Core Knowledge in Surveying: Initial Investigations
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Curriculum development

• A WG 2.1 objective

• What is the core knowledge in a surveying curriculum?
Core knowledge

• Essential knowledge that should be included in survey education study and training

• Used as a basis for developing ideal survey education curriculae

Core knowledge

• Current activities
  – National Council of Examiners for Engineering and Surveying (NCEES)
  – Greenfeld and Potts proposal
  – American Society of Civil Engineers (ASCE)
  – University Consortium for Geographic Information Science (UCGIS)
NCEES Fundamental Knowledge

• A list of knowledge topics provided to those seeking to take the NCEES Fundamentals of Surveying examination (a US licensing requirement)
• Developed by questionnaires sent to licensed surveyors across the US

NCEES Fundamental Knowledge

• 15 topic areas
  – I) Algebra and trigonometry
  – II) Higher mathematics (e.g. calculus)
  – III) Probability, statistics, measurement analysis and adjustment
  – IV) Basic sciences (e.g. physics, geology, etc.)
  – V) Geodesy, astronomy and computations
NCEES Fundamental Knowledge

• 15 topic areas (continued)
  – VI) Computer operations and programming
  – VII) Written communication
  – VIII) Boundary and cadastral law/administration
  – IX) Business law, economics, etc.
  – X) Field data acquisition and reduction

• 15 topic areas (continued)
  – XI) Photo/image acquisition and reduction
  – XII) Graphical communication and mapping
  – XIII) Plane surveying computation
  – XIV) Geographic information science
  – XV) Land development principles
Surveying Body of Knowledge

• Proposed by Greenfeld and Potts (US)

• Based loosely on a combination of the ASCE approach and ABET outcomes measures

Figure 1. The Body of Knowledge for surveying in terms of outcomes.
Surveying Body of Knowledge

• Three breadth outcomes
  – supervision and project management
  – business and public policy and administration
  – role of the leader and leadership principles

Surveying Body of Knowledge

• ABET outcomes
  – a) mathematics and science
  – b) design and conduct experiments
  – c) design a system, component or process
  – d) function on multi-disciplinary teams
  – e) identify, formulate and solve problems
  – f) professional and ethical responsibility
Surveying Body of Knowledge

- ABET outcomes (continued)
  - g) effective communication
  - h) broad education (social science, arts, etc)
  - i) life-long learning
  - j) contemporary issues
  - k) use modern instruments and techniques

ASCE Body of Knowledge

- Published in 2000

- Broad statements of educational areas
ASCE Body of Knowledge

- Areas of knowledge
  - Management
  - Critical Thinking
  - Communication
  - Government
  - Economics and Finance
  - Law
  - Professional Practice and Ethics

UCGIS Body of Knowledge

- Published in 2007

- Specific knowledge topics classified in 3 levels
UCGIS Body of Knowledge

- Ten knowledge areas
  - 1) Analytical methods
  - 2) Conceptual foundations
  - 3) Cartography and visualization
  - 4) Design aspects
  - 5) Data modeling

UCGIS Body of Knowledge

- Ten knowledge areas (continued)
  - 6) Data manipulation
  - 7) Geocomputation
  - 8) Geospatial data
  - 9) GIS&T and society
  - 10) Organizational and institutional aspects
UCGIS Body of Knowledge

• Analytical Methods
  – AM1 Academic and analytical origins
    • 1-1 Analytical foundations
    • 1-2 Analytical approaches
  – AM2 Query operations and query languages
    • 2-1 Set theory
    • 2-2 Structured Query Language (SQL) and attribute queries
    • 2-3 Spatial queries

UCGIS Body of Knowledge

• Analytical Methods
  – AM3 Geometric measures
    • 3-1 Distances and lengths
    • 3-2 Direction
    • 3-3 Shape
    • 3-4 Area
    • 3-5 Proximity and distance decay
    • 3-6 Adjacency and connectivity
Considerations in developing core knowledge

• 1) Level of depth of knowledge classification
  – Broad and general vs specific

• 2) Level of detail necessary for surveying sub-disciplines
  – Geodesists, land appraisers, etc.

• 3) Current relevance of the knowledge
  – Could some core knowledge become obsolete?

• 4) Differences of interpretation
  – Misunderstandings, disagreements, etc
Conclusions

• A set of core surveying knowledge would be useful for defining and developing educational curriculae

• Need a broad consensus across the sub-disciplines of surveying