

Ethics in Mathematical Education

Ernesto Rottoli, Bergamo

Abstract: The rising of non-Euclidean geometries forces mathematicians to go beyond the criterion of truth and to pose as priority the criterion of freedom. This criterion gains meaning in the circular path that links *ethos* with *logos* and it makes us able of experimenting with the wealth of the values of theory. Mathematical education thus finds a new dimension: it abandons the ambit of only formal constructions and finds again its role in the determination of the frames on which the originary *ethos* constructs its “intrinsic geometry”.

The role of Bayes’ law in education to tolerance is an example of these frames.

Kurzreferat: *Ethik im Mathematikunterricht.* Das Entstehen nichteuklidischer Geometrien zwingt Mathematiker dazu, dem Kriterium der Freiheit eine höhere Priorität als dem der Wahrheit beizumessen. Dieses Kriterium gewinnt Bedeutung durch die kreisförmige Verbindung zwischen *Ethos* und *Logos*. Es befähigt uns, mit dem Reichtum an Werten einer Theorie zu experimentieren. Die mathematische Erziehung findet so eine neue Dimension: sie verläßt den Bereich der rein formalen Konstruktionen und findet ihre Rolle wieder in der Bestimmung von “frames” (Rahmen), innerhalb derer das originäre *Ethos* seine “intrinsic Geometry” konstruiert. Die Rolle des Satzes von Bayes für eine Erziehung zur Toleranz dient als Beispiel für einen solchen Rahmen.

ZDM-Classification: E20

Mathematics is usually charged of taking the meaning out of words, to be an instrument for domination of nature and predetermination of event, to have produced the “mathematism”, that is the description of nature as an artificial and abstract system of symbols (Galimberti 1996). These charges result from the diffuse tendency to present mathematics as a formal construction, deprived of any meaning; only successively the meanings are recovered by means of the model building process, in order to fill the formal system itself with values. This process involves all the sciences in the risk of an epistemological flattening on the model, while, in my opinion, the wealth of the sciences resides in the breadth of its epistemological pattern that from the strength of principles goes to the weakness of ideal types, crossing the rich shading of epistemological values of models. The same process is becoming the prevailing paradigm of mathematical education that so loses important aims. This is in fact a wide-spread trend that seems to characterise a lot of efforts for reforming mathematical education. A new approach for defining the value of mathematical education is necessary to show the correct way.

Modern mathematics is the protagonist of an achievement whose innovative value is not yet well understood: the awareness of the plurality of truth. “After the birth of non-Euclidean geometry we are compelled to accept as true two opposed truths”. This fact forces mathematicians to go beyond the criterion of truth and to pose as priority the criterion of freedom: freedom as choice in function of value. “Freedom is the spirit of mathematics ... *ethos* pre-

cedes *logos*” (Toth 1997). In my opinion, freedom gains meaning not so much in the determination of a priority as in the duality between *ethos* and *logos*, in the circular path that links them. *Ethos*, considered as “sojourn in ourselves” (according to Heidegger), becomes the position from which the movement towards disclosure of values starts out and to which it comes back; a movement that occurs through the *theoria*, when the latter is given the ability to experiment with the wealth of meanings. If *theoria* was astonishment for the Greeks, contemplation in the medieval world, investigation of the nature and history of its transformations in the modern age, now its meaning turns to aspects of freedom: freedom to see with astonishment, freedom of contemplation, freedom of investigation. In continuously coming back to *ethos*, to the position where thought leads to the silence (Zaccaria 1992), just the structure of silence, its “intrinsic geometry” is renewed. This happens by gaining “symmetries”, the indications of meaning that reveal the values which guide choices.

In the process of determining the frames in which this intrinsic geometry is taking shape, mathematical education acquires a fundamental role. For this reason it gives an essential contribution to shaping correct interpretative dynamics. In fact, lack of references is often the origin of unjustified vagueness. Mathematical education, as carrier of freedom, represents the most important way to disclose the wide range of epistemological attitudes that extend from the strength of principles to weakness of ideal types.

Freedom in mathematical sciences and mathematical sciences as fundamental tools in education towards freedom offer effective frames for attainment of some of the values that nourish peace. The following, well-known example shows a frame that the education to one of these values, the tolerance, can find in science.

Different parties, even if they perfectly agree upon the facts and even if they are in good faith, come to conflicting conclusions. These paradoxical situations find their justification in Bayes’ law. This law collects conscious and unconscious stages of reasoning whenever the causes of some facts are investigated: depending on the choice of different prior probabilities, results become different; but prior probabilities depend on culture, on forming, on feelings. Trying to persuade people by discussing facts with the presumption to reach objective conclusions, is an illusion.

In Pirandello’s drama “Sei personaggi in cerca d’autore” (Six characters in quest of the author), when the comedian cuts the stepdaughter short by exclaiming “Let’s come to the fact, gentlemen! These are discussions”, the father makes clear: “Here, yes sir! But a fact is as an empty sack: empty, it is lying down. In order that it might stand, it is necessary to put into it reason and feelings that have determined this fact” (Pompily 1960).

Ethics, when understood in its original meaning, constitutes the position where the wide-spread process of inventing new and more suitable forms of mathematical education finds incentives and opportunities in order to adjust to the fast evolving society.

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Author

Ernesto Rottoli, via Raffaello Sanzio 26, I-24030 Presezzo (Bergamo), Italy. E-mail: Suardo@spm.it

Vorschau auf Analysethemen der nächsten Hefte

Für die Analysen der Jahrgänge 30 (1998) und 31 (1999) sind folgende Themen geplant:

- Demokratie und Mathematikunterricht
- Analysis an Hochschulen
- Mathematik in der Ingenieurausbildung
- Mathematik an Hochschulen lehren und lernen
- Mathematik und Deutsch
- Theoretische Betrachtungen zu Schulbuchanalysen.

Vorschläge für Beiträge zu o.g. Themen erbitten wir an die Schriftleitung.

Outlook on Future Topics

The following subjects are intended for the analysis sections of Vol. 30 (1998) and Vol. 31 (1999):

- Democracy and mathematics education
- Calculus at universities
- Mathematics and engineering education
- Teaching and learning mathematics at university level
- Concepts and issues in textbook analyses.

Suggestions for contributions to these subjects are welcome and should be addressed to the editor.