

# Education on Cartography based on some ethical principles

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## Abstract:

Preparing our students to make decisions when designing and generating maps should be a matter of ethical principles. From the early years of school, we learn that enlightenment principles are the basis of citizenship, which requires universal access to education, including knowledge of the territory in every aspect of the environment and society. Therefore, making maps must be an activity committed to improving the quality of life. It begins with training cartographers, who have completed their professional education, mainly in the university classroom.

It is essential to point out that in Brazil, little is done for cartography in primary education: the training of cartographers who can produce and manage geoinformation is relegated to universities. Teaching cartography in countries with socioeconomic conditions, such as Brazil, can bring to the classrooms situations and discussions connected to the severe social and environmental problems that society must face and their historical and geopolitical causes. These ethical issues unfold at Brazilian cartographers' different levels of intellectual education.

In our experience, we highlight three topics that we consider essential to the discussions, which intersect the problem of ethics in cartography and its impacts on the development of Brazilian society. They are directly related to mapping activities: (1) There is a high deficiency in the topographic mapping of the Brazilian territory; (2) The knowledge of the socioeconomic realities of the Brazilian population using census data in teaching thematic cartography; and (3) The consequences of ethical issues in cartography on managing the socioenvironmental problems in Brazil. The understanding of the relationship between ethics and the issues mentioned above can be established based on the following questions: (1) Why can the lack of topographic mapping of territory and, therefore, the impossibility of territory knowledge by each citizen, characterize an ethical issue? (2) How can teaching thematic cartography, which uses actual census data, characterize ethical issues in a country with income distribution and disparities in social vulnerability as problematic as in Brazil? (3) What are the consequences of ethical issues in cartography in managing the socioenvironmental problems in Brazil?

Topographic mapping in economically developing countries and countries with a long tradition of research on cartography is markedly different (Sluter et al., 2018). When we teach here in Brazil about the production of topographic mapping, we necessarily must present how it is carried out in countries such as France, Great Britain, Germany, Switzerland, Canada, and the United States of America and explain to our students that in our country, there is a lack of production of topographic mapping to cover the entire territory at different scales. The solutions for mapping our country should incorporate its landscapes' characteristics in the various biomes and the land use. Thus, technological and scientific research must be developed, and human resources must be trained to understand how Brazilian topographic mapping should be so that it can be of public service to Brazilian society, accessible to the entire population, free of charge, and fit for use.

One situation that illustrates the problem of imported solutions for Brazilian topographic mapping is the lack of a map feature class called "quilombo (Portuguese pronunciation: [ki'lõbu]; from the Kimbundu word kilombo, lit. 'war camp' is a Brazilian hinterland settlement founded by people of African origin, and others sometimes called Carabali. Most of the inhabitants of quilombos, called quilombolas, were maroons, a term for escaped slaves." ([en.wikipedia.org/wiki/Quilombo](https://en.wikipedia.org/wiki/Quilombo)). In our topographic mapping standards (Ministério da Defesa, 2002 a, b), there are indigenous people housing (*habitação indígena* in Portuguese) and indigenous people villages (*aldeia indígena* in Portuguese). Still, there is no quilombo. If quilombos are not on topographic maps, they do not exist officially. This is an important ethical issue since these locations represent an essential part of the country's culture, rooted in its origins.

We can address environmental and social justice issues in the examples and exercises prepared and proposed for teaching thematic cartography. In Brazil, population census data are the responsibility of the IBGE (Brazilian Institute of Geography and Statistics). IBGE organizes them into the following groups: population, work, education, health, and housing. Census data allows us to present to our students the consequences of having census data and not having topographic mapping on scales greater than 1:250,000 in a significant part of the national territory. Teaching thematic cartography helps us understand that the federal government's responsibilities with census data are better fulfilled than those with topographic mapping. We, cartographers, understand the deficiencies that can result in territory planning based only on statistical data and not on maps. Using census data in our classes on thematic cartography, we can show our students the deficiencies and difficulties in occupying the territory without proper topographic mapping.

The collapse of dam structures in Mariana and Brumadinho municipalities (Minas Gerais state) has seriously contaminated the environment and victimized people in the path of the sediments. These most emblematic cases occurred in 2015 and 2019 and resulted in the death of hundreds (Saes and Muradian, 2021; Silva Rotta et al., 2020). The firefighters had difficulty accessing cartographic data from the affected areas in these contexts. They needed cartographic data to plan rescue and containment actions and monitor the evolution of their actions. Because firefighters were trying to access proprietary data, i.e., generated by private companies, acquiring it was a series of obstacles: an ethical problem involving Cartography. This problem happens because, as previously reported, no adequate topographic maps (scale and updating) are produced as a public service in Brazil. Consequently, we face the emergence of ethical problems ranging from training human resources in producing topographic base maps to analysing data that supports decision-making in catastrophic events such as the ones we have reported.

In conclusion, when the government does not provide topographic maps for society, private enterprises such as mineral companies, reforestation companies, and pools of agricultural farmers hire photogrammetric and cartographic services to have their properties mapped. This situation leads to some consequences: private enterprises own their mapping products, and therefore, those maps are not available to any citizen, and that can turn into a severe ethical problem when society needs environmental protection and disaster management.

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