From design to evaluation of scripted networked collaborative learning environments

Yannis Dimitriadis
University of Valladolid, Spain
EMIC/GSIC research group
http://gsic.tel.uva.es/members/yannis

Some provocative questions (I)
Are there any convincing (definite) answers?

- Are ICTs (New Technologies)? already at “class”
  - Almost YES: Computers, local networks and Internet access (and software?): at homes, classes, virtual environments

- Has the class really changed due to ICTs?
  - Somehow NO: If mainly used for Powerpoint presentations, “copy&paste-ready” material at the Internet

- Are teachers willing-ready to use ICTs at class?
  - Almost NO: Visit the “computer-based” class, when necessary, as e.g. with the chemistry lab
Some provocative questions (II)
Are there any convincing (definite) answers?

- Are ICTs missing or insufficient?  
  - Generally NO: Lots of proposals in all sectors with a high rate of change/innovation (and consolidation?)
- Is there sufficient research in TEL?  
  - Almost YES: many conferences, groups, journals, etc.
- Is there a shift from individual or class learning?  
  - SCARCE: group activities mainly in K-6 or K-12 education ...
- Is there formal class planning (Ins. Design)?  
  - SOMEHOW: lectures, lesson plans, school plans (perceived as part of bureaucracy?)

And a provocative diagnostic

- Teachers are typically afraid of ICT in classes, they focus mainly on individual learning and in lectures, they use plans mainly for the administration
- Research in TEL is strong, with an equally strong disassociation between technology and educational experts, quantitative and qualitative advocates, without a tradition in case studies, focusing either on extremely macroscopic phenomena or in psychological experiments
- ICT is moving fast, and almost always ahead of educational needs, without clear standards and interoperable systems, suggesting always new packages
Some elements of a proposal (I)

- Improvisation, creativity and experience are not contradictory with planning, modeling: find a **compromise** bringing them together and use them through *patterns*.

- No technology is sufficient by itself, but there are many useful pieces that can be put together: *Search* for adequate tools and *integrate* in situations, as *tailored* by practitioners.

Some elements of a proposal (II)

- Standards and interoperability can be handled in a loose way in practice, so that people can keep up with the use of the technology: Use simple technology and loose coupling that can *scale up* and be *sustainable*.

- One can bring together *individual* and *group activities* (with different schemes and flavors) in real practice.
Some elements of a proposal (III)

- It is possible to have *non-dogmatic mixed* approaches (qualitative / quantitative, technologists / educators, academics / practitioners), consider the *full life-cycle of case studies*.

And for the rest of the talk (I)
(coherent with the proposal’s spirit ?)

- Suggest support for full cycle (*from design to evaluation*).
- Focus on all actors (*special attention to practitioners*).
- Survive technology changes, lack of standards, insufficient capacity of specific tools and developers (*search and integration of loosely-coupled tools and service orientation*).
- Find a compromise (*experience-patterns, planning-scripting, improvisation, monitoring, scaffolding-regulation*).
And for the rest of the talk (II)
(coherent with the proposal’s spirit ?)

- Suggest our *dream of CSCL* supported by patterns, services, ontologies, interaction analysis, mixed evaluation case studies and support of scripting, integration, flexibility, tailorability

- Contribute with all these reflections that come from a *multi(trans)-disciplinary team* of education and technology researchers and practitioners for more than 13 years (in a small-medium scale)

An overview of the proposal—“dream”
Not an easy proposal – “dream” ...

- **Learning Design Process (Participatory Design)**
  - Use Educators’ abstractions (but ... Technologists do not have educational knowledge!)
  - To produce computer interpretable artifacts (but ... Educators do not have technical knowledge!)

- **Design Enactment (Adaptability, Reusability, ...)**
  - Integration of (distributed) software “building blocks” (but what blocks? And how to integrate them?)

- **Monitoring - Evaluation – Regulation**
  - What and how? (E.g. only data collected from applications? And how to employ them?)

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So we “struggle” to work on ... (I)

- **Design Process**
  - Improve educ./tech. mutual understanding (TELL project framework and patterns)
  - Employ Authoring and Advising tools for scripting – planning oriented to educators (Collage and Bersatide)
  - Use “standard” languages to formalize designs and conciliate activity and data flows (IMS-LD, BPEL4WS)

- **Design Enactment**
  - Interpret formalized designs (Coppercore)
  - Support tailorability through grid service-oriented middleware and ontology-based tool search (Gridcole and Ontoolcole/Ontoolsearch)

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So we “struggle” to work on ... (II)

- **Monitoring - Evaluation – Regulation**
  - Propose mixed evaluation methods and support them computationally for improved efficiency (*Quest*, *Samsa*, *Iloca*)
  - Advocate for common computational representations for “interactions” and suggest Interaction-Aware architectures (*Common Format*, *Kaleidoscope*)
  - Study ways of regulating the learning process flexibly and appropriately for actors (*role-based framework*)

Collaborative Learning Flow Patterns (I)

- **Collection of**
  - Broadly accepted techniques repetitively used by CL practitioners (*best practices*) when structuring the flow of types of (*collaborative*) learning activities

- **Formalized as patterns (recurrent solutions to recurrent problems)**
  - What flow of activities is recommended from educational practice to promote desired objectives?
Collaborative Learning Flow Patterns (II)

- **Expected advantages**
  - Way of communicating Collaborative Learning expertise
  - Conceptual common ground among practitioners and developers
  - Promote software reuse: identification of reusable software tools
  - Intermediate step for computer-based formalization

A Collaborative Learning Flow (CLFP): Pyramid

<table>
<thead>
<tr>
<th>Facet</th>
<th>Explanation</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>CLFP name</td>
<td>Pyramid</td>
</tr>
<tr>
<td>Problem</td>
<td>To be solved</td>
<td>Complex</td>
</tr>
<tr>
<td>Context</td>
<td>Environment</td>
<td>Several participants – same problem</td>
</tr>
<tr>
<td>Solution</td>
<td>Collaboration structure</td>
<td>Gradual consensus</td>
</tr>
<tr>
<td>Actors</td>
<td>Participants</td>
<td>Teacher, learner, evaluator</td>
</tr>
<tr>
<td>Types of tasks</td>
<td>Performed by the actors</td>
<td>(Ej.) LEARNER ...</td>
</tr>
<tr>
<td>Educational objectives</td>
<td>Promote by the CL technique</td>
<td>To promote positive interdependence ...</td>
</tr>
<tr>
<td>Types of groups</td>
<td>Identified in the CL technique</td>
<td>Growing pyramid groups</td>
</tr>
</tbody>
</table>

Each individual participant studies the problem and proposes a solution. Groups of participants compare and discuss their proposals and, finally, propose a new shared solution. Those groups join in larger groups in order to generate new agreed proposals. At the end, all the participants must propose a final agreed solution.
A pattern language that "encloses" CLFPs

Collaborative Learning

Scripted Collaboration (11 de E-LEN report)

Pedagogical approaches

Roles and common CL mechanisms level

Collaborative Learning flow level

Structured discussion

Activity level

Asynchronous

Resource level

Jigsaw

CSCL scripting patterns

Debate PL (Goodyear, 2005)

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COLLAGE Authoring Tool

COLLAGE (COLlaborative LeArning desiGn Editor)

http://gsic.tel.uva.es/collage

(Graphic-based high-level specialized authoring tool for collaborative learning. Based on Reload. IMS-LD level A compliant)
Sample of Collage use (I)

- “CTM2” script (applied in the “Network Management” case study)
  - Optional undergraduate course on Network Management technologies

Teacher

I want to design a collaboration script that guides the students in the collaborative understanding of a complex long technical paper that can be divided into 3 different sections (3 versions of a network management protocol). I want the students to discuss and reach agreement on the main ideas of the paper...

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Sample of Collage use (II)

Selecting the CLFPs

- Reading information and examples

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Sample of Collage use (III)

Authoring a CLFP-based LD

- Combining the CLFPs

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Sample of Collage use (IV)

Authoring a CLFP-based LD

- Refining the CLFPs

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Collage evaluation

- Multicase study (Stake, 2005)

“Planet game” Case Study

ISSUE: Can we use Collage for creating a script representing a scenario proposed by a third-party?

“Collage workshops” Case Study

ISSUE: Does the design process implemented in Collage facilitate the reuse of CLFPs in the creation of particularized LD-represented CSCL scripts in a way that allows teachers to focus on the CSCL critical elements?

“Network Management” Case Study

ISSUE: Can we use Collage in real situations?

QUINTAIN: The proposed pattern-based design process for CSCL macro-scripts created with IMS LD

Gridcole: functionality

1. Provide IMS-LD unit of learning
2. Search for tools
3. Integrate tools
4. Perform scenario

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**Gridcole: Generic architecture**

- **Web Portal**
- **Security Manager**
- **Tools Searcher**
- **Database**
- **UoL Repository**
- **Learning Flow Engine**

**Gridcole: Sample of use**

- **Realización de benchmarks**
  
  - **Pregunta de la actividad**: 
  
  - **Opciones de respuesta**: 
  
  - **Resultados obtenidos**: 
    - **Fecha de ejecución**: 22/23/2111 CET 2020
    - **Ejecución exitosa**: Sí
    - **Nivel de dificultad**: Fácil
    - **Notas**: 

  - **Más información disponible en el enlace proporcionado**
Gridcole: Evaluation

- Prototype developed and tested
  - Use of stable and "standard" technologies (see convergence of Grid and Web services)

- Educational evaluation
  - Validation of its properties in 4 small-scale case studies (tailorability by educators, integration and execution of different types of tools)
  - Very positive subjective evaluation from participants (teachers and students)
  - Tests in medium-scale distance environments that involve multiple organizations

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A new look at “service search”

- Service-Oriented Tailorable Collaborative Learning Systems (SOTCLSs)
  - Services have to be searched

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Ontoolcole: An ontology for CSCL

- Simple, extensible model which considers
  - collaborative (or not ...) **tasks** (simple and composite)
  - performed by **actors** (persons, groups or systems) who play **roles**
  - that employ **tools**, 
  - need and produce **artifacts**

Ontoolsearch: Requirements

- **Educator-centric**
  - Reflect educator’s view of learning services
- **Search for CSCL tool capabilities**
  - Relevant for CSCL scenarios
- **Some sample queries**
  - *I want a TCP/IP simulator for a course on computer networks*
  - *I want a tool for the edition of a .doc formatted document by a group of four members*
  - *I want a tool to support asynchronous debates among twenty participants*
Query interface snapshot

Result interface and session history

- Result interface
  - Present retrieved tools to the user

- Session history interface
**Ontoolcole/Ontoolsearch**: Evaluation

- **Goal**: Assess with educators whether Ontoolcole/Ontoolsearch is better for the search of CSCL services than other existing systems
- **Method**: Formal comparison with a search system involving educators
  - Six predefined search tasks based on real educational settings
  - Control system: **Regain**
    - Representative information retrieval system based on keywords
- **Following a mixed methods approach**

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**Overview of the six search tasks**

- **Criteria**
  - Authenticity of search tasks
  - Focus on CSCL settings
  - Mix of open and close search tasks
- **Example**
  - "In a laboratory session involving students organized in groups, a shared whiteboard tool is required that allows a group of students to make annotations and drawings at the same time"
  - Target tools: DVDraw, Imagination Cubed, ipChart, wb
Realization and data sources

- 18 educators
- Telecom., CS, Philology, Maths
- Long exp. keyword-based searches
- Some exp. education tech.

Quantitative results

- **Retrieval performance is better with Ontoolsearch and is significantly different**
  - Mean difference = 0.17
  - Standard 95% confidence interval for difference = (0.08, 0.25)
  - \( p \)-value < 0.01 (highly significant)

- Special relevance of the **synonymy** problem in 4 search tasks
## Qualitative results (I)

<table>
<thead>
<tr>
<th>System</th>
<th>Finding</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regain</td>
<td><strong>Flexible and fast</strong></td>
<td>“I have more freedom to submit a question” [P5]</td>
</tr>
<tr>
<td></td>
<td></td>
<td>“You can begin very quickly” [P7]</td>
</tr>
<tr>
<td></td>
<td><strong>Conscious of the synonymy problem</strong></td>
<td>“It is difficult to find appropriate keywords. It always seems there are less tools than with Ontoolsearch” [P14]</td>
</tr>
<tr>
<td></td>
<td><strong>Requires revision of tool descriptions</strong></td>
<td>“It is necessary to read a tool description in order to assess its suitability” [P16]</td>
</tr>
<tr>
<td>Ontoolsearch</td>
<td><strong>Comprehensible conceptual model</strong></td>
<td>“The best is the structuring in tasks, the relationships among tools and using graphs for searching” [P9]</td>
</tr>
<tr>
<td></td>
<td><strong>Search guidance facilitates the search</strong></td>
<td>“Guidance makes easier to find what I search” [P14]</td>
</tr>
<tr>
<td></td>
<td><strong>Different paths for a search</strong></td>
<td>“There are multiple possible paths to perform a search. Very useful!” [P15]</td>
</tr>
</tbody>
</table>

## Qualitative results (II)

- **Usability of Ontoolsearch** [FINAL QUESTIONNAIRE, FOCUS]
  - Graphs considered adequate for searching
  - Good learnability and user satisfaction

- **Weakest points of Ontoolsearch**
  - Categorization not always intuitive
  - No feedback to users and lack of help

- **Other results** [FINAL QUESTIONNAIRE, FOCUS]
  - Perceived quality of retrieval performance (from 1 to 6)
    - 4.0 (Regain) vs. 5.3 (Ontoolsearch)
  - Considered appropriate for their real practice
Mixed evaluation method

- Context integration
- **Real Situations**
- Participants’ vision
- **New ways of interaction**
- Efficient and scalable processes
- Visualization systems
- Participatory aspects

A workflow view of the method

![Diagram of workflow with categories and analysis methods]

Phases:
- Preparation
- During the process
- Final phase

Data sources:
- Observ
- Discuss. Groups
- Questionnaires
- Automatic Data

Analysis Methods:
- Quantitative Analysis
- Qualitative Analysis
- SNA

Final phase:
- Face-face interaction
- After events
- Final

Category Schema
- Previous concepts (individual)
- After significant events
- Critics to projects
- Automatic Events
- Socio-metrics
Tools for the evaluation

But ...

- **What is the setup time?**
  - Need to learn and use several tools for authoring, search, evaluation ...
  - Need for infrastructure to design, enact, evaluate

- **Is Instructional Design adequate?**
  - (Over)-scripting damages teacher improvisation
  - (In)flexible (although tailorable) scripting does not take into account unexpected (but common) phenomena

- **Design tensions are always present**
Group Scribbles (I)

- Tool developed at SRI International (Center for Technology in Learning) and funded by NSF
- Joint further development, use and evaluation in Spain, Taiwan, Singapore, etc.
- Support for “disciplined improvisation” and “distributed coordination”
- Simple “physical” metaphor (Post-it)
- Lightweight, extensible infrastructure
- Almost “immediate” set-up

Group Scribbles (II)

![Image of Group Scribbles interface]

- Public Board
- Private Board
- Label Pad
- Scribble Pad
- Scribble Sheet
- Drawing Tools/Supplies
GroupScribbles (III)

And several case studies in Spain ...

Script based on Jigsaw and Pyramid CLFPS
And several case studies in Spain ...
And what can we finally suggest?

- **Scripted CSCL** is possible and useful in order to enable more effective interactions, although *(in)*flexible *(non)*fading *(over)*scripting can be scaring
- There is a strong design tension between **improvisation and scripting** but they may and can co-exist
- There is a lot of experience in designing teaching / learning activities, that can be exploited in terms of **design patterns**.
- Authentic **case studies** in different contexts may involving the principal actors (mainly teachers, but also technology designers or pedagogy people) may prove to be an essential element to elicitate design patterns
- A teacher and learner-centric approach requires the **creation of bridges** between approaches, worldviews, or research methods (engineers/social scientists, qualitative/quantitative, etc.) and hopefully employ **non-dogmatic** approaches

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And what can we finally suggest?

- There is a need to **take teachers into account within their real life**, and consider their abstractions and limitations (e.g. fear or limited time)
- Teachers need to **tailor** scripts according to their particular needs and produce flexible learning scripts
- **Search and integration of existing tools** offered by third-party providers allow for sustainable ICT use in education
- **Service orientation** can be the basis for such a sustainable approach, although **standards and domain frameworks** should converge
- Use of **shared knowledge** in terms of ontologies can aid semantic searches

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And what can we finally suggest?

- One can employ simple but motivating, extensible existing tools with a limited setup time, so that they can be integrated effectively in real “classes”
- And ...
- There is no recipe, even with this proposal
- And ...
- Be patient... The way is too long but challenging, since we have to be realists, i.e. look for the “utopia”

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