Aligning learning analytics and learning design to support teachers in orchestrating CSCL situations

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Orchestration of TEL scenarios

[Learning Design (LD)]

[Learning Analytics (LA)]

[Dillenbourg, 2011a] [Prieto et al., 2011] [Dillenbourg, 2011b] [Ferguson, 2012]
Orchestration of CSCL scenarios

Scripting [Dillenbourg, 2002]

Monitoring [Soller et al., 2005]

Additional complexity

[Jermann et al., 2004]
Research Context

Current trends in Technology Enhanced Learning (TEL)

[EDUCAUSE, 2010] [STELLAR, 2012] [Horizon, 2013]

And more complexity!!!
Synergies may appear when combining scripting and monitoring ...

... however, the integration is not straightforward

[Martínez-Monés et al., 2011]
GLOBAL OBJECTIVE

To provide teachers with design and enactment support capable of linking pedagogical intentions with monitoring needs for orchestrating blended CSCL scenarios supported by DLEs
Problem nature

CSCL paradigm
[Koschmann, 1996]
[Stahl et al., 2006]

Emerging & evolving factors

Need for teachers involvement

Methodology

Design-based research
[Barab&Kurt, 2004] [Brown, 1992]

• Iterative process

• Participatory design
[Kensing & Blomberg, 1998]
[Muller et al., 1993]

• Authentic educational settings
[Barab&Kurt, 2004]
- Higher Education (University of Valladolid)
- Blended CSCL scenarios:
  - face-to-face and computer-supported activities,
  - individual and collaborative work,
  - face-to-face and distance learning,
  - technologically supported by DLEs
- Time frame: 2-4 weeks.
Contributions
Proposals
Proposals
Monitoring-aware design model of CSCL scripts

Based on …

[Kollar et al., 2006]
[Kobbe et al., 2007]
[Fischer et al., 2007]
[Dillenbourg & Tchounikine, 2007]
[Weinberger et al., 2009]

[van der Aals et al. 2003]
[Avouris et al., 2004]
[Martínez et al., 2004]
[Kahrimanis et al., 2006]
[Harrer et al., 2009]

Dependences between scripting & monitoring
Monitoring-aware design model of CSCL scripts

Formulation

[Rodríguez-Triana et al., 2012b] [Rodríguez-Triana et al., in press (a)]
[Rodríguez-Triana et al., in press (b)]
Proposals

- Monitoring-aware design process of CSCL scripts
- Monitoring-aware model of CSCL scripts

Teacher

- Script-aware monitoring process of CSCL scenarios
- Architecture for data gathering & integration in DLEs
Monitoring-aware design process of CSCL scripts

Based on …

**Pattern-based design process of CSCL scripts**
[Villasclaras-Fernández et al., 2009]

- Dependences between scripting & monitoring
- Teachers’ feedback
Monitoring-aware design process of CSCL scripts

Formulation

1. Determine learning objectives & prerequisites
2. Specify activity flow
3. Configure activities & groups
4. Provide resources

1.1 Specify flow dependencies (sequence, groups, resources)
2.1 Define activity constraints (social level, interactivity type, learning mode, deadlines)
3.1 Define group constraints (size, group formation policies, participants)
4.1 Select tools according to monitoring opportunities
2.2 Include data gathering activities (for students)
3.2 Define activities to be monitored
4.2 Define resources & actions to be monitored
2.3 Include monitoring support activities (for teachers)
3.3 Define activities to be monitored
4.3 Include monitorable resources
2.4 Define data gathering activity constraints (social level, interactivity type, deadlines, location)
4.4 Define actions to be monitored

[Rodríguez-Triana et al., 2012b] [Rodríguez-Triana et al., in press (a)]
[Rodríguez-Triana et al., in press (b)]
Adaptar figura
Revisar mis citas
MJRT; 27/08/2014
Monitoring-aware design process & model of CSCL scripts
Implementation (I)
Monitoring-aware design process & model of CSCL scripts
Implementation (II) – EdiT2

<table>
<thead>
<tr>
<th>Activity</th>
<th>Group</th>
<th>Participant</th>
<th>Resource</th>
<th>Group</th>
<th>Participant</th>
<th>Resource</th>
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<tbody>
<tr>
<td>Resource review</td>
<td>All</td>
<td>Javier</td>
<td>Flights to Lausanne</td>
<td>Group A</td>
<td>Javier</td>
<td>Travel proposal</td>
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<td>Cultural Agenda</td>
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</table>

**Context & motivation**

**Contributions**

**Methodology**

**Evaluation**

**Conclusions & future work**
Monitoring-aware design process & model of CSCL scripts
Implementation (II) – EdiT2
Proposals

Architecture for data gathering & integration in DLEs
Proposals

Script-aware monitoring process of CSCL scenarios

Teacher

Design-based data analysis

Monitoring-aware design process of CSCL scripts

Monitoring-aware model of CSCL scripts

Script

Monitoring configuration

Monitoring data
Script-aware monitoring process of CSCL scenarios

Based on ...

Collaboration analysis process
[Soller et al., 2005]

1. Collect data
2. Construct a model (indicators)
3. Compare current & desired status
4. Advice & guide the interaction

- Dependences between scripting & monitoring
- Teachers’ feedback
Script-aware monitoring process of CSCL scenarios

Proposal

1. Collect data
2. Construct a model (indicators)
3. Compare current & desired states
4. Advice/guide the interaction

Collaboration analysis process (Solar et al., 2005)

Script-related tasks
- guided by the script definition (participants, resources, deadlines, ...)
- based on the script constraints (obtained from the pattern(s), the definition of the activities & the teacher’s decisions)
- i.e comparing the gathered evidences with the script definition
- Teachers are informed about discrepancies between the current and the desired state

[Rodríguez-Triana et al., 2011a] [Rodríguez-Triana et al., 2013] [Rodríguez-Triana et al., in press (b)]
Script-aware monitoring process of CSCL scenarios

GLIMPSE - Group Learning Interaction Monitor for Pedagogical Scripting Environments
Script-aware monitoring process: Monitoring reports

### Activity 3.5 - Improvement of the proposals

- **Beginning:** Sat May 18 00:00:00 CEST 2013
- **End:** Wed May 22 12:00:00 CEST 2013
- **Participants:** mandatory individuals
- **Learning model:** blended
- **Social level:** group

### Groups & Participants

<table>
<thead>
<tr>
<th>Groups</th>
<th>Participants</th>
<th>Workgroup report (super-group)</th>
<th>Final research proposal (super-group 1)</th>
<th>Activity description: Improvement of the proposals</th>
<th>Teacher's observations</th>
<th>Warnings (Σ evidence)</th>
</tr>
</thead>
</table>
| Super-group 1
| StudentName1 | 20% | link participation | link access edition | link access | link attendance submission comment | |
| StudentName2 | 20% |
| StudentName3 | 20% |
| StudentName4 | 20% |
| StudentName5 | 20% |

<table>
<thead>
<tr>
<th>Groups</th>
<th>Participants</th>
<th>Workgroup report (super-group)</th>
<th>Final research proposal (super-group 2)</th>
<th>Activity description: Improvement of the proposals</th>
<th>Teacher's observations</th>
<th>Warnings (Σ evidence)</th>
</tr>
</thead>
</table>
| Super-group 2
| StudentName6 | 20% | link participation | link access edition | link access | link attendance submission comment | |
| StudentName7 | 20% |
| StudentName8 | 20% |
| StudentName9 | 20% |
| StudentName10 | 20% |

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<thead>
<tr>
<th>Groups</th>
<th>Participants</th>
<th>Workgroup report (super-group)</th>
<th>Final research proposal (super-group 3)</th>
<th>Activity description: Improvement of the proposals</th>
<th>Teacher's observations</th>
<th>Warnings (Σ evidence)</th>
</tr>
</thead>
</table>
| Super-group 3
| StudentName11 | 20% | link participation | link access edition | link access | link attendance submission comment | |
| StudentName12 | 20% |
| StudentName13 | 20% |
| StudentName14 | 20% |
| StudentName15 | 20% |
Proposals

- Monitoring-aware design process of CSCL scripts
- Monitoring-aware model of CSCL scripts
- Script-aware monitoring process of CSCL scenarios

Architecture for data gathering & integration in DLEs
Wrap Up
Evaluation
Evaluative studies

- **EV1**
  - 185 students
  - 4 activities
  - 310 documents
  - 4 weeks
  - Moodle
  - GDraw, GPres, GDocs & GForms

- **EV2**
  - 15 students
  - 9 activities
  - 77 documents
  - 3 weeks
  - MediaWiki
  - GDocs & GForms

**Teacher Roles**
- T1: Experts
- T2: Experts
- T3: Expert
- T4: Non-Expert
- T5: Non-Expert

**Iterations**
  - EXP1
  - EXP2

- **Iteration 2** (2012 Feb-Mar - 2013 Mar-Apr)
  - EXP3
  - EXP4

- **Iteration 3** (2013 May - 2014 Apr-May)
  - EXP5

**Timeline**
- 2010 Oct-Nov
- 2011 Oct-Nov
- 2012 Feb-Mar
- 2013 Mar-Apr
- 2014 Apr-May

**Legend**
- Exploratory
- Evaluative
CSCL-EREM
Computer Supported Collaborative Learning Evaluand-oriented Responsive Evaluation Model)

- **Evaluands:** 4 contributions
- **Issues:** Do the contributions achieve their purpose?
- **Happenings:** 2 evaluative studies
- **Informants:** teachers, students, researcher, technologies
- **Data gathering techniques:** mixed methods, triangulation

[Jorrín-Abellán et al., 2009]
Research Question
Does our proposal provide teachers with design and enactment support capable of linking pedagogical intentions with monitoring needs for orchestrating blended CSCL scenarios supported by DLEs?

Anticipated data reduction
[Miles & Miles Huberman, 1994]
Data sources

ISSUES

Issue 1 (I1): Does the monitoring-aware design process of CSCL scripts help teachers to align pedagogical and monitoring issues?

Issue 2 (I2): Does the monitoring-aware model of CSCL scripts allow expressing the scripting and monitoring aspects required to guide the monitoring process?

Issue 3 (I3): Does the script-aware monitoring process provide teachers with relevant information for the management of the CSCL scenario?

Issue 4 (I4): Does the architecture facilitate the data gathering and integration of users’ interactions in CSCL scenarios supported by DLEs?

Informants & data gathering techniques

- Teacher’s interviews: EV(i)_T_INT(j)
- Teacher’s learning design: EV(i)_T_LD
- Teacher’s observations: EV(i)_T_OBS
- Researcher’s observations: EV(i)_R_OBS(j)
- Students’ questionnaires: EV(i)_S_QUE(j)
- Learning outcomes in the ICT tools: EV(i)_IT_LO
- Logs from the ICT tools: EV(i)_IT_LOG

Teachers

Researchers

Students

ICT tools
Findings: a selected example

 ISSUES

Issue 1 (I1): Does the monitoring-aware design process of CSCL scripts help teachers to align pedagogical and monitoring issues?

Issue 2 (I2): Does the monitoring-aware model of CSCL scripts allow expressing the scripting and monitoring aspects required to guide the monitoring process?

Issue 3 (I3): Does the script-aware monitoring process provide teachers with relevant information for the management of the CSCL scenario?

Issue 4 (I4): Does the architecture facilitate the data gathering and integration of users’ interactions in CSCL scenarios supported by DLEs?

Informants & data gathering techniques

RESEARCHER’S OBSERVATIONS EV(I)_R_OBS(I)

STUDENTS’ QUESTIONNAIRES EV(I)_S_QUE(I)

LEARNING OUTCOMES IN THE ICT TOOLS EV(I)_IT_LO

LOGS FROM THE ICT TOOLS EV(I)_IT_LOG

TEACHER’S INTERVIEWS EV(I)_T_INT(I)

TEACHER’S LEARNING DESIGN EV(I)_T_LD

TEACHER’S OBSERVATIONS EV(I)_T_OBS

ICT tools

Researchers

Students

Teachers
Findings: a selected example
Findings: a selected example

“The monitoring reports were relevant for me because they responded to my expectations.” [EV1_T_INT3]

“The monitoring reports very useful to ensure that there would be productive discussions and a common product. This information allowed me to avoid problems caused by students not doing the work previous to an activity.” [EV1_T_INT3]

“This type of analysis is useful. The fundamental aspect is that it tells you how students are progressing with respect to the plan. Concretely, in this scenario, reports gave the certainty that students were following the plan without having to dedicate a lot of time on my side.” [EV2_T_INT3]

41 out of 43 problems (95.35%) were detected [EV1_T_OBS] [EV1_IT_LOG] [EV1_IT_LOG] [EV1_R_OBS2]

16 out of 16 problems (100%) were detected [EV2_T_OBS] [EV2_IT_LOG] [EV2_IT_LOG] [EV2_R_OBS2] [EV2_S_OBE1] [EV2_S_OBE2] [EV2_R_OBS2]

Interviews to the teachers

Questionnaires to the students

Researchers’ observations

Teachers’ observations

Learning outcomes

Logs
Findings: a selected example

Focusing the analysis of the user’s action on the accomplishment of the decisions made at design time was relevant and useful for the teachers.

“The monitoring reports were relevant for me because they responded to my expectations.” [EV1_T_INT3]

“The monitoring reports very useful to ensure that there would be productive discussions and a common product. This information allowed me to avoid problems caused by students not doing the work previous to an activity.” [EV1_T_INT3]

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Research Question
Does our proposal provide teachers with design and enactment support capable of linking pedagogical intentions with monitoring needs for orchestrating blended CSCL scenarios supported by DLEs?
Monitoring-aware design process of CSCL scripts

Findings
Monitoring-aware design process of CSCL scripts

Achievements & Limitations

- The process supported teachers to identify and include monitoring aspects throughout the design process of CSCL scenarios.

- A more generic solution is needed to support teachers in the selection of tools (based on their monitoring affordances)
Monitoring-aware model of CSCL scripts

Achievements & Limitations
Monitoring-aware model of CSCL scripts

Achievements & Limitations

- The model was expressive enough to describe the design decisions and the information required to guide the monitoring process in both scenarios.

- Further evaluation should be done involving CSCL scenarios with different styles of script designs and monitoring needs.
Script-aware monitoring process of CSCL scenarios

Findings
Script-aware monitoring process of CSCL scenarios

Achievements & Limitations

• The process provided teachers with relevant feedback to improve the awareness on the learning situation and to support the regulation tasks.

• More advanced solutions should be found to support the gathering of data directly provided by teachers and students (to enrich computer-mediated evidence)

• New data sources and indicators are required to minimize the deviations and to take into account the quality of the participation
Architecture for data gathering & integration in DLEs

Findings

- **Topic 1**: Impact on the design process
- **Topic 2**: Data gathering
- **Topic 3**: Time cost
- **Issue 4**: Architecture for data gathering & integration

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**Context & motivation**

**Research goals**

**Methodology**

**Contributions**

**Evaluation**

**Conclusions & future work**
Architecture for data gathering & integration in DLEs

Achievements & Limitations

- Allowed the data gathering and integration in blended CSCL scenarios supported by DLE

- Security and data privacy issues of data gathering must be taken into account

- Problems may appear in relation to the data persistence
Conclusions

&

Future work
Conclusions
Impact on the research community

Despite focusing on blended CSCL scenarios supported by DLEs …

RESEARCH PROBLEMS

DESIGN PROBLEM
The lack of reflection about monitoring issues at design-time, sometimes conditioned the monitoring results

- Support of the CSCL scenario lifecycle
- Support teachers to reflect on their monitoring needs
- Move forward in the integration of LD & LA approaches in authentic learning scenarios

ENACTMENT PROBLEM
Existing monitoring proposals often follow a data-driven approach inferring indicators from the data available instead of using a predefined model

- Data analysis based on the user’s needs
- Analysis of blended learning data sources
- Involving teachers & students in the data gathering

TECHNOLOGICAL PROBLEM
The heterogeneous and distributed nature of the learning environment hinder the data gathering and integration

- Tools Integration
- Data gathering & integration

... we have faced general Blended Learning, CSCL & TEL problems
Conclusions
Methodological reflection

Methodology

- Design-based research
  - Iterative process
  - Participatory design
  - Authentic educational settings

- Time constraints
- Generalizable findings vs transferability
- Better comprehension of the teachers needs
- Researcher’s bias vs deeper understanding of the educational context
The alignment between scripting and monitoring helped to improve both processes.

Teachers intervene in the definition of the analysis with an affordable effort, and were able to interpret the results.

The approach is **minimalistic**: shows initial evidences that teachers check with their available information.

We applied a **qualitative** approach which helped to understand the complexity of the scenario.
Thank you!

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