophy as well as गणित, as does science today.[14] So, why is गणित inferior, especially if it is to be taught for science? Further, the use of the word "reason" involves a church double speak: the church (not the Greeks) invented metaphysical reasoning (reason minus facts, formal reason) *contrary* to normal reason (reason plus facts). Our school texts use one word "reason"

indiscriminately for both scientific (normal) reasoning and church (formal) reasoning, to advocate a (formal) mathematics which teaches church "reasoning" for its purported use in science.

Because facts are prohibited, the axioms of formal math (such as those of set theory) are pure metaphysics (i.e., irrefutable in the Popperian sense). Hence, formal mathematical theorems are *never* certain truths, and need not even be approximately valid knowledge. They can mislead, since the metaphysics of infinity in formal math (e.g. formal "real" numbers) is religiously biased since allied to church dogmas of eternity.[15] On Western superstition, deduction is infallible. I explain why formal mathematical theorems are not even certain *relative* truths. At best, they are FALLIBLE relative truths (relative to *both* axioms and logic[16]),

Another key difference is that गणित (though it had proofs) *focused on calculation.* Calculation is the source of practical value in everything from shopping for groceries to determining rocket trajectories, or finance[17] and AI. E.g., though Columbus supposedly *proved* the earth is round, mathematically backward Europeans were unable to *calculate* the earth's radius for centuries, as others had done millennia earlier, and this failure of calculation led to huge navigational disasters specific to Europeans, which lasted until the late 18th c.[18] Again, the "Pythagorean" "theorem" in the Manava śulba-sūtra[19] 10.10 states how to *calculate* the diagonal of a rectangle, using square-roots, impossible with Greek and Roman numerals.

The third difference follows: गणित accepted inexactitude in calculation. While precision is needed, calculations are inevitably inexact[20] or "approximate": this is obvious when they involve entities such as $\sqrt{2}$ declared as सविशेष.[21] All calculations done on digital computers today are inexact.[22] Formal math however claims exactitude. This is plain superstition, e.g. the Pythagorean theorem is not *exactly* true anywhere in the real world; not on the curved surface of the earth, not in space which too is curved.

The Western superstition that math is exact arose from a related Western religious superstition that math is *eternal* truth. Plato said that mathematics (from mathesis) arouses the eternal soul.[23] Proclus[24] explained this by sympathetic magic: math arouses the eternal soul just because math has eternal truths. This belief persisted as a post-Crusade church superstition that "God rules the world with eternal laws of nature",[25] written in "the language of eternal truth: mathematics". The Western attempt to sum Indian infinite series *exactly* led to a fantasy world of metaphysics (of infinity, formal "real" numbers), mimicking Aquinas' metaphysics of angels.[26] Few understand the trick of using biased metaphysics in math to push religiously biased conclusions into science, as in the creationism of Stephen Hawking.[27] Likewise, politically biased conclusions (e.g. "Arrow's impossibility theorem") can be pushed into economics[28] through formal math.

That is, **while math "works" for science, what "works" is *normal* math;** the formal math part, or the layer of metaphysics added to it by the West, is redundant. However, metaphysics does add political value (exclusively for the West) for the axioms of school and university math were all laid down by authoritative Western mathematicians, and a revolt is needed before alternatives can be mainstreamed.

Some confusing tricks are used to hide the religious connection of Western (formal) math. These include (1) emphasizing aesthetics over practical value, clearly absent in current, formal math,[29] (2) confounding the metaphysics in math with mere abstraction, and (3) myths about Greek achievements in math, to hide the church invention of formal reasoning.

Pedagogically, the book on Rajju Ganit[30] is ready, and Pune University may accept[31] the secular math course on calculus without limits.[32] Scientifically, Newton, though abusively anti-church in his censored writings,[33] was a fanatic Christian.[34] His religiosity about "laws of nature", and consequent misunderstanding of the Indian calculus,[35] led him to make time metaphysical, and this was the very reason why his physics failed a century ago.[36] My (revised) theory of retarded gravitation[37] aims to use the two-satellite experiment (and 'Oumuamua) to test for special relativistic (v/c) gravitational effects inexplicable on general relativity.

Conclusions. गणित differs from formal math because गणित is secular while formal math is based on religious superstitions. Ganit makes math easy because the metaphysics of formal math, as in Russell's 378 page proof of 1+1=2, adds enormously to the difficulty of math without adding practical value. Ganit improves science by eliminating the creep of biased metaphysics from formal math into science.

1 CKR, “Be critical, choose what is best”, public statement in *The Sun*, Malaysia, 29 Aug 2011, p. 16. Archived at http://ckraju.net/press/2011/the-Sun-29-Aug-2011-p16-clipping-ckr-response.gif. The debate, because of an editorial in the *Sun* on my talk, is archived at “Decolonisation: conversations in the Sun”, http://ckraju.net/blog/?p=61.

2 E.g. CKR, “To decolonise math, stand up to its false history and bad philosophy”, (http://ckraju.net/blog/?p=117) article published by *Conversation* (Global edition) on 24 Oct 2016, went viral, then CENSORED, by its South Africa editor on the strange ground that non-Whites are not editorially allowed to cite their own published research. The article was reproduced worldwide, and then censored worldwide, e.g. in India by both Scroll and Wire. But the Wire put it back (https://thewire.in/history/to-decolonise-maths-stand-up-to-its-false-history). The censored article was reproduced in full in “Black thoughts matter...”, *J. Black Studies,* **48**(3) (2017) pp. 256-278. Also in *Rhodes Must Fall* (Oxford), Zed Books, London, 2018, chp. 26. See, also, CKR, “Mathematics and censorship”, Kafila, https://kafila.online/2017/06/25/mathematics-and-censorship-c-k-raju/.

3 CKR, *Cultural Foundations of Mathematics: the nature of mathematical proof and the transmission of calculus from India to Europe in the 16th c. CE*, Pearson Longman, 2007. Quick summaries in articles in: *Encyclopedia of Non-Western Science, Technology and Medicine*, (ed. Healine Selin) Springer, 2014, 2016. “Calculus” pp. 1010–1015, http://ckraju.net/papers/Springer/ckr-Springer-encyclopedia-calculus-1-final.pdf, “Calculus transmission”, pp. 1016–1022. http://ckraju.net/papers/Springer/ckr-Springer-encyclopedia-calculus-2-final.pdf

4 CKR, “Probability in Ancient India”, *Handbook of the Philosophy of Science*, vol 7, *Philosophy of Statistics*, ed. Prasanta S. Bandyopadhyay and Malcolm R. Forster. General Editors: Dov M. Gabbay, Paul Thagard and John Woods. Elsevier, 2011, pp. 1175–1196. http://ckraju.net/papers/Probability-in-Ancient-India.pdf.

5 For a quick account, see my talk at MIT. Video: https://youtu.be/IaodCGDjqzs, abstract: http://ckraju.net/papers/Calculus-story-abstract.html, presentation: http://ckraju.net/papers/presentations/MIT.pdf.

6 CKR, “Teaching mathematics with a different philosophy. 1: Formal mathematics as biased metaphysics.” S*cience and Culture* **77** (2011) pp. 275–80. arXiv:1312.2099.

7 CKR, *Euclid and Jesus: how and why the church changed mathematics and Christianity across two religious wars*, Multiversity, Penang, 2012.

8 B Russell, “The Teaching of Euclid”, *The Mathematical Gazette* **2** (33) (1902), pp. 165-167. http://ckraju.net/geometry/Bertrand%20Russell%20on%20Euclid.htm.

9 http://ckraju.net/geometry/cambridge-note.html.

10 See, e.g., Rajju Ganit draft teacher’s manual at http://ckraju.net/geometry/Rajju-ganit-draft-teacher-manual.pdf.

11 http://ckraju.net/blog/?p=173, and http://ckraju.net/geometry/NCERT-grievance-detailed-note.pdf.

12 For the stock definition of a formal mathematical proof see, e.g., the text by E. Mendelson, *Introduction to mathematical logic*, van Nostrand, New York, 1964, p. 29.

13 CKR, “Computers, Mathematics Education, and the Alternative Epistemology of the Calculus in the YuktiBhāsā”, *Philosophy East and West*, **51**:3 (2001) pp. 325–362. http://ckraju.net/papers/Hawaii.pdf. Also “Mathematics and Culture”, in *History, Culture and Truth: Essays Presented to D. P. Chattopadhyaya*, ed. Daya Krishna and K. Satchidananda Murthy, Kalki Prakash, New Delhi, 1999, pp. 179–193.

14 E.g. (popular-level article) “Scientific temper in ancient India”, *ThePrint*, 29 March 2019. https://theprint.in/opinion/do-indians-have-a-scientific-temper-ancient-texts-reveal-we-did-way-before-the-west/214767/

15 CKR, “Eternity and Infinity: the Western misunderstanding of Indian mathematics and its consequences for science today.” *American Philosophical Association Newsletter on Asian and Asian American Philosophers and Philosophies* **14**(2) (2015) pp. 27–33. http://ckraju.net/papers/Eternity-and-infinity-Pages-from-APA.pdf.

16 CKR, Decolonising mathematics, *Alter*Nation 25(2) (2018), pp. 12-43b https://doi.org/10.29086/2519-5476/2018/v25n2a2.

17 See the example about stochastic differential equations driven by Levy motion in the Hawai’i paper cited at 11 above: calculation of the solution is possible, but there is (still) no proof that a solution exists. The sub-prime crisis of 2008 was probably due to excessive reliance on risk calculated on the Black-Scholes model where a mathematical proof of the existence of solutions is available, though the model is empirically false.

18 For detailed further discussion of the European navigational problem, and its solution available in early Indian texts, see *Cultural Foundations of Mathematics*, cited above, especially chp. 4. “Latitude, longitude, and the globe”.

19 *The Sulbasutras*, ed. and trans. S. N. Sen and A. K. Bag, INSA, New Delhi, 1983.

20 CKR, “Zeroism”, in *Encyclopedia of Non-Western Science, Technology, and Medicine*, Springer, 2016, , pp. 4604–4610. http://ckraju.net/papers/Springer/zeroism-springer-f.pdf.

21 Baudhayana 2.12. See, e.g., Sen and Bag, cited earlier.

22 See the example C program using floating point numbers in the Hawai’i paper at 11 above. For details of floats see my *Lecture Notes on C*, or the notes online.

23 Plato, *Meno*, trans. B. Jowett, http://classics.mit.edu/Plato/meno.html.

24 Proclus hence derives mathematics from mathesis. Proclus, *Commentary*, [*A Commentary on the First Book of Euclid’s Elements*], trans. Glenn R. Morrow, Princeton University Press, Princeton, New Jersey, 1970, Prologue, p. 38. Wikipedia as usual distorts the truth, using a secondary racist source, Heath, to claim that mathematics derives from mathema, which relates to science not religion.

25 Thomas Aquinas, *Summa Theologica*, *First part of the Second Part*, 91,1, http://www.newadvent.org/summa/2091.htm.
26 Thomas Aquinas, *Summa Theologica*, *First Part,* Q. 52, article 3. http://www.newadvent.org/summa/1052.htm#article3
27 CKR, *The Eleven Pictures of Time*, Sage, 2003. For a popular account, see, "The Christian propaganda in Hawking's work". *Daily News and Analysis*, full page article, 16 Jan 2011, https://www.dnaindia.com/lifestyle/review-the-christian-propaganda-in-stephen-hawking-s-work-1495047, or archived version at "Hawking singularities", http://ckraju.net/blog/?p=50.
28 See, *Eleven Pictures of Time*, cited above.
29 Plato put together both math and music, in his *Republic*, but math has changed. It is manifest that a mass of school children today love music (without being taught) and detest math and find it ugly. This issue of a fantasy aesthetics in present-day formal math, an aesthetics confined to a few experts with vested interests, as an excuse for the lack of any demonstrated value of formal mathematics, especially in post-independence India, is further discussed in CKR, "Kosambi the mathematician", *Economic and Political Weekly* **44**(20), 16 May 2009, pp. 33-45. Available at http://ckraju.net/papers/Kosambi-EPW.pdf.
30 C. K. Raju, *Rajju Ganita: String geometry for class IX.* For details of pedagogical experiments, and teacher-training workshops, see e.g., the poster at http://ckraju.net/blog/?p=155, and the media reports at http://ckraju.net/blog/?p=156.
31 "Mathematics in ancient India and its contemporary applications: it makes math so easy, so why don't we teach it?", talk at Univ. of Pune, 11 Oct 2019, abstract at http://ckraju.net/papers/ckr-Pune-abstract-and-bio.html.
32 CKR, "Teaching Mathematics with a Different Philosophy. 2: Calculus without limits". *Science and Culture*, **77** (2011) pp. 281–86. . arxiv:1312.2100. (Report on course at Universiti Sains Malaysia). Also, "Calculus without Limits: Report of an Experiment" 2nd People's Education Congress, HBCSE, TIFR, Mumbai, Oct 2009. In Proc. http://ckraju.net/papers/calculus-without-limits-paper-2pce.pdf. (Course at CUTS, Sarnath.) For posters of the course, see e.g., "Calculus without limits in Tehran", http://ckraju.net/blog/?p=84, "Calculus for social scientists", http://ckraju.net/blog/?p=83, and SGT university: http://ckraju.net/sgt/poster-calculus-without-limits.pdf. Also video at https://www.youtube.com/watch?v=0sdimbGwUCA.
33 See the revised biography, Richard S. Westfall, *Never at Rest: A Biography of Isaac Newton*, Cambridge University Press, paperback edition, 1983.
34 CKR, "Newton's secret" in *Eleven Pictures of Time*, cited above.
35 CKR, "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.
36 CKR, *Time: Towards a Consistent Theory*, Kluwer Academic, Dordrecht, 1994. Fundamental Theories of Physics, vol. 65.
37 For an expository account of the original correction to Newtonian gravitation, see CKR, "Functional Differential Equations. 4: Retarded gravitation", *Physics Education* (India) **31**(2) April-June, 2015, http://www.physedu.in/uploads/publication/19/309/1-Functional-differential-equations-4-Retarded-gravitation-(2).pdf.

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