Teaching alternative mathematics. 1: Rajju Ganit

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Abstract

The NCERT class IX math text has its chapter 5 titled "Euclid's geometry". However, there is no evidence for any historical Euclid. The leading Western historian of Greek mathematics (David Fowler) publicly admitted[1] that long ago (Nov 2002), in response to my critique. This lack of evidence was subsequently pointed out in my books,[2,3] in newspaper articles,[4] and periodicals,[5] and in papers presented at conferences[6] in the presence of an author of the NCERT math texts and a former Director of NCERT. The NCERT had no serious response. For example, the NCERT math head responded in 2007 by saying that no evidence was needed for "Euclid", since NCERT decided by a committee. He implied that children who studied the text had no right to ask questions and must forcibly accept the decision of the committee. In 2010, I announced a reward of Rs 2 lakhs for serious evidence about Euclid.[7] The reward stands unclaimed,[8] the texts stay unchanged.

The reference to "Greeks" hides the fact that "Euclid's" *Elements* was used as a church text for SEVEN centuries, to train priests in the post-Crusade church theology of reason.[9] Students are not

1   David Fowler, http://mathforum.org/kb/message.jspa?messageID=1175734 . Historia Matematica discussion list, 10 Nov 2002.
2   C. K. Raju, *Cultural Foundations of Mathematics*, Pearson Longman, 2007. PHISPC vol X.4. Chp. 1, "Euclid and Hilbert".
3   C. K. Raju, *Euclid and Jesus: how and why the church changed mathematics and Christianity across two religious wars*, Multiversity, Penang, 2012.
4   "इतिहास के विचलन", *Jansatta*, 23 Jan 2008. Clip archived at http://ckraju.net/papers/Jansatta-Euclid.jpg.
5   C. K. Raju, "Teaching racist history" *Indian Journal of Secularism* **11**(4) (2008) 25–28. http://ckraju.net/papers/Teaching-racist-history.pdf.
6   C. K. Raju, "Towards equity in math education. 1: Goodbye Euclid!", Paper presented at the Indian Social Science Congress, Mumbai, 2007. In: *Bharatiya Samajik Chintan* (New Series) **7** (4) (2009) pp. 255–264. http://ckraju.net/papers/MathEducation1Euclid.pdf.
7   In 2011, the reward was publicly reiterated in a talk chaired by the Malaysian Deputy Education Minister. C. K. Raju, "Decolonising History: Goodbye Euclid!", Universiti Sains Malaysia, 22 July 2011. Poster of talk at http://ckraju.net/blog/?p=63. The video of the talk was later removed by USM, but can again be found online, at "Goodbye Euclid!" part 1: https://www.youtube.com/watch?v=sEK1FCrLHjU, part 2: https://www.youtube.com/watch?v=MFf5co3G3R8, part 3: https://www.youtube.com/watch?v=zomZU949Cnw.
8   The Rs 2 lakh challenge prize for evidence about Euclid is repeated in the poster for the recent rajju ganit workshop in Indore. See, http://ckraju.net/blog/?p=155.
9   See, *Euclid and Jesus*, cited above. Or, C. K. Raju, "The religious roots of mathematics", *Theory, Culture & Society* **23** Jan-March 2006, Special Issue ed. Mike Featherstone, Couze Venn, Ryan Bishop, and John Phillips, pp. 95–97. http://ckraju.net/papers/Religious-roots-of-math-TCS.pdf. Or, C. K. Raju, "Teaching Mathematics with a Different Philosophy. 1: Formal mathematics as biased metaphysics". *Science and Culture* **77** (2011) 275–80. . arxiv:1312.2099.

informed that Indians rejected the book for centuries,[10] and that we started teaching "Euclid's" geometry only due to colonial education which was 100% church education when it came.[11]

In typical church manner, the NCERT text declares the use of "reason" to be "superior" to what geometry Indians did. But it does NOT inform students of the church double-speak about reason: that it refers to the church system of metaphysical reasoning (reason – facts) and not to normal reasoning (reasoning + facts) as most people interpret it to mean, and as used in Indian philosophy and Indian ganit[12] (and in science). The NCERT text does NOT inform students that the actual book *Elements* does NOT use such metaphysical or formal reasoning for the proof of ANY of its propositions from the first to the last,[13] or that this fact was eventually admitted in the West over a century ago.[14]

What is actually taught to students today is a complete hotch-potch of FOUR different and incompatible types of geometries. (1) Euclid's (religious) geometry,[15] (2) Hilbert's synthetic geometry[16] which tried to save the story of Euclid, (3) Birkhoff's axiomatic metric geometry (as recommended by the US School Mathematics Study Group,[17] after the sputnik crisis, and (4) empirical (and metric) compass box geometry. Students are given no indication that they are being taught an incoherent mix of incompatible geometries. Thus, the NCERT class VI text states that points must be invisible, but does not explain how a student can use the compass box to measure the distance between two invisible points. It says (alluding to synthetic geometry) that ideally a ruler should be unmarked. So, what should the student do? Erase the markings on the ruler provided in the geometry box. These are just two examples among many.

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10 The *Elements* was known in India, but rejected by a large section as a book with no practical value, hence not translated. Abul Fazl, Akbar's biographer mentions "Euclid's" *Element*s, but it was not translated from Farsi into Sanskrit until after the fall of the Moghul empire, in 1723 by Samrat Jagannath, as Rekha Ganit. The reason: the text is excessively prolix taking 47 propositions to prove the "Pythagorean theorem", which was traditionally proved in just 1 simple step in India. For the Indian proof, see, C. K. Raju, "Computers, mathematics education, and the alternative epistemology of the calculus in the Yuktibhasa", *Philosophy East and West*, **51**:3 (2001) pp. 325–362. http://ckraju.net/papers/Hawaii.pdf.

11 C. K. Raju, "Education and counter-revolution", *Frontier Weekly*, online. Similar version edited and republished as an article "Decolonising the hard sciences" in *Frontier Weekly* **46**(7) 25-31 Aug 2013. http://www.frontierweekly.com/archive/vol-number/vol/vol-46-2013-14/46-7/46-7-Decolonising%20Hard%20Sciences.html . Original at http://ckraju.net/papers/Education-and-counter-revolution.pdf

12 C. K. Raju, "Computers, mathematics education, and the alternative epistemology of the calculus in the Yuktibhasa", *Philosophy East and West*, **51**:3 (2001) pp. 325–362. http://ckraju.net/papers/Hawaii.pdf. Also, "Ganita vs mathematics: ten myths underlying formal math and the need to reject them", http://ckraju.net/blog/?p=111. Also, video: "Calculus: Ganit or math?" https://www.youtube.com/watch?v=U-r1CWU-KKM, Indian Institute of Science, 7 Dec 2015.

13 *Euclid and Jesus*, cited above.

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

15 The religious beliefs underlying geometry are clear from the very word "mathematics". Plato, especially *Meno*, *Republic* (book VII), *Phaedo* (73b), etc., links mathematics to mathesis meaning learning, and posits his famous doctrine that "all learning is recollection" (of eternal knowledge acquired by the eternal soul in its previous lives. After Socrates demonstrates the slave boy's innate knowledge of geometry, in *Meno*, Socrates proclaims he has hence proved the existence of the soul. Proclus, in his commentary on the *Elements*, derives mathematics from mathesis (and not from mathema, as Wikipedia mischievously does). *Dialogues of Plato*, trans. B. Jowett, Available online at the Internet Classics Archive hosted by MIT, http://classics.mit.edu/Plato/meno.html, etc. (In *Meno*, search for the second occurrence of "soul".) Proclus, *Commentary on the First Book of Euclid's Elements*, trans. Glenn R. Morrow, Princeton University Press, Princeton, New Jersey, 1970, Prologue part 2, p. 52. (Earlier translations are more honest, but even this one cannot avoid the several prominent passages linking mathematics to the soul.)

16 D. Hilbert, *The Foundations of Geometry*, trans. E. J. Townsend, Open Court, La Salle, reprint 1950.

17 School Mathematics Study Group, *Geometry*, Yale University Press, New Haven, 1961.

Before declaring the church method of metaphysical reasoning as superior to Indian geometry, the NCERT never critically compared it with Indian rajju ganit (string geometry)[18] or the geometry of the sulba sutra.[19]

We have carried out the comparison and have taught rajju ganit to teachers and students in four states: Maharashtra,[20] Karnataka[21] and Tamil Nadu,[22] and Madhya Pradesh.[23] The feedback has been very positive, and in favour of rajju ganit. The pre-test shows that students who study from NCERT texts are conceptually confused about all basic geometry concepts, like point, angle, straight line, etc.[24] The post-test shows that teaching of rajju ganit helps (1) to clarify geometry concepts, (2) make math easy, and (3) learn real-life applications.

18 C. K. Raju, "Towards equity in math education 2. The Indian Rope Trick" *Bharatiya Samajik Chintan* (New Series) *7* (4) (2009) pp. 265–269. http://ckraju.net/papers/MathEducation2RopeTrick.pdf.

19 S. N. Sen and A. K. Bag, *The sulbasutras*, Indian National Science Academy, Delhi, 1981.

20 http://ckraju.net/geometry/Nasik-group-photo.JPG.

21 http://ckraju.net/geometry/chamrajnagar-students-teachers.jpg.

22 http://ckraju.net/geometry/Gundulupete-1.jpg.

23 http://ckraju.net/blog/?p=155, and http://ckraju.net/blog/?p=156.

24 http://ckraju.net/geometry/NCERT%20critique-and-outline-of-alternative.pdf (draft).