Gamebrics: Integrating Analytical Rubrics into Serious Games to Teach Analytical Skills

Hugo Huurdeman, Hans Hummel, Rob Nadolski, Giel van Lankveld, Konstantinos Georgiadis, Johan van den Boomen, Hub Kurvers, Petra Neessen, Ron Pat-El & Aad Slootmaker
Introduction

• Acquiring complex skills: challenge f/ online learning
  • e.g. analytical thinking skills

• Serious games (SG):
  • potential to enhance acquisition complex skills

• Analytical rubrics:
  • proven feedback & evaluation instruments
  • but never integrated into gameplay SG
This presentation

1. Background
2. Approach
3. Initial results
4. Conclusion & outlook
1. Background (1/2)

- **Serious games (SG)**
  - achievement “serious” goals [e.g. Michael&Chen06; Gee07]
  - contribute to learning [e.g. meta-analyses Connolly12; Wouters13]

- **Focus here: scenario-based serious games** [Nadolski08]
  - Complex problem spaces, mimicking real-world situation
  - EMERGO framework
1. Background (2/2)

- Analytical rubrics
  - feedback & evaluation instrument
  - enabling assessment various settings [Arter&Chappuis10;VanDenBos17]
  - e.g. understanding knowledge, performance, higher-order skills

- Feedback
  - Information provided by educator about learner progress, to increase learning [e.g. Hattie&Timperley07;Narciss04]
2. Approach
2. Approach: Gamebrics

- Formative assessment of complex skills
  - via integration of rubrics
  - into existing serious games
- design, develop & evaluate integration [using validated methods]

- 3 SGs in different stages of development (at OUNL)
  - Kastanjehoeve (Management Sciences)
  - Junior Scientist (Psychology)
  - EduMythBusters (Educational Sciences)
2. Virtual internship

- Elderly home ("Kastanjehoeve")
- Solve authentic management problems
- Intro to business administration field
And do you think mission and vision could be recognized within Kastanjehoeve?

I think mission and vision were not clearly recognizable

I think mission and vision were clearly recognizable

The aspects of mission and vision important for the client I recognized clearly, but those of the employee to a lesser extent

The aspects important for the employees I recognized clearly, but those of the client to a lesser extent
2. Virtual internship

- Elderly home ("Kastanjehoeve")
- Solve authentic management problems
- Intro to business administration field
- Management Sciences, OUNL
- Management & Organisation (1st-year BSc)
- Existing SG expanded to include rubrics
3. Initial Results

3.1 Rubrics
3.2 Mappings
3.3 Guidelines feedback
3.4 Dashboard design
3.1 Analytical Rubrics

Defining analytical thinking sub-skills

Analytical thinking sub-skills [cf. Marzano93; Marzano07;08]

1. Comparing & selecting
2. Identifying errors
3. Inducing
4. Deducing (making inferences)
5. Decomposing information
6. Structuring information
7. Making decisions
8. Analyzing perspectives

Create rubric for each sub-skill

4 proficiency levels [Kratwohl02; Bloom56]

- **** Apply
- *** Analyze
- ** Understand
- * Recognize
3.2 Mapping game activities to rubric

• Validated method [Hummel17]
  • mapping *learning activities* *(from game scenario)*
    to *performance indicators*
  • by subject matter experts

• **Challenge**: game not originally designed with analytical skills in mind
  • Educators mapped each **SG activity** to:
    • *analytical thinking skill, observables, proficiency level, weight factor (score)*
3.2 Mapping game activities to rubric

- Validated method [Hummel17]
- Mapping learning activities (from game scenario) to performance indicators
- By subject matter experts

**Challenge**: game not originally designed with analytical skills in mind

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**SG Activity**: “Student has to analyze a work meeting. Within various segments of the conversation, different management techniques can be observed. The student has to select appropriate management techniques from a list for each segment. Students use general knowledge of management techniques in a practical situation.”

**Analytical thinking skill**: Deducing (making inferences)

**Observables**: how many segments classified correctly; in how many tries

**Proficiency level**: ** / Weight factor: standard
3.2 Mapping game activities to rubric

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<th>MG2-3</th>
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3.3 Guidelines in-game feedback

• Two types:

1. natural feedback as part of game scenario
e.g. game supervisor

2. generic reflection feedback (domain-independent) [cf. Hattie07;Narciss04]

Challenges:

• content: strike balance between (too) broad and (too) narrow
  • → parts: base (performance) + content remediation (desired behavior)

• timing: not interrupting ‘flow’ [Csikzentmihalyi08;Shute09]
3.4 Student dashboard design

A. Player progress
   • e.g. scores, completed activities

B. Performance (“Skills Wheel”*)
   • based on Pe(e)fectly Skilled project
   • e.g. assess own performance

C. Reflection feedback
   • e.g. improvement advice
<table>
<thead>
<tr>
<th>Sub-skill</th>
<th>Advice</th>
<th>Challenges</th>
</tr>
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<tbody>
<tr>
<td>1: Comparing &amp; selecting information</td>
<td>You successfully completed all challenges. You cannot improve yourself further.</td>
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<tr>
<td><strong>50/50 points achieved</strong></td>
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<td>2: Identifying errors in reliability</td>
<td>You successfully completed all challenges. You cannot improve yourself further.</td>
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<tr>
<td><strong>100/100 points achieved</strong></td>
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<td>3: Inducing</td>
<td>You have completed none of the challenges successfully. If you would like to improve further, try to determine the underlying characteristics of the different principles.</td>
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<tr>
<td><strong>25/100 points achieved</strong></td>
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<tr>
<td>4: Deducing</td>
<td>You completed the majority of challenges successfully. If you would like to improve yourself further, try to recognize while doing the challenges which deductions can be made from general principles, in which context, why, and which underlying properties they have. Take these considerations into account when making choices.</td>
<td><strong>6.1.3 Searching for a nurse</strong></td>
</tr>
<tr>
<td><strong>287/400 points achieved</strong></td>
<td><strong>TO BE PLAYED</strong></td>
<td><strong>Max. score:</strong></td>
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<tr>
<td>5: Decomposing information</td>
<td>This sub-skill has not been assessed yet.</td>
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<td><strong>0/0 points achieved</strong></td>
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<tr>
<td>6: Structuring information</td>
<td>You successfully completed all challenges. You cannot improve yourself further.</td>
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<td><strong>200/200 points achieved</strong></td>
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4. Conclusion & Outlook
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- Integration rubrics into serious games
  - Background & approach
  - Rubrics, mapping, feedback & dashboard
  - Challenges

- Design teacher dashboard

- Ongoing evaluation (2 SGs):
  - Experimental group (with dashboard) & control group (without)
  - So far — over 60 participants — ongoing
“...to be continued”
Gamebrics

www.gamebrics.nl
Acknowledgements

- UI/UX design by Mick Hummel
- SURF grant
References

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