The Integration of Digital Technologies in Cartography: An Approach from an Educational Perspective

Fernando Funchal Tavares da Silva [a], Paula Cristiane Strina Juliasz [a]

[a] Universidade de São Paulo, fernandofunchal@gmail.com, paulacsj@usp.br.

Keywords: Digital Cartography; Children and School Cartography; Digital Maps

Abstract: In times of abrupt technological advancement, the implementation of new tools often precedes the debate on their objectives and impacts. This phenomenon is equally evident within the educational field, where numerous pedagogical proposals mediated by innovative technologies have been integrated into basic education institutions.

Regarding the teaching of Geography, cartography stands out as one of the primary domains affected by the rise of digital technologies. It seems obvious that the 21st century generation interacts with space in a distinct way from previous generations. Similarly, the cartographic and locational materials that constitute the daily life of these individuals have undergone significant transformations, mirroring the increasing use of connected devices, such as computers and smartphones. This paradigm shift in how people conceive space and maps confronts the traditional forms of studying Geography throughout cartography.

How can we comprehend the landscape of cartography's role in education within a context of rapid and constant change, as we currently experience? To progress in this direction, it is imperative to clarify a fundamental point: What constitutes digital cartography? What are the new maps that have been employed in education? How can we distinct then in order to analyse their pedagogical potentialities.

Historically, teaching has often been tied to maps found in textbooks and official sources, such as governmental agencies. However, today, cartographic production is no longer centralized in the hands of a few actors, resulting in a vast array of cartographic materials, both in print and digital media. While this expansion of options represents an advantage by providing educators with a greater variety of choices, it also presents significant challenges. It's hard to keep up with this constantly changing technologies and even more demanding to choose and identify the pedagogical potential of each map.

Considering this, the need for definitions of the types of available digital cartography has become urgent. This paper seeks to identify how different authors have conceptualized this emerging field of digital cartography, focusing on the maps that appeared in papers that discussed cartography in primary education.

Through the analysis of bibliographic references dealing with the intersection of cartography and new digital technologies, we encountered a considerable challenge in systematizing and correlating the various works, as different studies presented distinct definitions and thematic scopes. In the process of selecting works within this field, we employed several search terms, including Geotechnology, Multimedia Cartography, Cartography and the Internet, Digital Cartography and ICT (Information and Communication Technologies). In this context, it becomes relevant to present the definitions put forth by different authors that contribute to constructing an overview of the research outputs in this domain.

Peterson (1994) was one of the pioneers in this debate, analyzing and conceptualizing multimedia cartography. In his studies, he emphasizes the transformative role of interactivity in maps. The possibility of interaction in maps provides the user with the ability to choose what to represent and how to visualize this information. Associated with the concept of multimedia maps and hypermaps—those maps that incorporate a plurality of messages, such as texts, sounds, images, and animations conveyed by computers—the category of clickable maps and maps based on georeferenced databases emerges (Kraak; Driel, 1997). These maps are also organized into electronic atlases, which are classified into three types: view-only electronic atlas, interactive atlas, and analytical atlas.

Another important categorization pertains to geotechnologies, which can be divided into three main areas: Geographic Information Systems (GIS), Remote Sensing (RS), and Global Navigation Satellite Systems (GNSS) (IBAM, 2015). Complementarily, GIS can be further subdivided into Desktop GIS Software, Web Mapping, Virtual Globes, and Portable GIS (Silva et. al., 2021 apud Longley et. al. 2013). Within these categories, there exists a diverse range of maps that may fit into one or more classifications. Moreover, within the same group, there can be substantial variations in the works themselves. For this reason, it is crucial to identify the components that define and determine the different types of digital maps, with particular attention to two main aspects: interactivity and the methods of distribution and

visualization. Maps can be organized according to the degree of interactivity they offer the user. Suely Moreira (2010) proposes a classification of maps based on the modalities and levels of interactivity. As for the means of distribution, it is evident that discrete media have lost ground to networked distribution, especially with the growth of the internet (Ramos, 2005).

All these forms of digital maps have impacted the use of cartography in schools. However, there has been no in depth study of the advantages and limitations of using digital cartography in education before its application. Beyond the naturalization of digital technologies as advantageous and inherent to a new digital culture, we must focus our analysis on the impacts and potential of these new tools in their classroom usage.

Academic research plays an important role in validating pedagogical practices. In the field of school cartography, academic research has also performed this crucial role of staying attuned to trends and analyzing the impacts of new cartographic tools, such as digital technologies, on the teaching and learning process. These studies are often focused on specific tools, such as the abundant pedagogical experiences with the use of Google Maps.

This paper aimed to unveil the urgency of this debate by systematizing various works and definitions on the emerging field of digital cartography. As it's reasonable to state that a greater awareness of the available panorama of digital maps, considering the specificities, potentials, and limitations of each tool, could contribute to a qualitative enhancement of teaching practices.

References

Instituto Brasileiro de Administração Municipal. Caderno de estudo: Introdução à geotecnologia. Rio de Janeiro: IBAM, 2015. 64 p. il. color. (Série Programa de Qualificação Gestão Ambiental).

Kraak, M.J., Ormeling, F. Cartography: visualization of spatial data. Essex: Longman, 1996. 222p.

Longley, P. A., Goodchild, M. F., Maguire, D. J., & Rhind, D. W. *Sistemas e Ciência da Informação Geográfica*. 2013. Bookman Editora.

Moreira, S. A. G. Cartografia Multimídia: interatividade em projetos cartográficos. 2010, Universidade Estadual Paulista Júlio de Mesquita Filho, Instituto de Geociências e Ciências Exatas, Rio Claro.

Peterson, M. P. From Tool to Medium: Implications of the Changing Role of the Computer in Cartography. In: *Associação Americana de Geógrafos (AAG)*, 1994, Omaha, Nebraska: Department of Geography / Geology, University of Omaha Nebraska.

Ramos, C. da S. Visualização cartográfica e cartografia multimídia: conceitos e tecnologias. 2005, São Paulo, Editora UNESP.

Silva, V. O.; Zucherato, B.; Peixoto, D. W. B. A Importância das Geotecnologias para a Educação Básica. In: *Revista Geoaraguaia*, 2021, Barra do Garças –MT. v.11 n. Esp. Geotecnologias. p. 202-226.