

The value of open GIS in higher education.

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What is open source?

- Open source software is software where the source code is made available under a license that allows the modification, and re-distribution of the software at will. (opensource.org)

What is open source GIS?

- A system built on open source designed to capture, store, manipulate, manage, and present spatially referenced information.

Open Source GIS

- Desktop GIS
 - Web GIS
 - Database Systems
 - Mobile GIS
 - Open Community Mapping Effort
- [OsGeo Foundation](#) –
 - GeoNode, GRASS GIS, gvSIG, Marble, QGIS, FDO, GDAL/ORG, GEOS, GeoTools, OrfeoToolbox, OSSIM, PostGIS, GeoNetwork, degree, geomajas, GeoMOOSE, GeoServer, Mapbender, MapFish, MapGuide, MapServer, OpenLayers
 - [LocationTech](#)
 - Geogig, Proj4J, geomesa, Spatial4j



Open Source GIS – Timeline

- 1978 - MOSS (Map Overlay and Statistical System)
- 1982 - GRASS GIS (Geographical Resources Analysis Support System)
- 1996 - GeoTools project started at the University of Leeds
- 1998 - GDAL/OGR development started, Python support was added in 2000
- 2001 - PostGIS started; OSGeo incubation 2009-2012
- 2001 - GeoServer started by "The Open Planning Project"; OSGeo incubation 2009 - present
- 2002 - Quantum GIS initial revision in CVS
- 2004 - uDig was started by Refrations Research
- 2009 - OpenGeo Suite first released
- 2010 – GeoNode first released



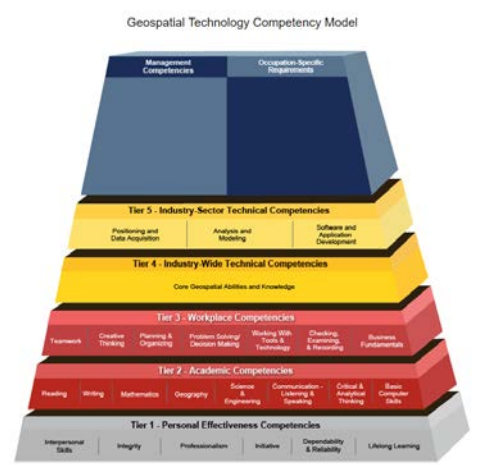


Why bring open GIS into the classroom?

- Competencies
- Market demand
- Employer demand
- Generational interest
- Peer-reviewed benefits
- Role in emerging fields

Open source in geospatial competencies

Explicit
Implicit
Parallel



Geographic Information Science & Technology Body of Knowledge
Edited by David Bittencourt, Michael Jenkins, and Johnson, Karim Nigam, and Taylor Latta, Braden Platero, and Elizabeth West
UNIVERSITY CONSORTIUM FOR GEOGRAPHIC INFORMATION SCIENCE

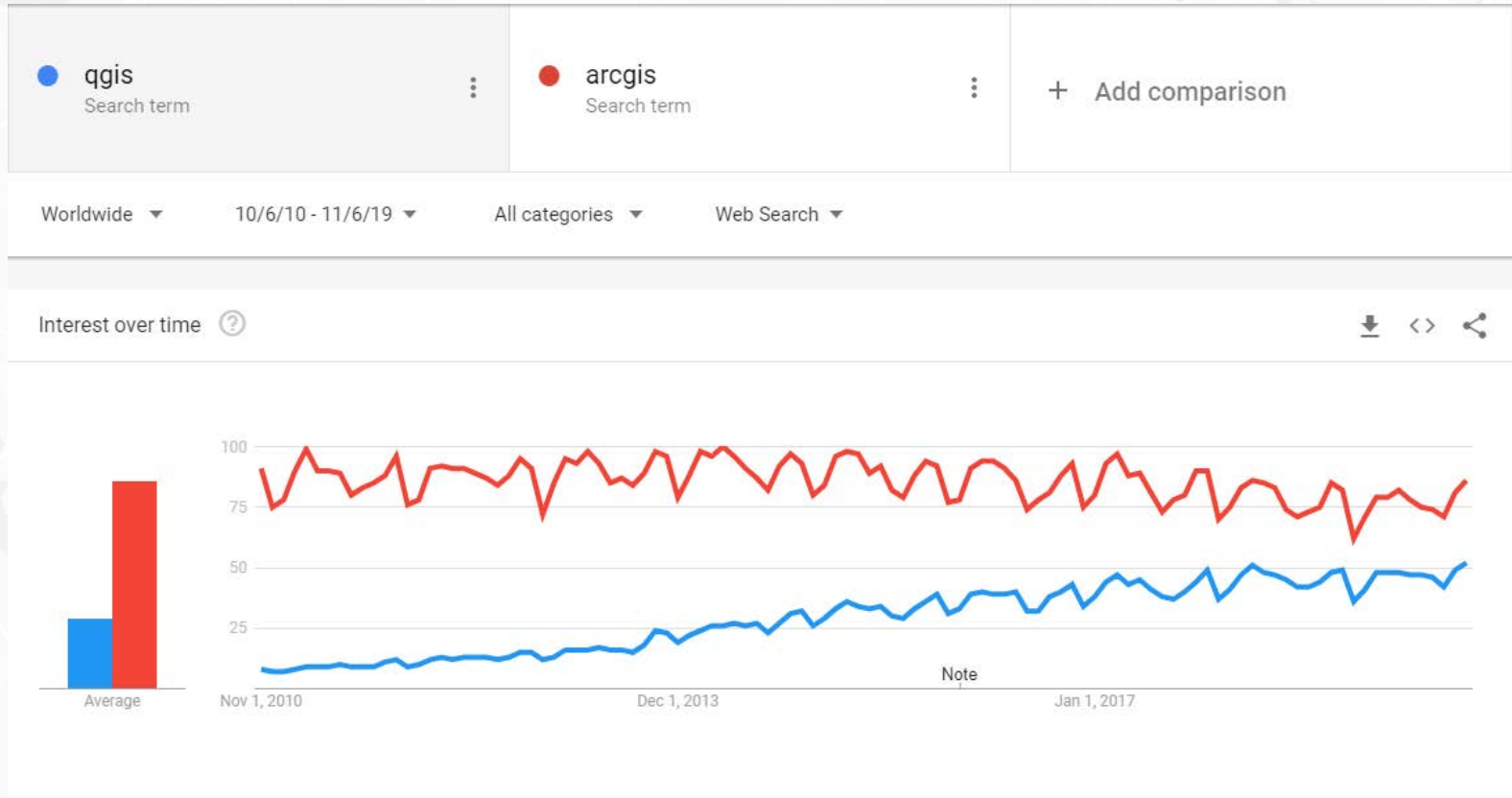
Analytical Methods <ul style="list-style-type: none">A101 Analytical and statistical methodsA102 Spatial analysisA103 Query creation and query languagesA104 Geospatial data integrationA105 Geospatial data managementA106 Geospatial data visualizationA107 Geospatial data analysisA108 Geospatial data processingA109 Geospatial data storageA110 Geospatial data distributionA111 Geospatial data securityA112 Geospatial data privacyA113 Geospatial data ethicsA114 Geospatial data governanceA115 Geospatial data complianceA116 Geospatial data standardsA117 Geospatial data interoperabilityA118 Geospatial data portabilityA119 Geospatial data migrationA120 Geospatial data backup and recovery	Cartography and Visualization <ul style="list-style-type: none">C101 Cartographic representation techniquesC102 Cartographic designC103 Cartographic layoutC104 Cartographic productionC105 Cartographic distributionC106 Cartographic evaluationC107 Cartographic innovationC108 Cartographic researchC109 Cartographic educationC110 Cartographic practiceC111 Cartographic ethicsC112 Cartographic standardsC113 Cartographic interoperabilityC114 Cartographic portabilityC115 Cartographic migrationC116 Cartographic backup and recovery
Conceptual Foundations <ul style="list-style-type: none">C101 Philosophical foundationsC102 Historical foundationsC103 Sociological foundationsC104 Ethical foundationsC105 Professional foundationsC106 Research foundationsC107 Educational foundationsC108 Practice foundationsC109 Innovation foundationsC110 Research foundationsC111 Educational foundationsC112 Practice foundationsC113 Innovation foundations	Design Aspects <ul style="list-style-type: none">D101 The scope of GIS/TD102 Data designD103 User interface designD104 System architectureD105 Data architectureD106 Application designD107 System implementationD108 Data modelingD109 System evaluationD110 System maintenanceD111 System securityD112 System backup and recovery
Data Modeling <ul style="list-style-type: none">D101 Basic storage and retrieval systemsD102 Data modelingD103 System evaluationD104 System maintenanceD105 System securityD106 System backup and recovery	



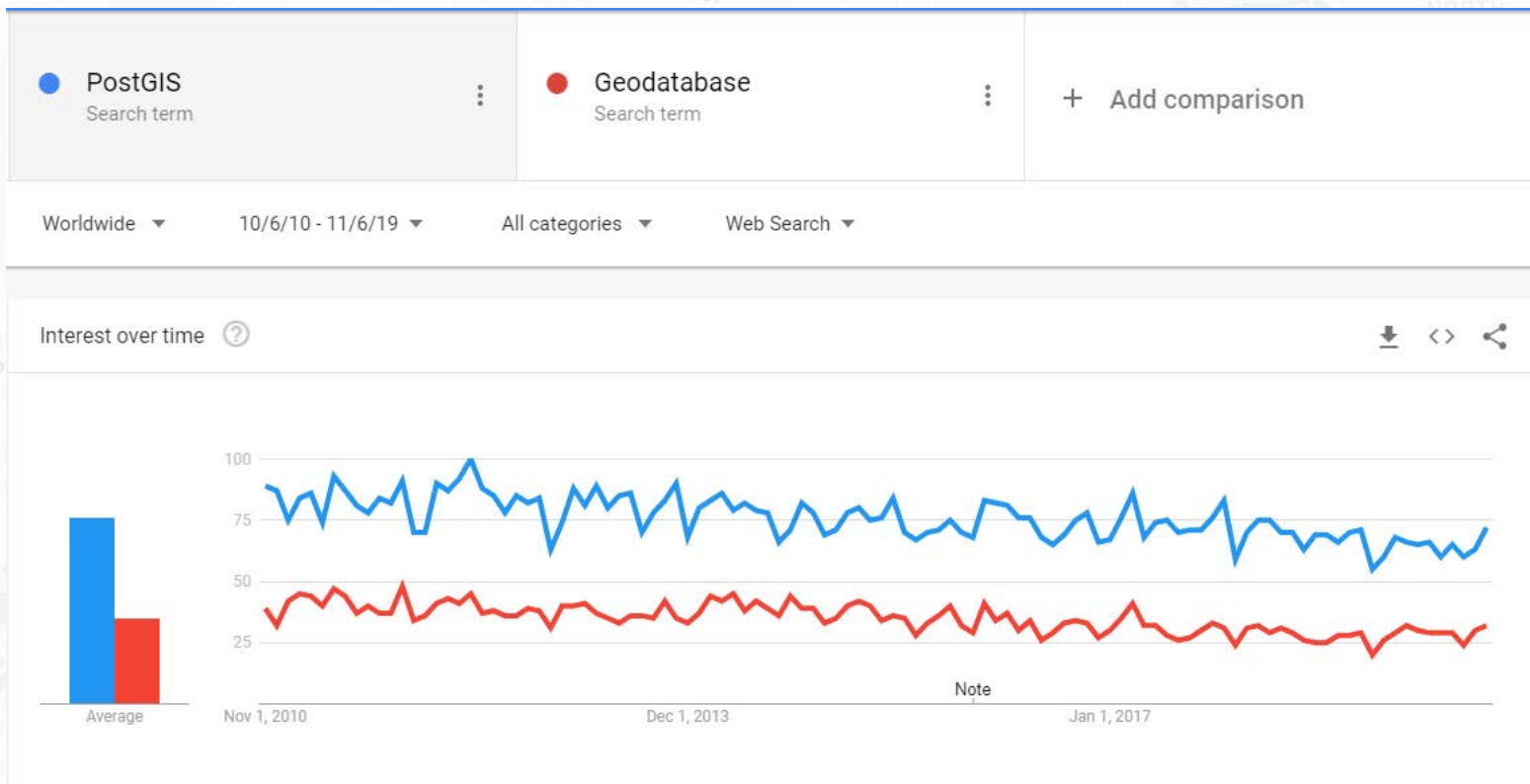
A grayscale map of the Greater Boston area, showing various neighborhoods and streets. The map is centered on the city of Boston, with labels for areas like Belmont, Waltham, Watertown, and Brighton. The word "Demand?" is written in a large, bold, black font in the center of the map. The map shows a network of streets, including major roads like the Concord Turnpike and the Blue Hills Parkway, and smaller streets like Main St and River St. The word "Demand?" is positioned over the central part of the city, roughly between Waltham and Watertown.

Demand?

Open Source Continues to grow



Open Source Continues to Grow



Source: [Google Trends GIS geodatabase](#)

Employer Demand?

Site	Search Terms	No. Jobs
LinkedIn	GIS	10,741
Indeed	GIS	10,853
LinkedIn	GIS and Open source	389
Indeed	GIS and Open source	485
LinkedIn	GIS and Esri	2,223
Indeed	GIS and Esri	1,660
LinkedIn	QGIS	261
LinkedIn	GeoServer	193
LinkedIn	PostgreSQL	11,107
LinkedIn	PostGIS	223
LinkedIn	Geodatabase	389
LinkedIn	Open Source	35,124

Searches conducted on November 6, 2019

Employer Demand

2018



Open Source Jobs Report



of hiring managers are **recruiting Linux talent**



of open source pros say money is the best part of their job, **find out what really inspires them**



of hiring managers are **having a hard time recruiting** enough open source talent



Knowledge of **cloud technologies** impacts hiring decisions more than any area of open source

29 SURPRISING FACTS THAT EXPLAIN

WHY MILLENNIALS SEE THE WORLD DIFFERENTLY

MILLENNIALS ARE NOW THE SINGLE LARGEST GROUP WITHIN THE WORK FORCE, AND WILL SOON BECOME THE BIGGEST CONSUMER GROUP, TOO. UNDERSTANDING, AND BEING ABLE TO ENGAGE WITH, MILLENNIALS IS GOING TO DETERMINE HOW SUCCESSFUL YOUR BUSINESS WILL BE.



1

Millennials are carrying a total of **\$1 trillion** in student debt.



2

Over **63%** of Gen-Y workers have a bachelor's degree.



3

48% of employed college graduates work in jobs that don't require a four-year degree.



4

45% believe a decent paying job is a "privilege," not a "right."



5

64% of Millennials would rather make **\$40,000** a year at a job they love than **\$100,000** a year at a job they think is boring.



6

88% prefer a collaborative work culture rather than a competitive one.

9

92% believe that business success should be measured by more than just profit.

10

40% of Millennials think that blogging about workplace issues is acceptable, compared to 28 percent of Boomers.



18

35% of employed Millennials have started their own business on the side to supplement their income.

21

84% say that helping to make a positive difference in the world is more important than professional recognition.

22

They're more loyal to employers than previous generations.

23

The top ideal employers of currently employed Millennials are Google, Apple, Facebook, the U.S. State Department, and Disney.

24

41% of Millennials have no landline at home and rely on their cell phones for communication.

25

Millennials value community, family, and creativity in their work.

26

Millennials are not just virtually connected via social networks; they value the role that they play in these communities.

Millennials more open to open source

Millennials are also strong proponents of the use of open source technologies: 87 percent believe it is important for them to work for an organization that allows them to use open source technologies. But they aren't so far apart from their non-millennial peers on that front: 81 percent of Gen X and boomer respondents felt the same way.

Part of that mindset is about the desire for flexibility and creative liberties in the way they do their work. IT organizations tend to be strongly process-oriented, but 88 percent of millennials across all markets say their organization's current IT policies and procedures don't allow them to be as creative as they could be at work. And 90 percent of millennials say frequently using their own approach is faster than their organization's preferred approach. At the extreme end, 33 percent of millennials say their approach is faster "all the time" compared with 29 percent of non-millennials.



Benefits?



Peer-reviewed research

“By ensuring that students learn to distinguish between geospatial concepts and software specifics, students become more flexible and stronger spatial thinkers when choosing solutions for their independent work in the future....

By understanding the concepts and their implementation, students will become better scientists, who are able to generate, reproduce, critique and improve research and analysis.” ISPRS Int. J. Geo-Inf. 2015, 4 953

GTCM

Tier	Critical Work Functions	USGIF
Software and Application Development	Ensure that software code complies with industry standards, such as those promulgated by the Open Geospatial Consortium (OGC)	N
	Customize geospatial software using proprietary and open source software components, such as ESRI's ArcObjects, Intergraph's GeoMedia software suite, and the GeoTools open source project	N
	Evaluate open source software components for re-use and potential return contributions	N

GIS&T – Body of Knowledge

Knowledge Area	Unit	USGIF
Cartography and Visualization	CV5-1 Map Production	Y
Design Aspects	DA3-2 Resource Planning	N
Data Modeling	DM4-7 Object-based spatial databases	Y
Geocomputation	GC6-5 Agent-based modeling	N
Geospatial Data	GD12-5 Transport Protocols	N

Knowledge Area	Unit	USGIF
GIS&T and Society	GS4-2 Mechanisms of Control of geospatial information	N
	GS5-4 Balancing security and open access	N
Organizational and Institutional Aspects	OI5-5 Openness	Y
	OI6-1 Coordinating Organizations	Y

USGIF – EBK

Competency	Unit	
GIS & Analysis Tools	Open Source Geospatial Data	Sources and Types of Open-Source Geospatial Data (e.g., non-structured data)
		Geospatial Crowdsourcing (e.g., volunteered geographic information, “participatory sensing”)
		Common Capabilities and Limitations of Open-Source Geospatial Data (e.g., opensource versus proprietary data, data quality)
		Open-Source Geospatial Standards
		Sources of Open-Source Geospatial Error
		Open-Source “Spoofing”