

Considering Framework Data Concepts in GIScience Higher Education



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Project Scope



- **“Teaching about Framework Data Concepts”**
 - Training Materials for NSDI Framework Standards
 - Best Practices for Integrating Framework Principles into Higher Education Curricula
- **FGDC Future Initiatives Training Program**
 - Rocky Mountain Cooperative Ecosystem Study Unit Funding Award # 4121HS007:
 - Sharon Shin, FGDC Metadata Coordinator
 - Lynda Wayne, GeoMaxim



Today's Outline



- **Framework Data Concept**
- **Context within U.S. National Spatial Data Infrastructure**
- **FGDC Framework Data Standards**
- **Status of Framework Data Awareness in Education and Research**
- **Strategies for Teaching about Framework in GIScience Curricula**

What is Framework?



- **Key Aspects of Framework:**
 - Themes of most commonly used digital geospatial data
 - Procedures, technology, and guidelines that provide for integration, sharing, and use of these data.
 - Institutional relationships and business practices that encourage the maintenance and use of data.
- **Key Benefits of Framework:**
 - Facilitate production and use of geographic data
 - Reduce overall operating costs for geographic data clients
 - Improve service and decision-making



Components of the U.S. NSDI



Partnerships

Services

Metadata

Framework

GEOdata

Standards



NSDI Framework Approach

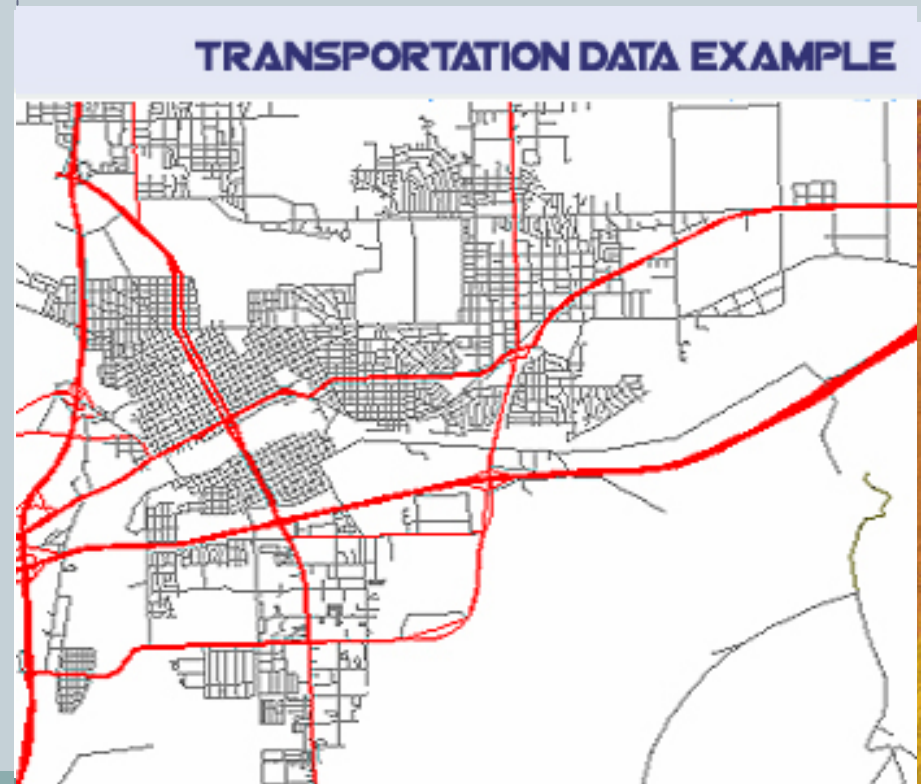


...a collaborative initiative to develop geographic datasets that are compatible based upon spatial location and content. This allows different users to jointly access and work seamlessly with data collected from a variety of sources and for variety of reasons, ultimately reducing project costs and increase cooperation.

- **Data**
- **Procedures & Technology**
- **Institutional Relationships & Business Practices**

Seven Thematic Framework Elements

- Cadastral information
- Orthoimagery
- Elevation
- Geodetic control
- Hydrography
- Governmental units
- Transportation

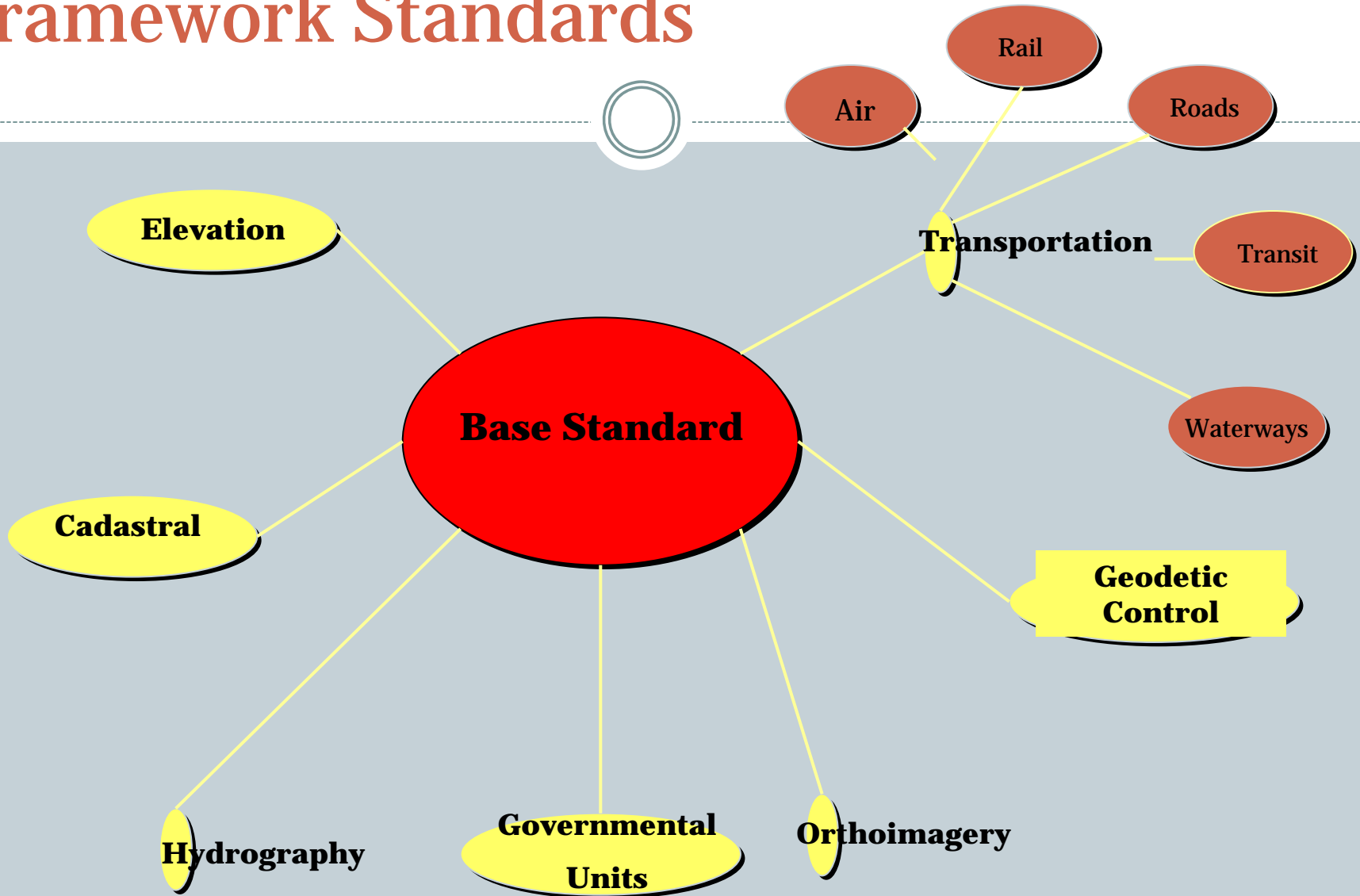


NSDI Framework Data Content Standards



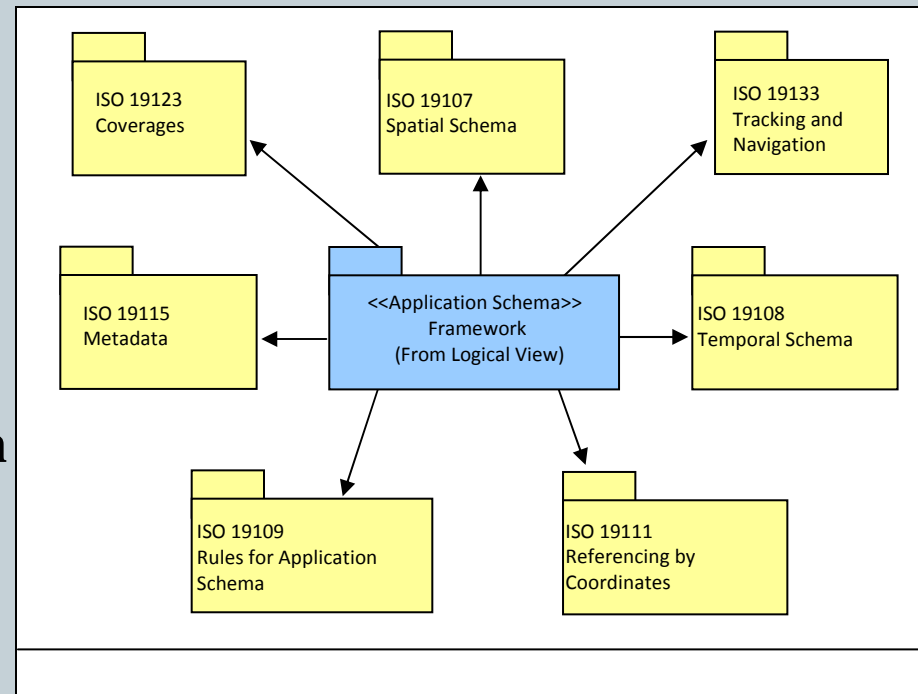
- A suite of standard parts that collectively define minimum requirements for data to be considered Framework data.
- Provide guidelines for creating and documenting data that allows computer software to use a set of characteristics to parse data sets and test for compatibility.
- Do not define how a user must create data.
- Each of the seven themes has its own standard part, and potentially sub-parts; none of the individual Framework Standard parts can stand on its own.

Framework Standards



Framework Standards

- Standards are all dependent upon concepts in the ISO 19100 series of geographic information standards. For example, the metadata component implemented by the Framework Base Standard is based on ISO 19115 which specifies requirements for all geographic metadata.



Framework Standards



- **Framework supports:**
 - community standards for sets of **spatial features**, feature representation, and attributes to a least common denominator
 - exchange of data through collecting, converting, or associating information to common **Framework data standards** with an **encoding format**
 - multiple representations of real-world features at different scales and times by **feature identifier** and generalization

Teaching Framework



The National Spatial Data Infrastructure (NSDI)

Geospatial Data Discovery and Access	Geospatial Data Integration	Geospatial Partnerships, Policy and Planning
<i>Geospatial One-Stop Portal</i>	<i>NSDI Standards</i>	<i>NSDI Policies and Practices</i>
<i>Geospatial Metadata</i>	<i>NSDI Data Themes</i>	<i>NSDI Partnership Opportunities</i>
<i>Geospatial Web Services</i>	<i>The National Map</i>	<i>Geospatial Business Planning</i>

NATIONAL SPATIAL DATA INFRASTRUCTURE FRAMEWORK DATA

Framework Data Content Base Standard

COURSE INFORMATION

The National Spatial Data Infrastructure (NSDI) Framework is a collaborative initiative to develop geographic datasets that are compatible based upon spatial location and content. The Framework approach allows data collected for variety of reasons and agencies to work together seamlessly; which can ultimately reduce project costs and increase interagency cooperation. The Framework Data Content Base Standards Suite dictates the requirements for Framework data.

This course covers the fundamentals of the Framework Data Content Base Standard which addresses the components which are contiguous throughout each of the Framework Standards. It is designed for users who are both interested in an overview of the Framework Data Content Base Standard as well as designers and developers implementing Framework data, and associated tools.

PREREQUISITES

- General Understanding of GIS, Geospatial Data and Metadata
- Familiarity with the FGDC and NSDI
- Basic knowledge of Geographic Data Standards (specifically ISO 19100 series)



RELATED TOPICS

NSDI Training Tracks:

An initiative to define areas, topics, and materials for training within the NSDI.

ISO 19100 Series:

Suite of standards developed for geographic data and datasets. The most notable is ISO 19135 which pertains to metadata.

ANSI Standards:

Similar work to ISO, but standards directly apply to data created within the United States.

finalslides

Outline	Thumb	Notes	Search
Slide Title			Duration
A.1 - Course Introduc...			00:16
A.2 - Course Modules...			00:32
A.3 - Pre-test Instruct...			00:16
1.1 - Understanding F...			00:15
1.2 - What is Framew...			00:54
1.3 - Seven Thematic...			00:33
1.4 - Cadastral			00:42
1.5 - Digital Orthoima...			00:43
1.6 - Elevation			00:51
1.7 - Geodetic Control			00:41
1.8 - Governmental U...			00:39
1.9 - Hydrography			00:43
1.10 - Transportation			00:47
1.11 - Why Framewor...			00:57
1.12 - Framework Or...			01:04
1.13 - Practical Uses f...			01:01
1.14 - Framework at t...			00:40
1.15 - Framework at t...			00:52
1.16 - Framework at t...			00:47
1.17 - Framework in ...			00:44
1.18 - Understanding ...			00:39
2.1 - Framework Data...			00:17
2.2 - Framework Data...			00:31
2.3 - Purpose for the ...			00:39
2.4 - Hierarchy of Sta...			00:36

46 Minutes 10 Seconds Remaining

Recognizing Framework & Framework Standards in Research and Education



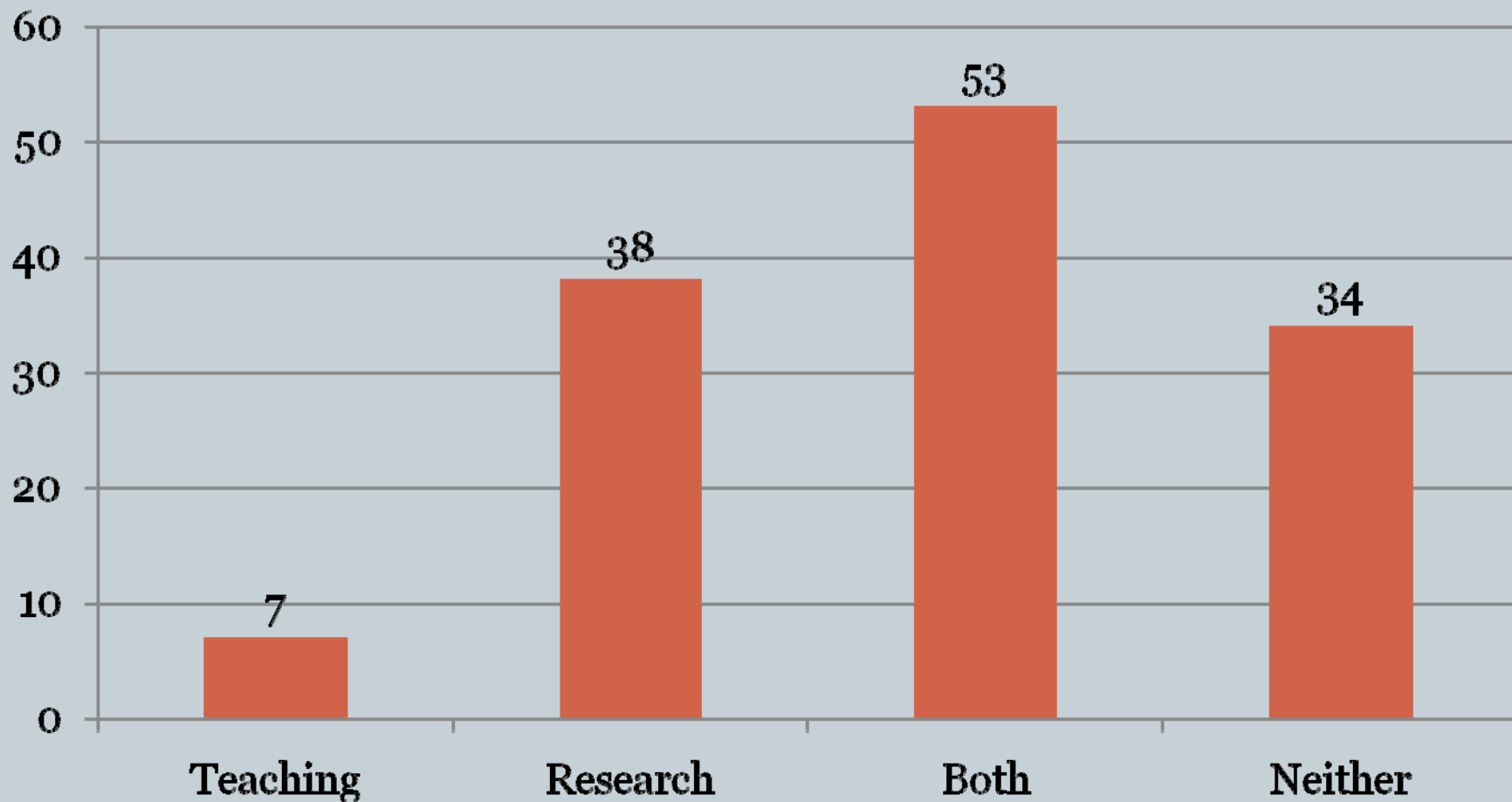
- **Online Survey of Geospatial Standards and Infrastructures**
- **Textbook Meta-Analysis**
- **GIS&T Body of Knowledge Cross-Walk**

Survey on Geospatial Standards & Infrastructures



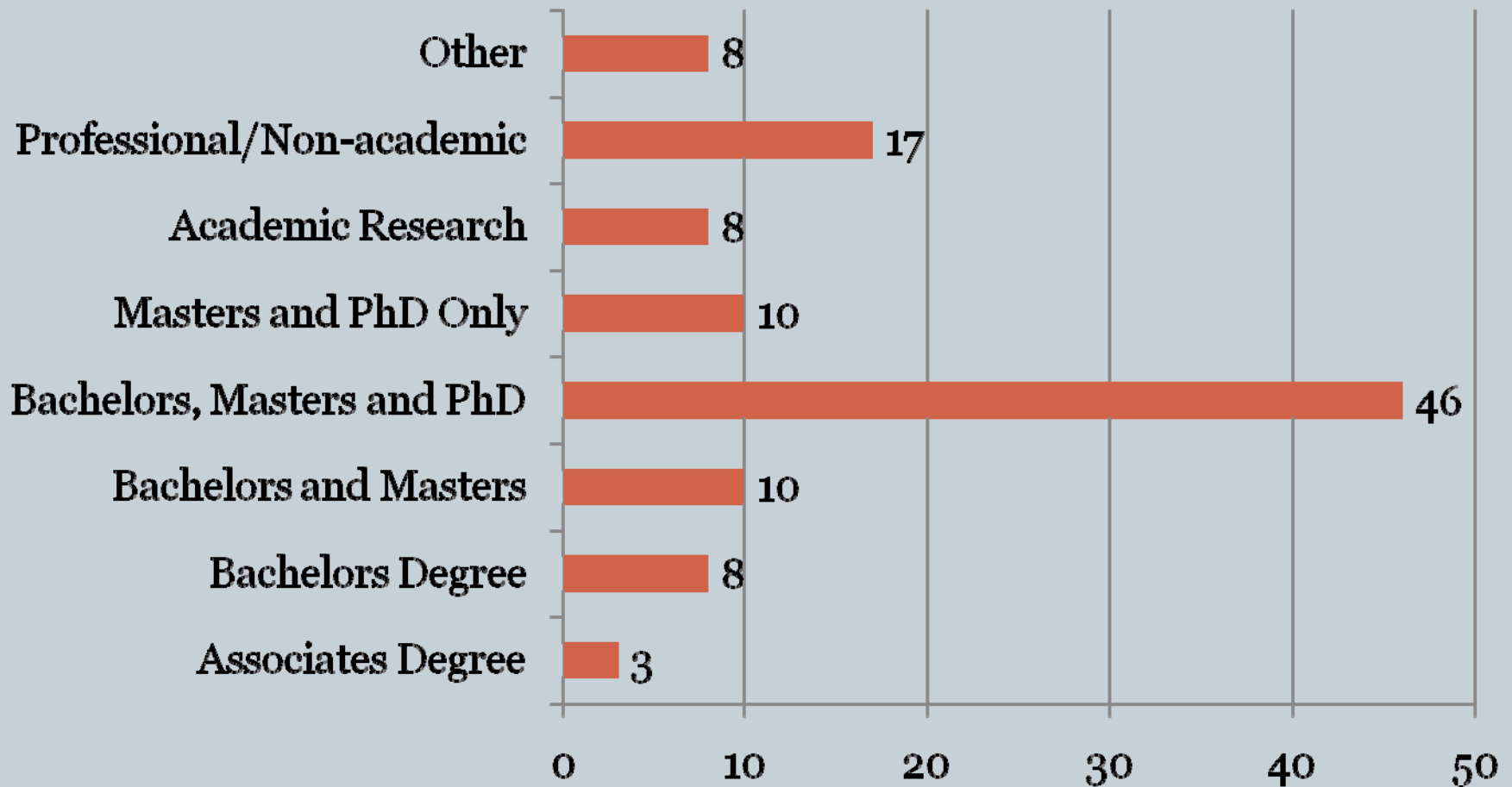
- 2007 Online Survey of subscribers to AAG GISSG, UCGIS and ESRI Education Program
- Total Questions: 41
- Total Respondents: 141
- Total Valid Responses: 86-132 depending on question – 101 average valid responses.
- Respondents represented both US and international concerns.
 - Including Canada, Spain, India and others.

Respondent Institutional Role



Responses: 132

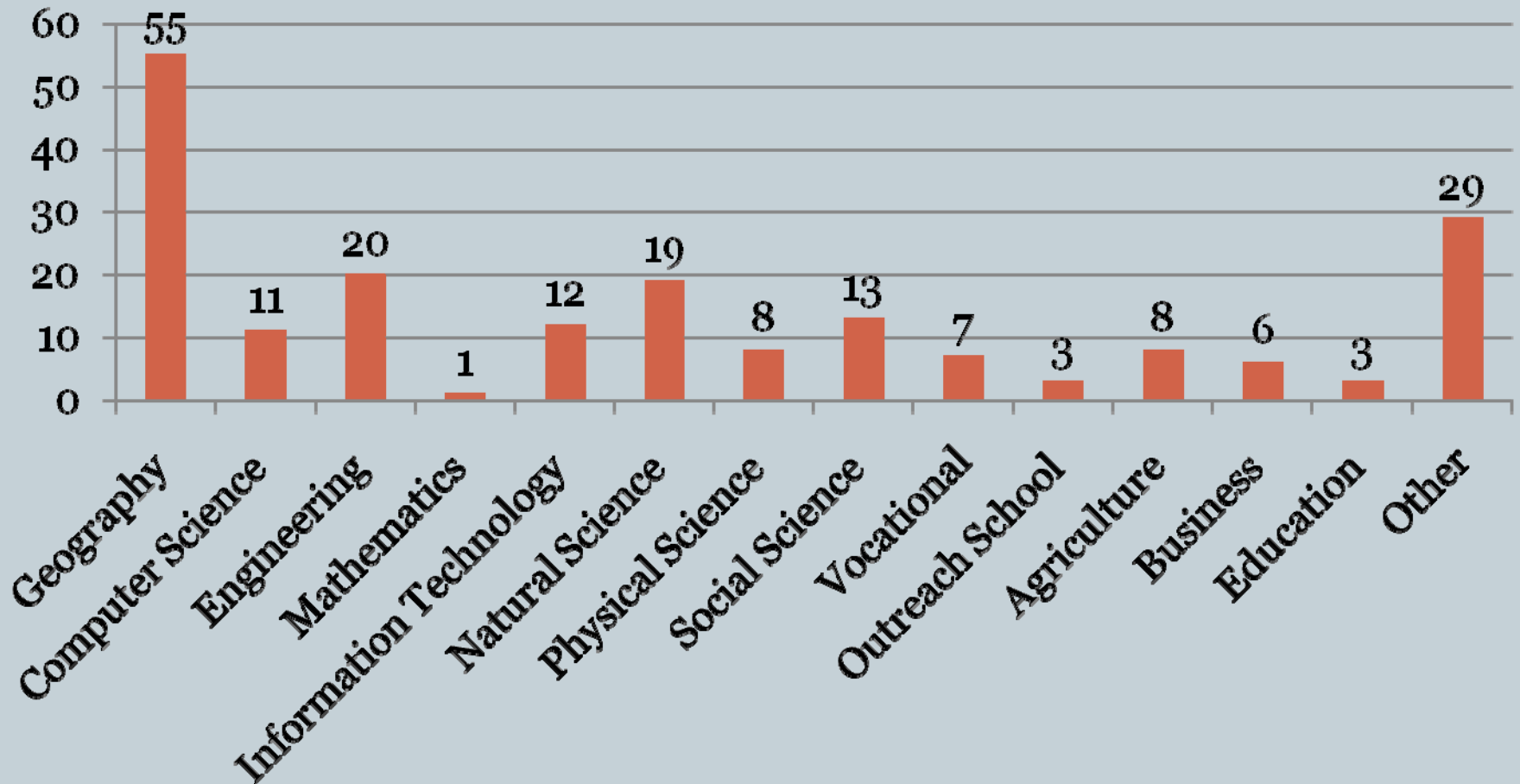
Institutional Type (inc. Degree Programs)



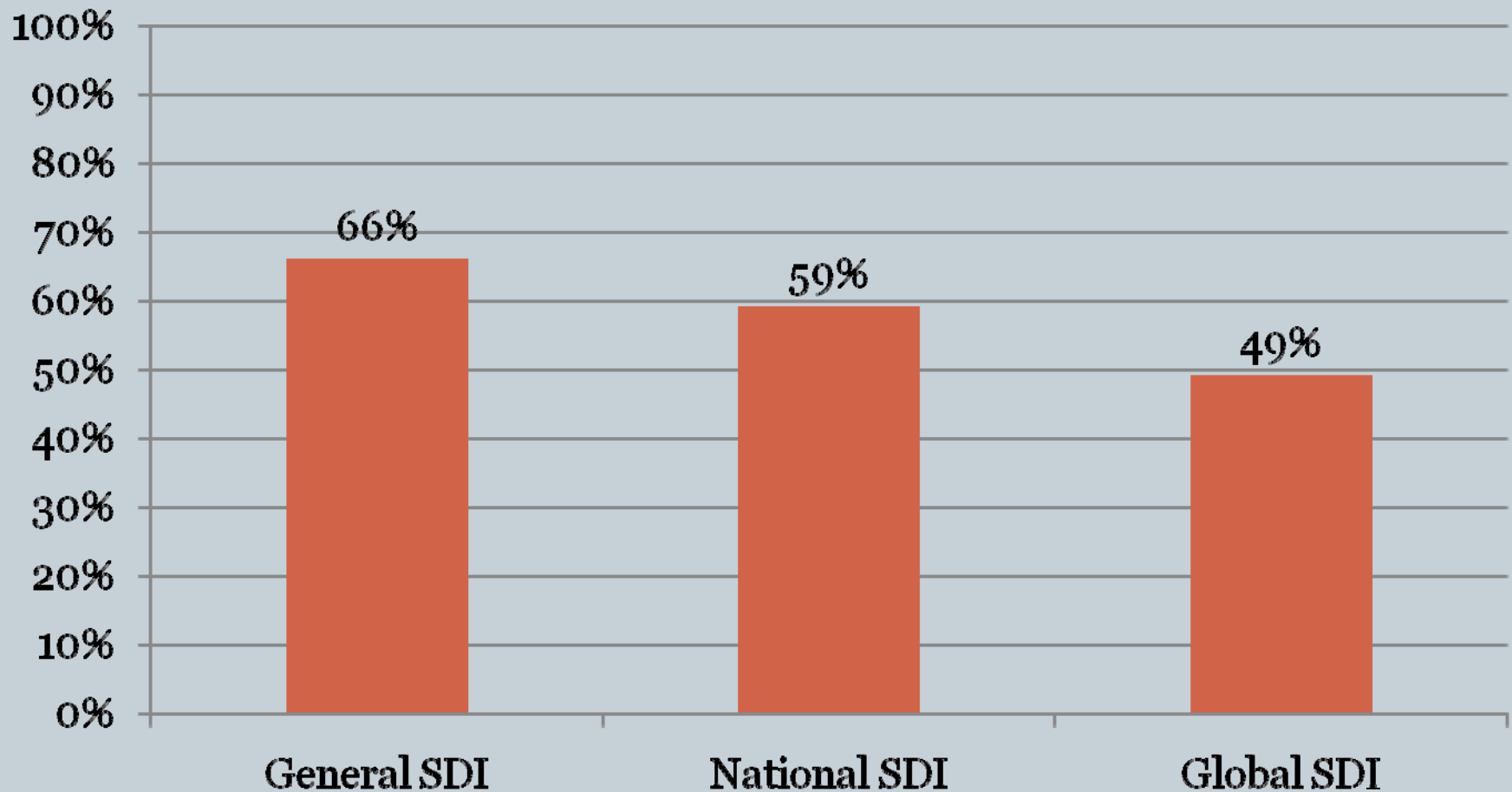
Responses: 110

Reponses of "other" that did not fit in one of the above included a GIS certificate program, a library, and K-12.

Where is GIS&T taught?



General Importance of SDI in Curriculum



n=89, 91, 90

Reported % is the number of respondents who selected important or very important.

Familiarity with Framework Concepts

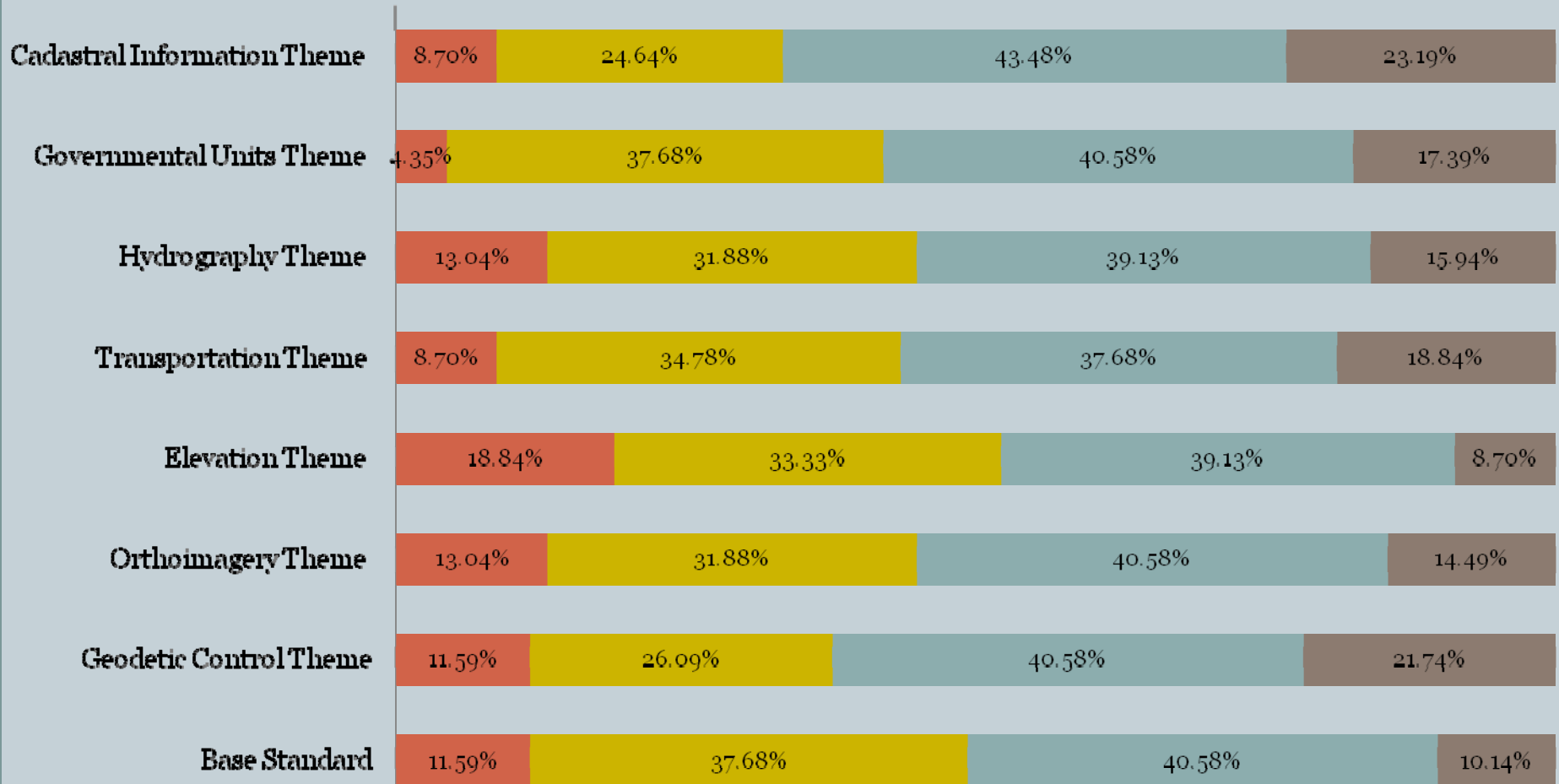


- 58% of respondents report 5 or more years of awareness of SDI concepts (n=88).
- 45% of respondents report 5 or more years of using SDI concepts in day-to-day activities (n=86).
- **76% of respondents indicate somewhat or greater familiarity with Framework (n=91).**

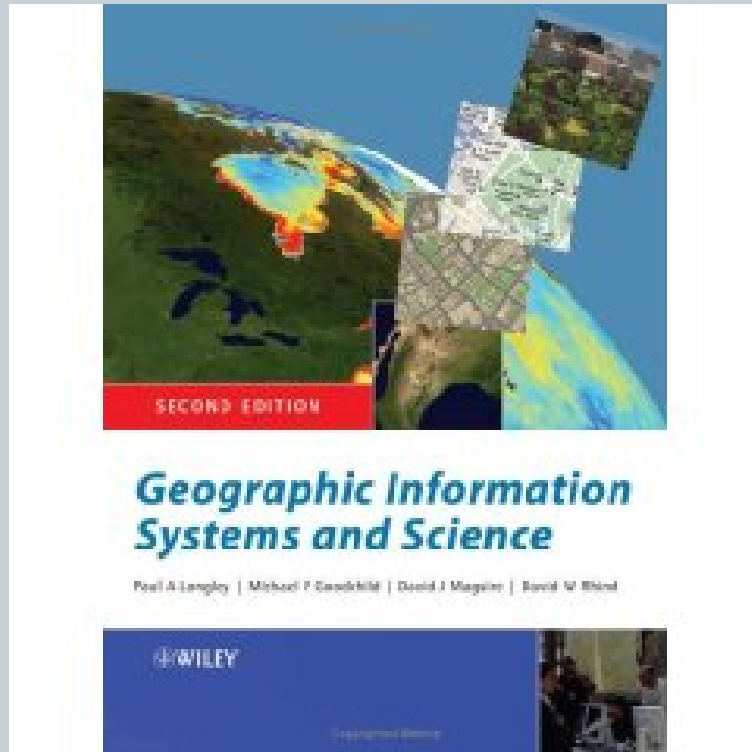
Framework Theme Familiarity



Very Familiar Familiar Somewhat Familiar Unfamiliar



Framework Concept Meta-Analysis of GIS Textbooks



- Data availability and access
- Spatial data infrastructures
- Standards
 - Data models
 - Software architecture

Geographic Information Science & Technology Body of Knowledge

Edited by David Johnson, Michael Griffiths, and Deborah Karim, with Robert Cook, Andrew Pines, and Elizabeth Strain

UNIVERSITY CONSORTIUM FOR GEOGRAPHIC INFORMATION SCIENCE

Analytical Methods

AM1 Academic and analytical origins

- 1.1 Academic traditions
- 1.2 Analytical approaches

AM2 Query operations and query languages

- 2.1 SQL queries
- 2.2 Relational Query Language (SQL) and database systems
- 2.3 Spatial queries

AM3 Geospatial measures

- 3.1 Distance and weight
- 3.2 Slope
- 3.3 Area
- 3.4 Perimeter and distance from
- 3.5 Accessibility and connectivity

AM4 Basic analytical operations

- 4.1 Buffer
- 4.2 Overlay
- 4.3 Mosaic/merge
- 4.4 Map algebra

AM5 Basic analytical methods

- 5.1 Data model analysis
- 5.2 Models and spatial systems
- 5.3 Spatial model analysis
- 5.4 Spatial statistics
- 5.5 Analyzing vector-based and raster data
- 5.6 Analyzing geospatial data
- 5.7 Spatial network analysis

AM6 Analysis of surfaces

- 6.1 Interpolating surface generation
- 6.2 Representation of surfaces
- 6.3 Surface analysis
- 6.4 Interpolation
- 6.5 Surface surfaces

AM7 Spatial statistics

- 7.1 Analytical methods
- 7.2 Theoretical processes
- 7.3 The spatial measurement
- 7.4 Theoretical concepts of spatial association
- 7.5 Local measures of spatial association
- 7.6 Global
- 7.7 Spatial methods

AM8 Geostatistics

- 8.1 Spatial modeling for statistical analysis
- 8.2 Geostatistical data analysis
- 8.3 Geostatistical modeling
- 8.4 Geostatistical analysis
- 8.5 Mapping models

AM9 Spatial regression and econometrics

- 9.1 Theories of spatial econometrics
- 9.2 Spatial econometric models
- 9.3 Spatial modeling
- 9.4 Spatial econometrics and geographical information systems (GIS)

AM10 Data Mining

- 10.1 Overview of data mining techniques
- 10.2 Data mining applications
- 10.3 Data mining systems
- 10.4 Data mining and modeling

AM11 Network analysis

- 11.1 Network analysis
- 11.2 Shortest paths (classified measures)
- 11.3 Network flow analysis
- 11.4 Flow modeling
- 11.5 The Traveling Salesman Problem
- 11.6 Shortest network problems
- 11.7 Accessibility modeling

AM12 Optimization and location-allocation modeling

- 12.1 Optimization modeling and location-allocation modeling
- 12.2 Linear programming
- 12.3 Integer programming
- 12.4 Location-allocation modeling and

Cartography and Visualization

CV1 History and trends

- 1.1 History of cartography
- 1.2 Technological transformations

CV2 Data visualization

- 2.1 Data visualization
- 2.2 Data visualization techniques
- 2.3 Data visualization systems
- 2.4 Data visualization applications

CV3 Principles of map design

- 3.1 Map design fundamentals
- 3.2 Map design for cartography
- 3.3 Map design for visualization
- 3.4 Cartography for cartography and visualization

CV4 Graphic representation techniques

- 4.1 Basic graphic representation techniques
- 4.2 Symbolic design
- 4.3 Symbols and cartographic design
- 4.4 Color and cartographic design
- 4.5 Text and cartographic design
- 4.6 Presentation of geographic information
- 4.7 Presentation of geographic information

CV5 Map production

- 5.1 Map production
- 5.2 Map production
- 5.3 Map production

CV6 Migration and evolution

- 6.1 The evolution of maps
- 6.2 Map production
- 6.3 Map production
- 6.4 Map production
- 6.5 Map production

Design Aspects

DA1 The scope of GIS/ET systems design

- 1.1 Using location-referenced information
- 1.2 Geographic information systems, databases, and data management
- 1.3 The scope of GIS/ET systems design
- 1.4 The scope of GIS/ET design
- 1.5 The scope of GIS/ET design

DA2 Project definition

- 2.1 Planning for design
- 2.2 System requirements analysis
- 2.3 System requirements analysis
- 2.4 System requirements analysis

DA3 Resource planning

- 3.1 System analysis
- 3.2 System analysis
- 3.3 System analysis
- 3.4 System analysis

DA4 Database design

- 4.1 Database design
- 4.2 Database design
- 4.3 Database design

DA5 Analysis design

- 5.1 Analyzing user requirements
- 5.2 Analyzing user requirements
- 5.3 Analyzing user requirements

DA6 Application design

- 6.1 Application design
- 6.2 Application design
- 6.3 Application design

DA7 System implementation

- 7.1 System implementation
- 7.2 System implementation
- 7.3 System implementation

Conceptual Foundations

CF1 Philosophical foundations

- 1.1 Analytical and design
- 1.2 Theoretical
- 1.3 Theoretical foundations

CF2 Cognitive and social foundations

- 2.1 Theoretical foundations of geographic information
- 2.2 From concepts to data
- 2.3 Theoretical foundations of GIS
- 2.4 Theoretical foundations of GIS
- 2.5 Theoretical foundations of GIS
- 2.6 Theoretical foundations of GIS

CF3 Domains of geographic information

- 3.1 Space
- 3.2 Time
- 3.3 Theoretical foundations of geographic information

CF4 Elements of geographic information

- 4.1 Geographic information
- 4.2 Geographic information
- 4.3 Geographic information
- 4.4 Geographic information

CF5 Relationships

- 5.1 Geographic information relationships
- 5.2 Geographic information relationships
- 5.3 Geographic information relationships
- 5.4 Geographic information relationships

CF6 Imperfections in geographic information

- 6.1 Imperfections
- 6.2 Imperfections in geographic information
- 6.3 Imperfections in geographic information
- 6.4 Imperfections in geographic information
- 6.5 Imperfections in geographic information

Data Modeling

DM1 Basic storage and retrieval structures

- 1.1 Basic storage structures
- 1.2 Basic storage structures
- 1.3 Basic storage structures

DM2 Database management systems

- 2.1 Database management systems
- 2.2 Database management systems
- 2.3 Database management systems

DM3 Geospatial data models

- 3.1 Geospatial data models
- 3.2 Geospatial data models
- 3.3 Geospatial data models
- 3.4 Geospatial data models
- 3.5 Geospatial data models

DM4 Vector and object data models

- 4.1 Vector data models
- 4.2 Vector data models
- 4.3 Vector data models
- 4.4 Vector data models
- 4.5 Vector data models

DM5 Modeling 3D, uncertain, and temporal phenomena

- 5.1 System requirements
- 5.2 System requirements
- 5.3 System requirements

Content:

- 10 Knowledge Areas
- 73 units
- 329 topics
- 1,600+ objectives

Utility:

Course & curriculum planning

Program comparison

Certification, accreditation, and articulation

Workforce development

GIS&T BoK Framework Cross-Walk



- **KA: Geospatial Data (GD)**
 - Unit GD6: Data Quality
 - Unit GD12: Metadata, Standards and Infrastructures
- **KA: GIS&T and Society (GS)**
 - Unit GS3: Use of Geospatial Information in the Public Sector
 - Unit GS5: Dissemination of Geospatial Information
- **KA: Organizational and Institutional Aspects (OI)**
 - Unit OI5: Institutional and Inter-Institutional Aspects
 - Unit OI6: Coordinating Organizations

Considerations in Teaching Framework



- **Course-by-course applicability**
 - Geographic Information and Map Use
 - Introductory GIS
 - Advanced GIS
 - GIS Management
 - Special Topics (data modeling, database design, etc.)
- **Framework Components**
 - SDI Context, Thematic Information Content, Technical Context, Operational Context, Business Context
- **Breadth v. Depth**
 - E.g., Development-->Stewardship-->Sharing

Considerations in Teaching Framework



- **Desired Learning Outcomes and Drivers**
 - New technology adoption (Heywood & Petch 1991)
 - Metadata (Berendsen et al. 2003)

- 1. Conviction
- 2. Motivation
- 3. Skills
- 4. Knowledge
- 5. Experience

Contributing Resources



- **National Map:**

- Provides access to networked databases of current information about the Nation's landscape.
- Consistent structure for geographic knowledge needed by the Nation
- Builds data sharing and data update partnerships at multiple levels

- **GeoSpatial One-Stop:**

- Comprehensive public portal for geospatial information from federal agencies and a growing number of state, local, tribal, and private agencies

- **FGDC CAP Grant Awardees - Framework Data Client Services Development**

- E.g., USGS National Hydrography Dataset; Virginia Statewide Road Network

Next Steps



- **Institutional versus Technical Focus**
 - NSDI
 - Conceptual Schemas
 - UML, XML, GML...
- **Applicability of “Training” Materials for Higher Education Curricular Use**
- **Course-Specific Examples**

Questions?



FOR MORE INFORMATION:

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