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?

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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

NCEES Fundamental Knowledge

- 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

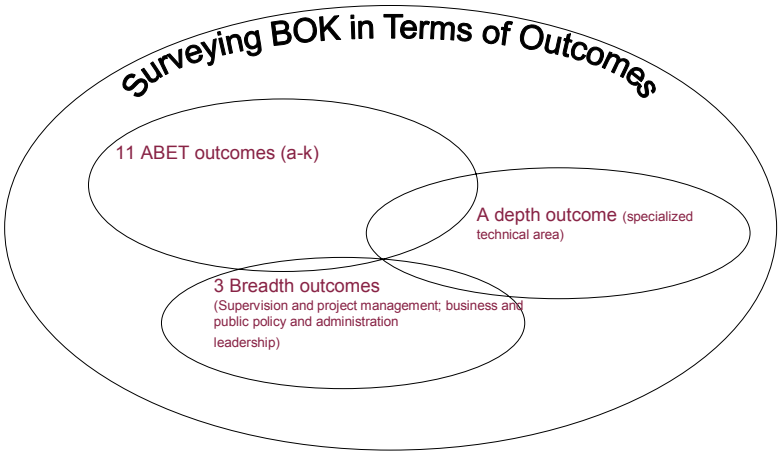

Figure 1. The Body of Knowledge for surveying in terms of outcomes.

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.

Considerations in developing core knowledge

- 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