

**OPEN SOURCE GEOGRAPHIC INFORMATION SYSTEMS,
REPRESENTATION OF SPACES, AND APPLICATIONS IN RESEARCH AND
TEACHING GEOGRAPHY**

Leandro de Aguiar e Souza
Instituto Federal de Educação, Ciência e Tecnologia de Minas Gerais - IFMG
leandro.souza@ifmg.edu.br

Resumo

Os debates aqui apresentados abordam ferramentas de geoprocessamento produzidas através de tecnologias de código aberto e livre e suas aplicações potenciais à pesquisa e ao ensino de Geografia. Tais discussões se aplicam ao contexto do Instituto Federal de Minas Gerais, cuja inserção na Educação Profissional e Tecnológica – EPT estabelece um ambiente que envolve, simultaneamente, diferentes níveis educacionais tais como o ensino técnico integrado de nível médio, graduações tecnológicas, licenciaturas, bacharelados, pós-graduações lato e stricto sensu, dentre outros. Soma-se a isso a caracterização dos Institutos enquanto espaços voltados à prática indissociável entre ensino, pesquisa e extensão, cuja estrutura em múltiplos campi estabelece uma mesma institucionalidade aplicada a contextos distintos. Em tais realidades, é comum que docentes ligados ao campo da Geografia atuem em diversos cursos, de diferentes níveis de ensino. Além disso, a inserção territorial dos campi, somada às políticas de Estado que dão suporte aos Institutos, conformam relações diversas com seus respectivos entornos, tanto em escala local quanto regional. Tal conjunto de questões demanda a adoção de práticas cujo extravasamento das lógicas disciplinares convencionais se faz necessária. O aprendizado através de projetos atrelados a questões territoriais trazem a Geografia para o primeiro plano. Diante disso, plataformas de geoprocessamento de código aberto e livre são aqui discutidas enquanto dispositivos voltados à produção de representações geográficas para o estabelecimento das articulações propostas ao presente contexto.

Palavras-Chave: Educação Profissional e Tecnológica; Representações de Espaços; Geoprocessamento; Sistemas de Informações Georreferenciadas; Pesquisa e Ensino de Geografia.

Introduction

The Federal Institute of Education, Science, and Technology of Minas Gerais, Brazil, compounds a range of government measures with the status of State Policy. The Federal Law N°11.892/2008, responsible for creating all Brazilian Federal Institutes, determines that education, research, and extension practices establish articulations with local, productive, cultural, and social arrangements (BRASIL, 2008). This norm emphasizes the importance of mapping potentialities for the regional, socio-economic, and cultural development of administrative territories under the influence of Federal Institutes. Furthermore, the organization in multiple campuses and the insertion of these unities in peripheral or less developed areas amplifies this State Policy's role in reducing national, regional, and local inequalities.

In these environments, academic communities establish relations between different levels of education, from the basic to the superior level. This context applies to all practices, including teaching, researching, and extension projects.

In this scenario, Geography plays an essential role through the necessity of articulations with productive, cultural, and social arrangements, together with actions of mapping development potentialities.

This work aims to investigate how open-source geographic information systems can contribute to mapping processes and territorial analyses, whose applications occur in teaching, research, and extension practices in the Federal Institute of Minas Gerais, Brazil. Furthermore, this study searches to comprehend how these devices could amplify relations between the Federal Institutes, governments, and local communities. In this reality, open-source geographic information systems are relevant research devices applicable to geographical, environmental, and territorial studies.

This work is justified by comprehending these devices as systemic instruments for the attendance of Federal Law N°11.892/2008 directrices. In this perspective, multi-scalar databases could potentialize articulations between local realities, regional processes, and institutional practices.

For the delimitation of methodology, activities from two specific campuses of the Federal Institute of Minas Gerais were selected: the Santa Luzia campus - whose courses and projects have been made in areas related to territorial, infrastructural, and social applied sciences, and the Ouro Preto campus – that offers License and Professional Master in Teaching Geography, between other courses. These unities have been developing projects and activities that adopt open-source geographic information systems applied to local and regional studies.

This discussion was referenced between 2020 and 2023 when some research projects developed the topics above. The project, ' Mapping of local productive arrangements related to the campuses of Federal Institute of Minas Gerais' (SOUZA, 2023), is the leading case study of the current approach. The justification for this selection is based on the fact that this project developed surveys, analysis, and appointments about the use of mapping devices in the creation of tools to potentialize articulations between the unities of the Federal Institute of Minas Gerais and their areas of influence. Furthermore, the project directly applies to the realities of the Ouro Preto and the Santa Luzia campuses.

The representation of spaces of Henry Lefebvre and the spatial analysis through Open Source Geographic Information Systems

'The Production of Space', published by Henri Lefebvre (2012), is an essential theoretical basis for this topic. For Lefebvre (2012), the social space is dialectically product and process from the mode of production of a specific historical period. In this work, he developed three categories of analyses: spatial practice, representation of spaces, and representational spaces.

For Schmid (2008), these concepts were formulated by Lefebvre (2012) at a socio-spatial level, with deployments in the level of individuals (inserted on specific societies). These implications define complementary analytical categories: perceived, conceived, and lived spaces (LEFEBVRE, 2012).

For Lefebvre (2012), these fields connect physical, mental, and social aspects at the conformation of 'the space of social practice, the space occupied by sensory phenomena,

including products of the imagination such as projects and projections, symbols and utopias' (LEFEBVRE, 2012, p.12). For Schmid (2008), this conjunction appoints to a three-dimensional dialectic, whose processes come up with transformations and uncertainties in specific periods.

Nowadays, the representation of spaces has direct connections with satellite and panoramic visualizations in multiple scales, making it possible to visualize different parts of the terrestrial globe almost simultaneously. Although access to this information has been increasing through applications in personal computers and mobile devices, the possibilities of producing them are relatively restricted.

The evolution of open-source geographic information systems (GIS) has been accomplishing a relevant role in the production and analysis of territorial and environmental data in digital platforms. The open-source geographic information systems are interpreted here as social and technological devices capable of expanding this universe.

Free software, such as open-source GIS, are social technologies thanks to their potential to change social relations, reduce inequalities, and extend access to different members of a society. According to the Free Software Foundation (FSF, 2022), in a free and open-source environment, the users actively control digital devices, which does not occur in non-free software. FSF (2022) affirms that when a program's control happens exclusively through its developers' actions, this software becomes an instrument of power.

Applying this debate to Geography, it is relevant to consider the concept of territory, essentially related to the range of power relations over the social space (HAESBAERT, 2007). The production of a GIS in a non-free software inserts a second level of hierarchization, restricting access to territorial analyses to a small group with conditions to acquire them.

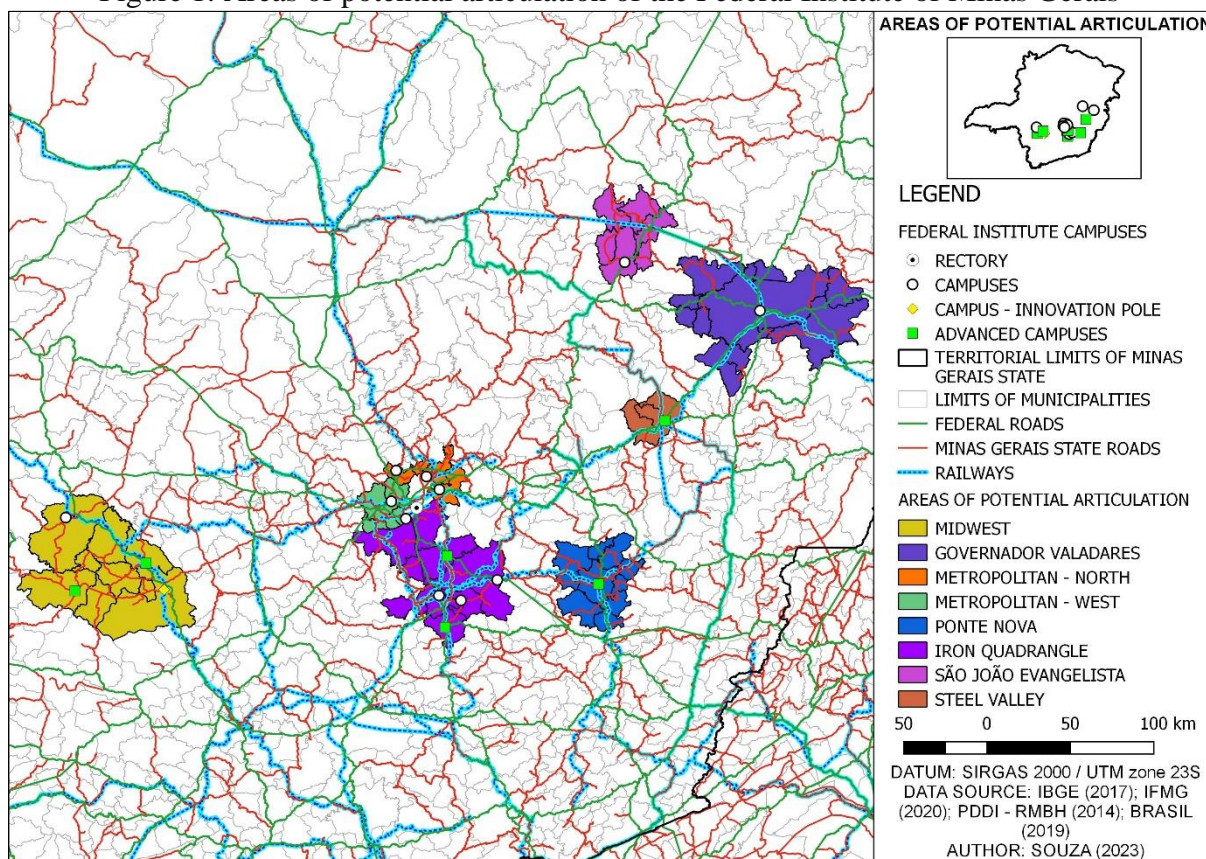
Open-source GIS devices could amplify possibilities of representation of spaces, dialectically transforming spatial practices and, subsequently, reaching subjective issues commonly attached to the field of representational spaces.

Open Source Geographic Information Systems and its applications in research and teaching Geography in the context of the Federal Institute of Minas Gerais

The research project 'Mapping of local productive arrangements related to the campuses of Federal Institute of Minas Gerais', elaborated during 2020 and 2023, conformed a range of tools to support diverse institutional activities. This project contains aspects of transversality through the evolvment of different courses from two unities (the Santa Luzia and the Ouro Preto campuses). Furthermore, it has as its object territorial and environmental analysis about all areas of influence of the eighteen unities of the Federal Institute (SOUZA, 2023).

The project built a robust geographic information system from secondary databases associated with primary territorial data of all unities that compound the Federal Institute of Minas Gerais. Between the contributions, the research produced an analytical tool to identify areas of potential articulation that could be useful in defining new courses, research, and extension projects. These delimitations are in the map of Figure 1 below.

Figure 1: Areas of potential articulation of the Federal Institute of Minas Gerais



Author: Souza (2023)

Figure 1 shows some infrastructural and territorial information whose superposition and subsequent analysis led to the delimitation of areas of potential articulation. These polygons contain the Federal Institute of Minas Gerais campuses and some fundamental territories under their influence. With additional information continually inserted and actualized in the open-source geographical information system, it is possible to identify demands and development potentialities.

Furthermore, this database contemplates information from distinct dimensions, such as environmental (physical, hydrographic, biological), territorial (political-administrative delimitations), and economic (GDP, location of industries and services). Through this device, local, productive, social, and cultural arrangements are understood in consonance with the Law's provisions that create the Federal Institutes.

Conclusions

The construction of environments of study, teaching, and research is an essential challenge to achieving the main directrices of the Federal Institute of Minas Gerais. Not just physical environments, such as laboratories and equipped classrooms, but a range of extended

relations institutionally supported. Adopting open-source geographical information systems can be relevant to consolidating articulations between the Federal Institute and the areas under their influence.

The term device is appropriate to the current discussion thanks to the open-source software that, together with specific research and teaching methodologies, has been useful in integrating actors related to an extended academic community (Federal Institute, governments, and local communities).

Establishing procedures to improve these devices is essential to offer courses and projects effectively related to local productive arrangements.

In the Federal Institute of Minas Gerais context, the use of digital platforms related to open-source devices raises prolific debates that surpass technical fields, reaching the spheres of popular digital production.

References

BRASIL. República Federativa do Brasil. **Lei Nº 11.892, de 29 de dezembro de 2008.**

Institui a Rede Federal de Educação Profissional, Científica e Tecnológica, cria os Institutos Federais de Educação, Ciência e Tecnologia, e dá outras providências. Brasília: Presidência da República, Secretaria Geral, Subchefia para Assuntos Jurídicos, 2008.

FSF. Free Software Foundation. **What is Free Software?** Boston: Free Software Foundation, 2022. Disponível em: <https://www.gnu.org/philosophy/free-sw.en.html> . Acesso em: 11 jun. 2022.

HAESBAERT, Rogério. **O mito da desterritorialização: do “fim dos territórios” à multiterritorialidade.** Rio de Janeiro: Bertrand Brasil, 2007.

LEFEBVRE, Henri. **The production of space.** Malden: Blackwell Publishing, 2012.

SCHMID, Christian. Henri Lefebvre’s theory of the production of space: towards a three-dimensional dialectic. In: GOONEWARDENA, Kanishka *et al.* **Space, difference, everyday life.** Nova York: Routledge, 2008.

SOUZA, Leandro de Aguiar. **Arranjos produtivos, territórios, educação profissional e tecnológica: o IFMG e suas articulações potenciais.** Belo Horizonte: Editora IFMG, 2023. No prelo.