USE OF BUILDING INFORMATION MODELING IN STUDENT PROJECTS AT WPI

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Worcester Polytechnic Institute
Overview

• MAJOR QUALIFYING PROJECTS
• ABET ACREDIDATION
• BIM UNDERGRADUATE COURSE AND PROJECTS
• CONCLUSIONS
Major Qualifying Projects (MQPs)

- WPI Degree Requirement
- Senior Project
- Equivalent to Three Courses (typically extended over 3 terms)
- Groups (students/faculty)
- Meets Capstone Design Experience (ABET)
Capstone Design Experience

ABET General Criterion 4, states that “Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints that include the following considerations:

• economic
• environmental
• sustainability
• manufacturability
• ethical
• health and safety
• social and political”
ABET Outcomes

1. Components of Civil Engineering Practice: Technical, Professional, Ethical
2. Preparation for the future changes in Civil Engineering
3. Understanding of Design Process, including the following: Ability to Perform Design, Multidisciplinary Aspects, Collaboration Skills, Communication Skills, Consideration of Cost, Consideration of Time Management
4. Understanding of options for careers and further education
5. An ability to learn independently
6. Broad education envisioned by the WPI Plan & described by the Goal & Mission of WPI
7. Understanding of the Civil Engineering profession in a societal and global context.
BIM Educational Infrastructure

- CE587 (since 2010)
- CE 1030 (since 2003)
- CE3030 (since 2007)
- CE3031 (since 2008)
- Undergraduate projects (Since 2005)
- Graduate Projects and Research (Since 2001)
Expected BIM Use in MQP

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<td>14</td>
<td>1</td>
<td>2</td>
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Expected BIM Use in future for other reasons

<table>
<thead>
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<th></th>
<th>2008</th>
<th>2009</th>
<th>2011</th>
<th>2012</th>
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<td>Profit</td>
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<tr>
<td>Fun/Enjoy/Person al</td>
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<td>2</td>
<td>4</td>
<td>2</td>
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<td>Work/Job</td>
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<td>2</td>
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<td>5</td>
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<td>Mandatory use on future</td>
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<tr>
<td>Improve school assignments</td>
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<tr>
<td>Rendering</td>
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<td>1</td>
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<tr>
<td>Enhance performance</td>
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<td>2</td>
<td>0</td>
<td>0</td>
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Rendering is expected to enhance performance.
Actual use of BIM tools in MQP projects
BIM Uses in MQPs

- Cost Estimation
- 4D
- 5D
- Geo 3D
- Structural Analysis
- Energy Analysis
- Site Analysis
- MEP FP
- FM
- Clash Detection

Legend:
- 2009-2012
- 2013
MQP: New WPI Athletic Facility
by Bernard, Grant, Petrocchi, Blanck, Sealund (2009)

ABET Outcomes Met by the Project: YES

<table>
<thead>
<tr>
<th>ABET Criterion 4</th>
<th>ECONOMIC</th>
<th>CONSTRUCTABILITY</th>
<th>ENVIRONMENTAL</th>
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<th>ETHICS</th>
<th>HEALTH &amp; SAFETY</th>
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MQP: WPI Recreation Center: Construction Management and Alternative Design Analysis

by Fournier, Munion, Stella (2011)

ABET Outcomes Met by the Project: YES

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MQP: WPI Recreation Center: Construction Management through 5D Building Information - Modeling with Alternative Design Considerations

by Baker, Beliveau, Sylvia and Williams (2012)

ABET Outcomes Met by the Project:  YES

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MQP: WPI Sports and Rec Center III: Construction Management and Constructability Analysis: 
by by Moynihan, Oliveri & Weisman (2011)

ABET Outcomes Met by the Project: YES

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MQP: UNUM Building Green Roof Study  
by Huard, Huard, McGinnis & Rodrigues (2012)

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Conclusions

• BIM supports MQP project development for up to 25% on the average of these projects
• The students expressed their intentions to use BIM tools beyond courses & projects
• The rate of adoption of BIM by the industry expecting students to acquire BIM skills and knowledge is considered to be a strong motivator.
• The level of sophistication and depth shown by those students who use BIM tools to support their MQP development work is increasing.
• The use of BIM in MQPs contributes to meet ABET outcomes and ABET General criterion 4 on Capstone Design Experience
• The impact of using BIM tools in the curricula in the Department of Civil and Environmental Engineering has been clearly identified but it has not been formally assessed up to this point.
Future Direction

• Get more faculty involved in MQPs in which BIM tools are used and eventually into course content
• Expand use of BIM tools to integrate design and analysis as expertise increases and tool interoperability improves
• Integrate formal assessment of BIM-based activity contributions into the department’s review for next ABET accreditation visit to take place in 2014
Thank You!