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# **A methodological proposal to design a trace-based system to qualify cognitive features inscribed in digital learning resources**

Françoise Greffier, Federico Tajariol

Objets et Usages Numériques Research Team,  
ELLIADD Laboratory,  
University of Franche-Comté

francoise.greffier, federico.tajariol@univ-fcomte.fr

**Abstract.** To reuse existing digital learning resources, a teacher has to perform a complex and creative in order to adapt them to the students' needs and fit their cognitive abilities. Nevertheless, metadata do not generally describe the cognitive facets of a digital learning resource. We give here a partial account of a trace-based system in its current state of development to index digital learning resources according to the metadata describing their 'cognitive features'. By 'cognitive feature' we mean the cognitive activities (e.g., reading, listening, body interactions, etc.) associated with different message formats (e.g., text, audio, interactive animations, etc.).

**Keywords.** trace-based system, cognitive styles, indexation of digital learning resources.

## **1 Introduction**

Information and Communication Technologies for Education (ICTE) allow teachers to enrich the content of a Digital Learning Resource (DLR) with different formats: a text, an audio file, an image, an interactive animation, etc. So, for example, someone who is asked to read a text uses different abilities and skills than when (s)he observes a diagram illustrating the same content, and, because of his(her) cognitive style [1], (s)he better understands through the former cognitive activity than by the latter. In this way, the ICTE enable the personalization of the learning experience [2] [3]. When he works with DLR, a teacher runs into difficulties because of the scarcity of details about the cognitive features of a DLR. To tackle this problem, we seek to a) define metadata to describe the cognitive features associated with the presentation format of a DLR, b) realize a trace-based system (TBS) which enables to establish the metadata and to carry out a system to index the DLR.

## **2 The System to Index the Dlr (SID)**

In order to approach the cognitive side of a DLR, we use the Multiple Intelligence (MI) Theory [4], which has been successfully applied to the design of TEL

environments [5]. According to the MI theory, the set of intelligence of a person is a set of abilities and skills (s)he develops to solve problems and process information. The MI theory suggests different sets of intelligence (e.g., kinaesthetic, linguistic, logical-mathematical, musical, visuo-spatial). These sets are related to specific semiotic components. For example, a person who has a visuo-spatial intelligence is able to better think through semiotic components such as visual elements (e.g., images, graphs, cards, colours, etc.) and structures (e.g., patterns, diagrams, etc.) rather than speeches (linguistic intelligence).

Our proposal, called SID, is a trace-based system (TBS) we built on a *collecting observed elements*, and a *transformation of them* [6].

First, the SID works as a parser to collecting observed elements . The ontologies describe the modelling of descriptors (observed elements) of the forms of intelligence : semiotics components. The parser receives a DLR as input (e.g., a file such as a .ppt, .pdf, .doc) on which the parser locates and counts the semiotic components of a DLR.. The parser, developed under Java 1.7.0\_11, uses some API such as itext (for PDF format) or poi apache, which includes some methods used to get back text, recognize picturesí Some algorithms are developed, for example to distinguish a photography of a diagram, counting rates of colours in the whole of pixels.

Second, the SID performs previous countingø transformations, to create indicators (ex : percentages of sentences) used to measure the part of different sets of intelligence inscribed on the DLR. Finally SBT will determine metadata, to let know cognitive styles of DLR.

Then, a tool for automatic indexing will be added to the TBS. In fact, in spite of some ontology-based image system [7] and some metadata granularity broad (e.g., the standard LOM allows the description of « image, fixed image and animated image »), we observed that the DLRs are seldom indexed in general.

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