Developing Standards-Based Education Modules for Building Information Modeling

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Project Background

- Building Information Modeling (BIM) is a digital representation of physical and functional characteristics of a facility.
  - Enables the consistent and continuous use of digital information **across the life cycle** of a built facility by **different stakeholders**
- BIM has been integrated into the curriculum of Architecture, Engineering, and Construction programs in many universities.
  - Immersed in existing courses
  - Standalone courses
  - Integrated in students' project work
- Currently, most BIM courses have a strong focus on the training of students' practical skills of software use but are weak on the foundational interoperability technology.

BIM Education Requirements vs. Our Project Focus

Table 3. BIM Education Requirements for Construction Management—Part 2: Technology

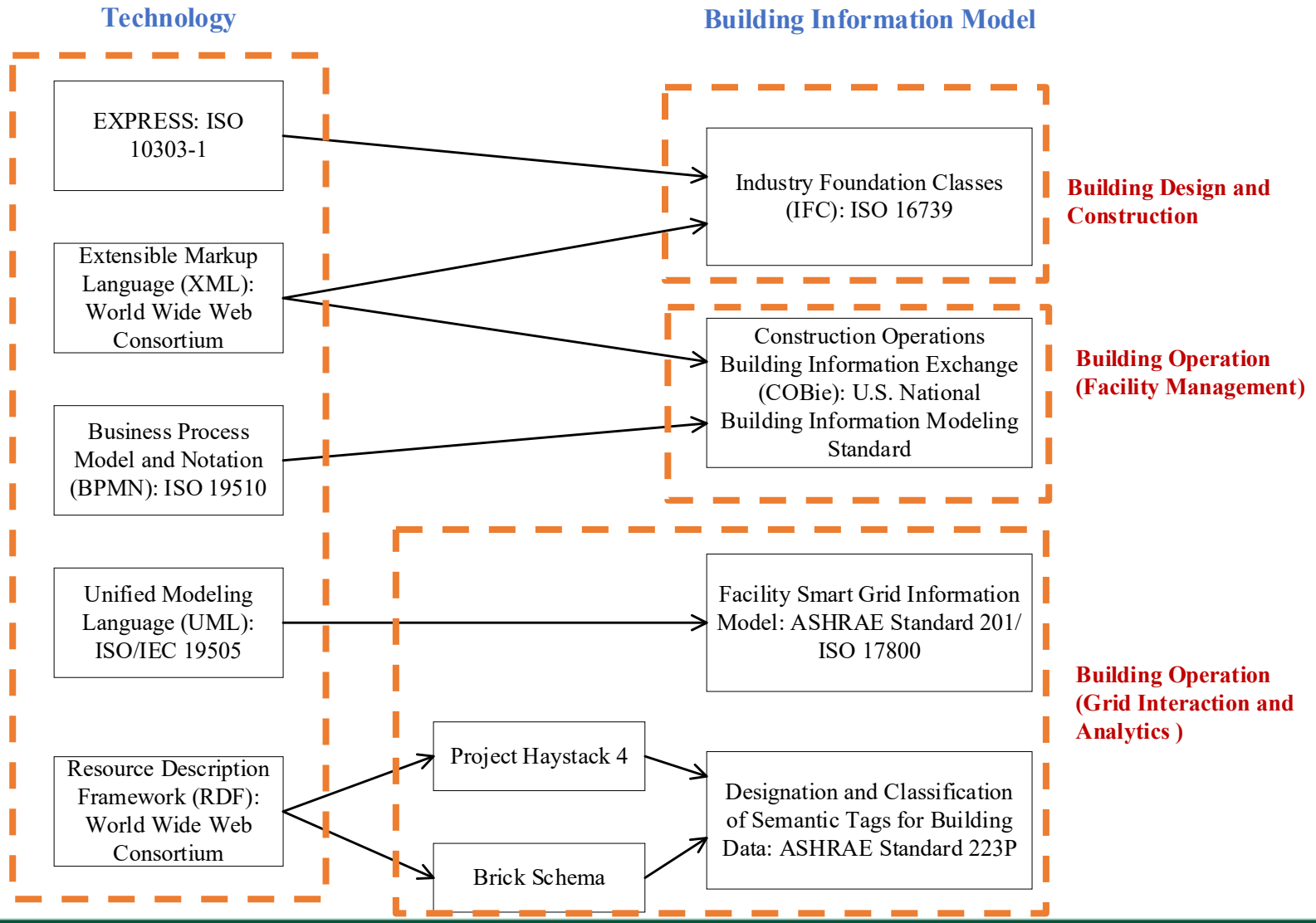
Number	BIM skills and technologies	Recommended level of achievement		
		First degree	Masters/30 credits	Experience
2.1	Basic BIM operating skills	3	4	5
2.2	Modeling with standard catalog elements	3	3	4
2.3	Creating and modeling with custom elements	3	4	5
2.4	Massing/solid modeling	3	4	6
2.5	Central databases/information repositories	2	4	5
2.6	Interoperability (file formats, standards, and structure for data sharing)	2	3	5
2.7	Communication tools, media, channels and feedback	3	5	6
2.8	Ways to store and share information (e.g., cloud computing, networking, big-room equipment)	3	3	5
2.9	Choosing right BIM technologies/processes/tools for specific purposes	3	5	6
2.10	Laser scanning	2	3	4

Source: Sacks, R. and Pikas, E., 2013. Building information modeling education for construction engineering and management. I: Industry requirements, state of the art, and gap analysis. *Journal of Construction Engineering and Management*, *139*(11), p.04013016

Project Goals

- To develop standards-based education modules that strengthen the connection between BIM and its fundamental technology and the connection between BIM and documentary standards.

Project Approach



Four Education Modules

- Module 1: Semantic data modeling and process modeling
  - Object-oriented modeling concepts
  - Semantic modeling languages such as XML, UML, and RDF
  - Business process modeling
- Module 2: Industry Foundation Classes (IFC)
  - Object-based inheritance hierarchy (i.e., IfcRoot, IfcObject, IfcProduct and their subclasses)
  - Object relationships (such as spatial aggregation hierarchy, relationships between spaces and their bounding elements, and the specification of materials).

Four Education Modules

- Module 3: Construction operations building information exchange (COBie)
  - COBie file formats (i.e., IFC, XML, and SpreadsheetML)
  - Content of a COBie spreadsheet file
  - File format, structure and content of a COBitLite file
- Module 4: Semantic interoperability for grid-interactive efficient buildings
  - Tagging conventions and taxonomies of building equipment and operational data
  - The components of Brick ontology
  - The latest development and progress of ASHRAE Standard 223P: Designation and Classification of Semantic Tags for Building Data

Module Structure

- Each module has 2~5 sessions and each session includes the following components
  - learning objectives and expected outcomes
  - lecture slides
  - video lectures
  - homework and further reading

Potential Adoption by UNCC Courses

- Building Information Modeling (CMET 2135): Dr. Don Chen
- A new course on Advanced BIM: Dr. Don Chen
- Software Engineering (ITIS 3155): Dr. Weichao Wang
- Energy Management (ENER 4140/5140): Dr. Weimin Wang

Communication Plan

- Plan to reach out to professors who teach BIM-related courses based on our professional network (e.g.,):
  - Department of Construction Management, University of Houston
  - Department of Built Environment, North Carolina A&T State University
  - Kimmel School of Construction Management and Engineering Technology, Eastern Carolina University
- Plan to disseminate the project results:
  - Share the project information through social media
  - Create a project webpage to host all education materials developed from this project
  - Post the education materials on the Whole Building Design Guide (WBDG) website (https://www.wbdg.org)

Project Timeline