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Adaptive reflective processes using the IMS-LD specification

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The reflection amplifier "Rate your confidence degree"

In the **Dangerous Knowledge Tour** (see Fig. 1 and 2), the adaptive rules were: a) if the answer to the test question is wrong and if the confidence degree of the student in this answer is higher than 40%, the same content is presented again for re-reading, b) if the answer to the test question is wrong and if the confidence degree of the student in this answer is below 40%, the student is asked to justify this confidence degree before being presented the same content again for rereading, c) if the answer to the test question is right, the student gets the next content, whatever his confidence degree is.

Reflection affordances

The importance of reflection (and akin notions of meta-cognition or learning-to-learn skills) in learning situations is well attested in the literature. Meta-analysis or literature reviews repeatedly pinpoint reflective practice as a highly influential factor of learning, if not the most influential one. However, despite this alleged importance, current instruction shows a shortage of training for this generic skill both in regular classrooms and in eLearning settings. This dearth is all the more difficult to explain that reflective techniques do exist, as evidenced by our literature review and that teachers express an interest for these techniques, as shown by a study that we conducted. **The research work presented in this poster takes on this instructional deficit and offers a new range of reflection support tools called "REFLECTION AMPLIFIERS", viz. deliberate and well-considered prompting approaches that offer learners structured opportunities to examine and evaluate their own learning.**

Adaptive units of learning

The other concern of this work is for **ADAPTIVITY**, that is the possibility to tune the learning experience to the characteristics of learners (age, knowledge level, needs, objectives, preferences, styles, modalities, etc.) These **PERSONALISATION** processes are implemented with the IMS-LD **SPECIFICATION, LEVEL B**, via the IMS-LD authoring tool **RECOURSE**. The reflection amplifiers are therefore embedded in IMS-LD learning flow, either through a properties/conditions logics or as external reflective **WIDGETS** incorporated in the learning design. In all cases, they are due to induce regular, focused and compact tingling for evaluating ones own learning, in a permanent crisscrossing between cognitive and metacognitive landscapes.

First empirical results

The technical feasibility and the pedagogical relevance of this approach to reflection were tested with a first **CONTROLLED EXPERIMENT** conducted with 54 test persons. Four major findings emerged: 1) in a quasi formal learning context, reflection amplifiers could be implemented as widgets with success and were used as requested, 2) their use induced the feeling of an higher intensity of reflection, 3) they did not enhance exam performance, 4) despite this lack of effect on performance, a fair proportion of participants qualified them as contributors to learning.

The **"DANGEROUS KNOWLEDGE TOUR"** and the **"5 WEB USABILITY PRINCIPLES"** are **two up-and-running distance courses** that cumulate two novelties. On the one hand, the adaptive processes were modelled with the IMS-LD authoring tool Recourse at level B. On the other hand, it provides the first example of an adaptive sequencing based on a combination of cognitive and metacognitive formative tests.

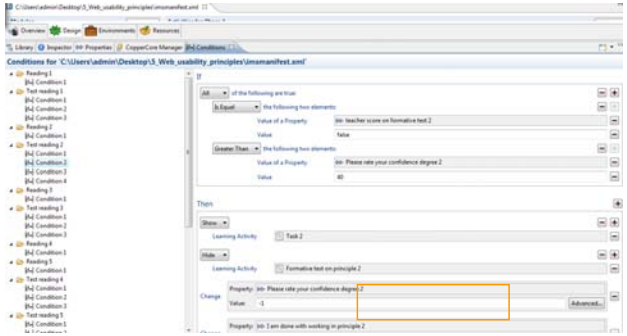

Figure 1. CONFIDENCE DEGREES given by students enact adaptive rules defined through properties and conditions logics available in the **RECOURSE** authoring tool.

Figure 2. The distance course "5 Web usability principles" offers offers a reflection amplifiers based on an external Skype **WIDGET**.

Figure 2. The next step will try out a third method to embed a third type of reflection amplifiers in an IMS-LD unit of learning: the use of the Widget Server **WOOKIE**.

Reflection patterns in IMS-LD

In more detail, the IMS-LD specification supports a multitude of reactive (or responsive) interaction components, that are used for Learning, making use of aforementioned paradigms. To bring reflection amplifiers and adaptive elements to meaningful use it is necessary to implement them in a contextualized manner. Should the context warrant for example for a learning game to be the best choice (which usually has the most complex requirements with respect to responsiveness), individual elements can be translated into **GAME DESIGN PATTERNS** that are used to implement the element.

Classically, IMS-LD with its approach for Level B to incorporate **first order quantified propositional logic expressions**, makes it possible to trigger events after certain conditions hold. For example: a user gave the correct answer 3 times. That can be rewarded by a score increase or additional clues how to proceed. Suddenly, before even knowing, we are using 3 different patterns that are very frequently used for game design: reward, clues, score. All of these can be interpreted as reflection amplifiers relevant for performance self-assessment. We therefore hypothesize that **game design patterns can indeed be very relevant for reflective learning**.

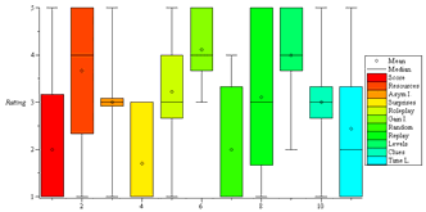

Figure 3. Results diagramme of the use of individual game design patterns for learning in general (the rating was done by 10 experts)

Using data from an earlier study we found some evidence for the usefulness of game design patterns for reflective learning functions. In that study we had asked **10 experts** from our research domain and presented them a choice of game design patterns that are typically used in learning games. We asked them to rate each of the patterns on a Likert-scale (where 5 was "best"), according how well they may support one out of 22 "learning functions". Although the result can be interpreted with some reservation as only one learning function on average reached the value 4 out of 5, a positive observation is that 18 out of 22 learning functions had at least one game design pattern scoring higher than 4. This means that the great majority of learning functions are supported by specific game design patterns. Taking another interpreting look for our purpose here, the relevance for some of the more **AWARENESS-RELATED LEARNING FUNCTIONS** is obvious.

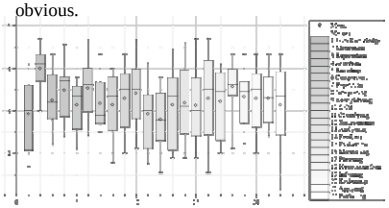

Figure 4. Results diagramme of the usefulness of the set of game design patterns in figure 3 for individual learning functions. (the rating was done by 10 experts)

For further information

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