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Developing a 4-dimensional interdisciplinary learning environment

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making space: a 5-dimensional learning environment for construction industry students

Chris Landorf
introduction

• in construction, the theory-practice nexus is complicated by:
  – a competitive and fragmented industry
  – limited involvement of the tertiary sector in construction related research

• this results in innovations being retained as proprietary knowledge, while the body of professional knowledge remains standardised and theoretical

• the dangerous nature of construction sites further limits student access and the capacity to contextualise learning
introduction (cont.)

• work integrated learning as an opportunity to address the application of knowledge and skills in a real-world context.

• opportunities exist for alternative ways of providing the benefits of work integrated learning through simulated real-life contexts

• this webinar presents the development of an Australian Office for Learning and Teaching funded multi-disciplinary 4-dimensional (4D) digital learning environment for construction industry students
the industry context

• construction is a significant sector of the Australian economy
• recent studies suggest fundamental flaws in the industry:
  – complex and competitive structure
  – transient, multi-disciplinary and unique projects
  – adversarial procurement methods, and
  – poor innovation, productivity and continuous improvement
the educational context

- recent studies also suggest challenges for professional education:
  - overcrowded and fragmented curriculum
  - difficult to maintain industry-relevant knowledge
  - technical content has increased but not % of coursework, and
  - teamwork expectations have increased but not % of coursework
- virtual 3D learning environments have been explored but not 4D or 5D
developing the learning environment

- in December 2013, a project team representing:
  - architecture and engineering, University of Queensland
  - construction management, University of Newcastle
  - architecture, University of South Australia
were awarded a 2-year $220,000 OLT Innovation and Development grant

- the goal was to provide a realistic, practical and multi-disciplinary learning experience for students in construction-related professional disciplines

- the project utilised 75 x 3-dimensional digital photographic surveys taken at 1-2 week intervals (4-dimensions) over the construction of the University of Queensland’s Advanced Engineering Building (AEB)

- aural and pedagogical resources extended this to a 5D environment
the learning environment concept

a unique view on the construction process

explore fully interactive panoramic views of the construction site
the learning environment concept

Request for information
Architects instruction
Variation price request
Variation order
Contract price adjust.
Notice of delay
Extension of time
Progress claim
Progress certificate
Meeting minutes
Document transmittal

contract administration

construction drawings
the learning environment concept

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problem-based learning exercises
the learning environment concept

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problem-based learning exercises

4D virtual tour
the learning environment concept

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- contract administration
- construction drawings
- problem-based learning exercises
- 4D virtual tour
- Design + construction team interviews
the learning environment concept

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contract administration

construction drawings

problem-based learning exercises

4D virtual tour

Design + construction team interviews

1D Documents

2D Drawings

3D Activities

4D Virtual Tour

5D Interviews
the learning environment in action

Survey 3 – 07/06/2011
http://4dconstruction.uqcloud.net/VirtualTour/action/splash/index

Survey 33 – 28/02/2012

architecture
the learning environment in action (cont.)
the learning environment in action (cont.)
the learning environment in action
the learning environment in action

Other resources drop down menu
architecture

the learning environment in action

Other resources drop down menu  Technical drawings
the learning environment in action

Videos of key construction processes
http://4dconstruction.uqcloud.net/AEB/Resources//Auditorium_internal%20fitout.mp4
http://4dconstruction.uqcloud.net/AEB/Resources//Atrium.mp4
http://4dconstruction.uqcloud.net/AEB/Resources//Terracotta_facade.mp4
<table>
<thead>
<tr>
<th>Stage</th>
<th>Period</th>
<th>Activity</th>
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<tbody>
<tr>
<td>1. Development</td>
<td>January-June 2014</td>
<td>access construction documentation, review course curriculum and develop prototype learning environment</td>
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<tr>
<td>2. Usability trial</td>
<td>July-Dec. 2014</td>
<td>develop new course curriculum, conduct usability trial and evaluate</td>
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<tr>
<td>3. Pilot study</td>
<td>January-June 2015</td>
<td>conduct interviews, embed scenarios, conduct semester 1 pilot and evaluate</td>
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<td>4. Evaluation</td>
<td>July-Dec. 2015</td>
<td>conduct Semester 2 pilot and evaluate, incorporate results and finalise project</td>
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<tr>
<td>Year and program</td>
<td>Course topic</td>
<td>Learning activities</td>
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<tr>
<td>Year 1 Building</td>
<td>Building code compliance</td>
<td>immersive learning scenarios</td>
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<td>Year 1 Building</td>
<td>Construction technology</td>
<td>self-directed learning resource</td>
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<td>Year 2 Engineering</td>
<td>Concrete structures</td>
<td>self-directed learning resource</td>
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<td>Year 3 Architecture</td>
<td>Construction technology</td>
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<td>Year 3 Architecture</td>
<td>Building services</td>
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<td>Year 3 Building</td>
<td>Business management</td>
<td>immersive learning scenarios</td>
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<tr>
<td>Year 5 Architecture</td>
<td>Contract management</td>
<td>immersive learning scenarios</td>
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results - UniSA

• semester 1 2015, Year 3 Bachelor of Architectural Studies students at UniSA

• students worked in pairs on an assessable activity in response to the question ‘How does technology affect the design concept of a building?’

• students were asked to use annotated screen shots, plans, sections and sketches to communicate:
  – observations of design intent-services integration relationship
  – location and movement of services through the building
  – sequencing of services related construction activity, and
  – passive and active architectural strategies for sustainable design
results – UQ

- semester 2 2015, Year 3 Bachelor of Architectural Design students at UQ
- students worked in teams of 4 on assessable in-class scenario-based observational activities set each week for 4 weeks
- students were asked to use annotated screen shots, plans, sections and sketches to communicate an analysis of:
  - BCA strategies (fire stairs, exits, hose reels, hydrants, sanitary amenities)
  - structural systems (loads, framing, bracing)
  - environmental systems (passive, active), and
  - construction systems (materials, components, sequencing)
results – enhanced understanding

University of Queensland

- strongly disagree: 25%
- neutral: 17%
- disagree: 2%
- agree: 56%

University of South Australia

- strongly agree: 23%
- neutral: 5%
- disagree: 4%
- agree: 70%
University of Queensland

- strongly agree: 12%
- neutral: 19%
- agree: 67%
- disagree: 2%

University of South Australia

- strongly agree: 23%
- agree: 66%
- neutral: 7%
- disagree: 4%
conclusion

- work experience has a long tradition in professional education
- industry complexity and student numbers have impacted on workplace access
- opportunities exist for virtual learning environments
- the 5D environment attempts to provide such a setting
- can be used as:
  - a demonstration tool or
  - an immersive environment for team and problem-based learning
- offers an improvement over traditional teaching methods if used holistically

thank you
Session feedback:

With thanks from your hosts
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Recording available
http://transformingassessment.com