Combining educational games and virtual learning environments for teaching Physics with the Olympia architecture

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Outline of presentation

• Background & related work
• Olympia
  – Aims & objectives
  – Olympia architecture
  – Case study & methodology
  – GUI design & student model
  – Results & evaluation
• Conclusion & future work
Background & related work

• Ultimate goal: Make teaching & learning more effective

• Virtual learning environments (VLEs) & educational games
  – Subliminal messages (Williams 2008)

• Emotion & cognition -> deeply intertwined & equally important (Norman et al. 2003)

Aims & objectives

• Enhance VLE’s Human Computer Interaction (HCI) level using features of commercial & educational games

• Enhance student motivation & understanding

• Test hypothesis in specific case study: Teaching Physics at undergraduate level
Olympia architecture

- Enables combination of VLEs, educational games & new generation of VLEs with ITSs
- Originated and based on the generic architecture introduced by Noguez & Sucar (2005)
- Semi-open environment (Noguez & Sucar, 2006)
Case study & methodology

Implemented enhanced & traditional VLEs using Olympia architecture for teaching momentum

Divided 20 undergraduate students (ITESM-CCM) into experimental & control groups
Students interacted with the corresponding VLE

Results were evaluated using Weighted hypothesis testing (Wasserman 2004)
GUI design
Student model based on PRMs

Diagram:
- ConservationOfMomentum
  - LinearMomentum
    - Saved
      - MassAstronaut
      - MassToolsExploration
      - Direction
      - VelocityToolsExploration
    - VelocityAstronaut
## Results & Evaluation

### Average Knowledge Detected (%)

<table>
<thead>
<tr>
<th>Statistical Function</th>
<th>Velocity and Rectilinear Uniform Movement</th>
<th>Linear Momentum</th>
<th>Conservation of Momentum</th>
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<tbody>
<tr>
<td></td>
<td>Enhanced VLE</td>
<td>Traditional VLE</td>
<td>Enhanced VLE</td>
</tr>
<tr>
<td>Average</td>
<td>65.88</td>
<td>61.83</td>
<td>61.09</td>
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<tr>
<td>Standard deviation</td>
<td>19.79</td>
<td>16.62</td>
<td>24.38</td>
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<td>Z</td>
<td>1.09</td>
<td>0.28</td>
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</tbody>
</table>

### Interaction Results (Number of Cases)

<table>
<thead>
<tr>
<th>Statistical Function</th>
<th>Successful Cases</th>
<th>Total Cases</th>
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<tbody>
<tr>
<td></td>
<td>Enhanced VLE</td>
<td>Traditional VLE</td>
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<tr>
<td>Average</td>
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<td>2.70</td>
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<tr>
<td>Standard deviation</td>
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<td>2.15</td>
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<td>Z</td>
<td>-1.04</td>
<td>1.50</td>
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Conclusion & future work

• Olympia incorporates features of VLEs, educational games & ITSs
• Olympia evaluated in specific case study of teaching Physics at undergraduate level
• Students feel more motivated interacting with enhanced VLE
• Experiment on a larger population
• Enhance student learning model
• Implement additional educational games
Questions