

# Design Patterns for Recording and Analyzing Usage in Learning Systems

**Agathe Merceron**  
**TFH Berlin, De**



# DPULS JEIRP partners

- **Leader**
  - Christophe Choquet, University Le Mans, FR
- **Steering committee**
  - Christophe Choquet, University Le Mans, FR
  - Agathe Merceron, TFH Berlin, DE (ESILV, FR)
  - Francesca Pozzi, ITD-CNR, IT
  - Feliza Verdejo, Uned, E
- **Consortium**
  - *University Le Mans, FR*
  - *Engineering School ESILV, FR*
  - *ITD-CNR, IT*
  - *Distance University Uned, E*
  - *AIDA - Paris, FR*
  - *University Grenoble, Fr*
  - *University Birmingham, UK*
  - *University Sofia, BU*
  - *Distance University Quebec, CA*

# Scope, aims and purpose

- Learning system (dedicated software or LMS or CSCL) for technology mediated activities.
- Emphasis on support for special participants: designers, teachers.
- Emphasis on which interactions to record, and on how to analyse them.
- Capitalize knowledge on tracking problems and solutions.
- Share this knowledge.

# Methodology

- Collection and initial structuring of experiences.
- Identification of recurrent tracking problems and solutions.
- Creating, Refining and Validating Design Patterns.

# Collection of Experiences

**View Pépite's diagnosis** Exercise n°16

◀ Previous question    Go to question...    Next question ▶    Close

---

**Exercise 16**

A conjurer is sure of himself while carrying out the following trick.  
 He says to a player: " Think of a number, add 8, multiply by 3, subtract 4, add the number you thought of, divide by 4, add 2 and subtract the number you first thought of: you have found 7. "  
 Say if this affirmation is true or false. Justify your answer.

**Lauren P.'s answer**      **Justification / calculations**

Vrai

$$\begin{aligned}
 &= [(x+8) \times 3 - 4 + x] / 4 + 2 - x \\
 &= (3x + 24 - 4 + x) / 4 + 2 - x \\
 &= 4x + 20 / 4 + 2 - x \\
 &= x + 5 + 2 - x
 \end{aligned}$$

**Diagnosis**

Treatments    Use of letters    **Algebraic calculation**    Conversion    Type of justification    Connaissances num.

- Correct use of transformation rules
- Weak technical mastery
- Incorrect use of transformation rules, but correct identification of the role of operators + and ×
- Unsuitable use of brackets leading to correct result
- Unsuitable use of brackets leading to incorrect result
- Use of identified transformation malrules
- Sign error during a calculation
- Incorrect identification of the role of operators + and ×
- The transformation rules used make expressions

**Construction Machine**    Combien ?    Exercises, With Error Checking    Preferences

5 cards out of 32 with 2 Hearts, 2 Spades

and pack, how many five-card hands is it possible to form with exactly 2 hearts and exactly 2 spades?

subsets with 5 elements taken in a 32 card pack

Help on Construction

Erase this Stage

1 elements verifying one property

is not in {Hearts, Spades}

Formula:  $C(n,p)$     n    p    Ok    Add Stage

**Drawings**

such that suit is Hearts :  $C(8,2)$

such that suit is Spades :  $C(8,2)$

such that suit is not in {Hearts, Spades} : ?

suppress selection    modify selection

Validate Construction

I am Done !!

**Logic Tutor**

Premise References	Line Number	Formula	Rule	Line References
{3}	0	$(A \vee (B \wedge C))$	Premise (P)	{}
{1}	1	$(A \rightarrow C)$	Premise (P)	{}
{2}	2	$\neg C$	Premise (P)	{}
{1, 2}	3	$\neg A$	Modus Tollens (M T)	{1, 2}
{3, 1, 2}	4	$(B \wedge C)$	Disjunctive Syllogism	{0, 3}
{3, 1, 2}	5	$(C \wedge B)$	And Commutation (And)	{4}
{3, 1, 2}	6	C	Simplification (Simp)	{5}
{3, 1, 2}	7	$(C \wedge \neg C)$	Conjunction (Conj)	{2, 6}

Premises: {0,1}    Formula: C    Rules: Inherent Proof (I.P.)    Line References: 2,3

Conclusion: C    Add Line

# Experiences → Recurrent problems and Solutions

- What do they all share?

View Pépite's diagnosis

Exercise n°16

Exercise 16

A conjurer is sure of himself while carrying out the following trick. He says to a player: "Think of a number, add 8, multiply by 3, subtract 4, add the number you thought of, divide by 4, add 2 and subtract the number you first thought of: you have found 7." Say if this affirmation is true or false. Justify your answer.

Lauren P.'s answer

Vrai

Justification / calculations

$$\begin{aligned} &= [(x+8) \times 3 - 4 + x] / 4 + 2 - x \\ &= (3x + 24 - 4 + x) / 4 + 2 - x \\ &= 4x + 20 / 4 + 2 - x \\ &= x + 5 + 2 - x \end{aligned}$$

Diagnosis

Treatments Use of letters Algebraic calculation Conversion Type of justification Connaissances num.

- Correct use of transformation rules
- Weak technical mastery
- Incorrect use of transformation rules, but correct identification of the role of operators + and ×
- Unsuitable use of brackets leading to incorrect result
- Unsuitable use of brackets leading to incorrect result
- Use of identified transformation malrules
- Sign error during a calculation
- Incorrect identification of the role of operators + and ×
- The transformation rules used make expressions

Logic Machine

Exercises, With Error Checking

5 cards out of 32 with 2 Hearts, 2 Spades and 1 card of another suit, how many five-card hands is it possible to form with exactly 2 hearts and exactly 2 spades?

Subsets with 5 elements taken in a 32 card pack

1 elements verifying one property is not in (Hearts, Spades)

Formula:  $C(n,p)$

such that suit is Hearts :  $C(8,2)$   
such that suit is Spades :  $C(8,2)$   
such that suit is not in (Hearts, Spades) : ?

Validate Construction

I am Done !!

Logic Tutor

Premise References	Line Number	Formula	Rule	Line References
(3)	0	$(A \vee (B \wedge C))$	Premise (P)	(1)
(1)	1	$(A \rightarrow C)$	Premise (P)	(1)
(2)	2	$\neg C$	Premise (P)	(1)
(1, 2)	3	$\neg A$	Modus Tollens (M T)	(1, 2)
(3, 1, 2)	4	$(B \wedge C)$	Disjunctive Syllogism	(0, 3)
(3, 1, 2)	5	$(C \wedge B)$	And Commutation (And)	(4)
(3, 1, 2)	6	$C$	Simplification (Simp)	(5)
(3, 1, 2)	7	$(C \vee \neg C)$	Conjunction (Conj)	(2, 6)

Premises: 0,1 Formula: C Rules: Inherent Proof (I.P.) Line References: 2,3

Conclusion: C

Add Line

Save Apple Window

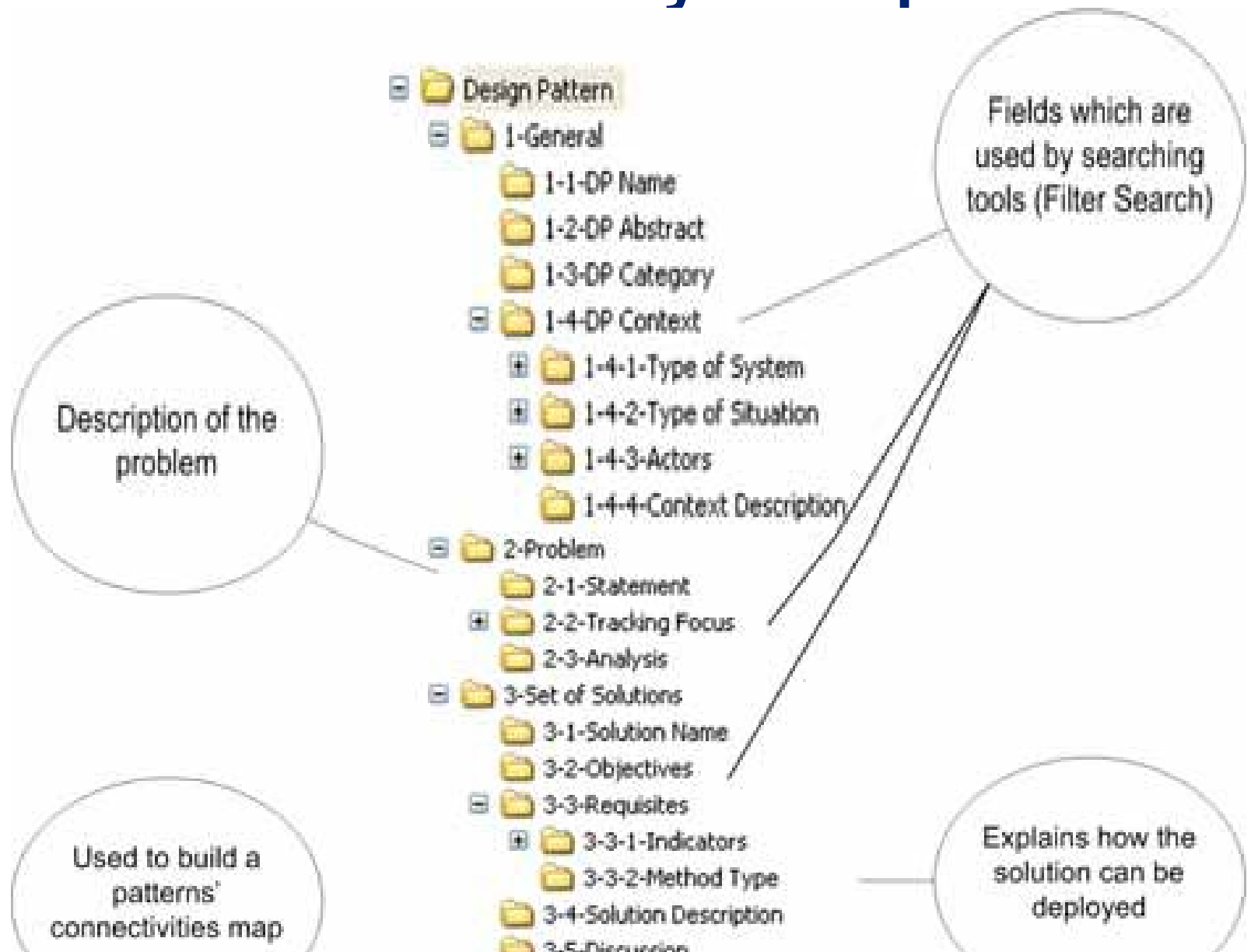
# Learners' Assessment - Scenario

• *Sarah is a teacher who organizes lab work for a group of students. She wants a report on the lab work session to check whether some know-how has been mastered and to get an insight on the kind of strategies the students have used. Her aim is to plan the next session and to adapt her teaching to her students' understanding. She **needs an overview on the students' activity** during the lab session.*

# Recurrent problems and solutions

- Definition of a common vocabulary able to describe tracking problems and solutions.
  - Identification of indicators.
  - Allows for search facilities through a Pattern Browser.
- Relationships between problems.

# Common Vocabulary - Snapshot



# DPs Structure

- Collaboration
- Learners' assessment
- Material Validation
- Tutoring/Regulation of Learning

# DPs: Learners' Assessment

- LA1 Multidimensional Analysis of a Learner's Solution to a single Exercise
  - LA1.1 Pattern matching to analyze the learner's solution
  - LA1.2 Specific software to analyze the learner's solution
  - LA1.3 Human assessor to check the automatic analysis of the learner's solution
- LA2 Overview on a learner's activity across a set of exercises
  - ....
- LA3 Overview of the activity of a group of learners on a single exercise
- LA4 Overview of the activity of a group of learners on a set of exercises



# Browser: Search View

The screenshot shows a web browser interface for a search application. At the top, there is a navigation bar with links for "Home", "Design Patterns", and "Search". A "Logout" link is located in the top right corner. A dropdown menu is open under the "Search" link, listing several search options: "My saved searches", "Template Search", "Query Search", "Filter Search", "Relationship Search", and "Plain Text Search". The "Template Search" option is currently selected. Below the dropdown, the main content area is titled "Step 1)". It contains a search form with the following fields: "Pattern Name:" (a text input field), "Abstract:" (a larger text input field), "Category:" (a dropdown menu with options: Course Usage, Collaboration, Assessment, Pedagogical, Administrative), "Type of system:" (a dropdown menu with options: Individual Learning System, CSCL, LMS, Individual Diagnosis System), and "Type of situation:" (a dropdown menu with options: Individual Learning, Classroom, Asynchronous Collaborative Learning, Synchronous Collaborative Learning, Problem Solving Activity). The word "Context" is positioned to the left of the "Type of system:" and "Type of situation:" labels.

# Main Outcomes and Achievements

- Organization and participation to the UALS workshop of AIED Conference 2005.
- Guest editors of a special issue of AACE-Journal of Interactive Learning and Research „Usage Analysis of Learning Systems“, issn1093-023x, Volume 18, Issue 2, April 2007.
- Guest editors of a special issue of the French-speaking review STICEF. To be published.
- Indexation of the Browser of design patterns for recording and analysing usage of learning systems in the open archive TeLearn
  - <http://telearn.noe-kaleidoscope.org>

