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# CULTURAL AND EDUCATIONAL MEDIATION MEETS MULTIMEDIA-BASED ADAPTIVE STORYTELLING: A PROFILE-SENSITIVE SYSTEM FOR PERSONALIZED PRESENTATIONS

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## ABSTRACT

The paper highlights the reasons for implementation and the functions of a system that proposes advanced facilities for setting up adapted storytelling-based presentations. Educational and cultural mediations are privileged but not exclusive. In the first part we propose a quick review of the state-of-the-art concerning the storytelling shift in ICT research and development; we discuss, specifically, its power to render interpretation strategies salient, promote reading and, hopefully, understanding. In the second part we briefly describe the most innovative functionalities of the system both in constructing and visualizing presentations. We particularly focus on: i. the creation of the presentation fulcrum, ii. the construction of a presentation, iii. the implementation of an “intelligent” module that offers contextualized assistance, able to expand and adapt a presentation to different reception expectations and iv. the indexing/research module. We finish with a brief discussion about some evaluation results and conclude with the contributions of the presented approach.

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**KEYWORDS:** storytelling, adapted presentation system, educational and cultural mediation, grain, grain composition, points of view, depth levels, rhetoric variants, narrative functions.

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## 1. INTRODUCTION: STORYTELLING AS A GROUND AND AS AN OBJECTIVE

In this paper we present the advanced stage of a project, initially introduced at VAMCT 2013 (Kanellos & al., 2014). The aim of this project is to set up a system able to support customized mediations which are essentially cultural and educational. Such mediations take the form of enriched storytelling-based presentations. Telling stories about a subject (a theme, a situation, a fact, an artwork...) seems nowadays a kernel issue, in so far as storytelling seems to be critical – if not already decisive – in responding to human learning and/or social and/or communicative needs. Numerous reasons sustain, both the educational and cultural interest of a system able to assist users in constructing, adapting and sharing stories (among many others: cf. Cavazza & Pizzi, 2006, for a comprehensive critical review; or Bryan, 2011, that proposes an extended survey of the ways of storytelling using digital technologies, even through social media, blogging and gaming). Storytelling seems, indeed, crucial for knowledge, important for motivation and, more generally, strategic for transmission of knowledge and culture.

Stories remain an essential form for knowledge encapsulation, despite their “upcoming end”, already announced by some – still resistant – (post-) structuralist thinkers. For instance, the semiotic approach of (Barthes, 1984, pp. 63-69) augurs “the death of the author”, while the post-structuralist (Lyotard, 1979), criticising modernity, argues even about the end of “meta-narratives”. Nevertheless, the announced end of stories is not a fact: we all still need to produce and to consume myths – and even to believe in myths. Perhaps because the human cognition, and probably individual and collective subconscious, are structured as a discourse. It is nowadays admitted that we are tightly established within an economy of stories, which guarantees that we remain human (Citati, 1999, pp. 8-14). It would even be possible to understand humans as “narratives”: our living experience, our relationships with others, our rationality or memory, all mostly take the form of (or are frequently supported by) some story. This ability to relate and to tell, to discover and to learn through stories, which is a genuine “myth-making function”, seems, for (Molino & Lafhail-Molino, 2003), to be a fundamental factor in the development of the human being. Much earlier, the neurologist (Sacks, 1985) noted that a man needs a continuous narrative, and even an inner narrative, in order to maintain his identity. (Dennet, 1988) even proposed to understand storytelling ability as “an above all matter of conscience”, insofar as being aware means having the power to tell stories. For (Jacob 2011), the story is part of the human cognition,

playing a similar role to Chomsky’s language conception (i.e. a constitutional human part, like an organ): “the narrative system” is equally important as the digestive or respiratory system, he claims; it has the ability to furnish both storytelling competence and performance. Telling a story is not only telling something: it is always “telling something fulfilling the requirements of a horizon of expectations”. This is perhaps the real foundation of any “narrative human contract” (Ricoeur, 1991). Storytelling could thus be seen as a modality of mediation that introduces a communication pact. Its goal is to allow people to seize a subject (an object, a theme...) symbolically. Through this narrative pact, the auditor (or reader, or spectator...) should better (at least, more easily) grasp the meaning gap, access personal appropriations and sharing schemata and, presumably, sustain memory. In fewer words, building, receiving and telling stories proves a knowledge system in action, dealing with oneself, others and the world.

In an ICT era like our own, digital documents maintain the “narrative pact”. Indeed, regardless of their form and use, digital documents still ensure meaning functions with same narrative goals. Digital stories bring only new narrative opportunities, demonstrating better narrative multiplicity. For instance, they allow users to generate alternative stories through repeated interactions. Thus, the story seems more personal, more intimate; but the digital document still remains a meaning-vehicle, whose deployment possibilities are upstream given by its creator (Bryan, 2011).

Narratology studies make clearer such “narrative stability”, which globally conserves interpretative principles (Cavazza & Pizzi, 2006). Does that mean that there are some invariants regulating human narrative activity? The answer is not trivial. The issue of “universals of narrative” has been the subject of intensive research for many decades. The pioneering works of (Propp, 1970) are certainly emblematic. They analyze the concept of “narrative function” where one can recognize some of the basic elements in systematization of any storytelling construction. Applied to the case of fairy tales, in Propp’s studies, this concept can easily be generalised. Such a function is “the action of a character, defined in terms of its significance in the unfolding of the plot”. Called also “ground” or “element”, this character’s function is the “fundamental part of the tale” or, better, the “elementary link” in the building of a plot (or a scenario). Adaptation is directly concerned, inasmuch as, through this link, Propp studies some perhaps universal laws of narrative interchangeability. Indeed, he observes that the characteristic of tales is that the narrative components are movable to other stories. Moreover, even if the succession of funda-

mental functions is generally the same, the absence of some of them does not imbalance the basic structure of the plot; nor modify the arrangement of other functions.

The consequences of these observations are major. They allow to better understand narrative adaptations. In fact: firstly, all functions are not mandatory for how the story works and makes sense; secondly, a function can be removed (in order, for instance, to be embedded into another story). Very soon (Bremond, 1973), criticized this conception; he argued that the story is not a “fixed sequence of functions”, as Propp suggests, but rather a “logic of possible narratives”. The latter are put forward by the different bifurcations of the story. The criticism of Bremond makes clearer the adaptation potentiality of the notion of “narrative function”.

In any case, these principles do not seem damaged by the arrival of the digital era. Stories co-evolved with human “episteme and techné” (Hayles, 2012), retaining their basic characteristics. They even receive, somehow, an operational context, offered by the interactive possibilities of digital documents. These ideas resume the theoretical basis for the development of the system we propose—a system that targets adaptive storytelling-based presentations. Despite the limitations of the Propp conception of narratives, recently outlined by the contribution of (Tomaszewski & Binsted, 2007) for digital developments, a function-based system has precious benefits and utilities as far as narrative generation is concerned (Sjöström, 2013). In a digital context, storytelling may recover dynamic structures, able to evolve according to continuous rectifications that adapt them to a given communication pact even more, through interactive procedures (Wand, 2002).

## 2. MODELLING THE STORYTELLING PROCESS

These last remarks had important design implications for the system we developed. Indeed, from these two theoretical perspectives (Propp and Bremond, *op. cit.*) and the derived criticisms (Cavazza & Pizzi, Sjöström, Hayles, Tomaszewski & Brinstead, *op. cit.*) we retained the importance of possible exchanges and arrangements of narrative functions. Such functions may uniformly be assumed by digital documents (resources) that do reify a narrative link (the “grains”; cf. below). They are set up and organized in the context of a narrative strategy pursued for some type of mediation (establishing a “narrative contract” with a reader, either imagined or effectively concluded). On the other hand, it does not seem aberrant to consider that any subject (object, theme, artwork...) can be envisaged as a narration (or can be accompanied by a narration), insofar as it comes al-

ways with “a narrative charge”. Such a charge deals with numerous contexts and, therefore, associated representations and interpretations. In the case of educational and cultural mediation, a system of narrative construction should therefore work as a promoter of a (re)presentation and interpretation economy. This is done via three steps:

A. *Formally*, our modelling goal was to build a system facilitating intervention on the narrative structure of a story (to build or already built up). In the framework of interpretive semantics, the idea is to promote cues able to catalyze reading (and furthermore, interpretation) paths. The narrator/mediator needs, generally, to have means to freely propose non-linear and dynamically reconfigured stories for her/his audience. For instance, she/he must have the opportunity to insist on a detail, to highlight a concept, to emphasize some parts of the story, etc. This is precisely realized by selecting resources that will assume the role of the narrative functions. But the mediation addressee may also wish to participate in the narrative process in specified contexts (cooperative scenarios, flipped classes, active pedagogy, enacted culture, etc. (Aarseth, 2005)). Thus, she/he must also be able to combine narrative functions proposed by the narrator/mediator i.e. to adapt the presentation of the selected material to her/his conception of the optimal progression of the story.

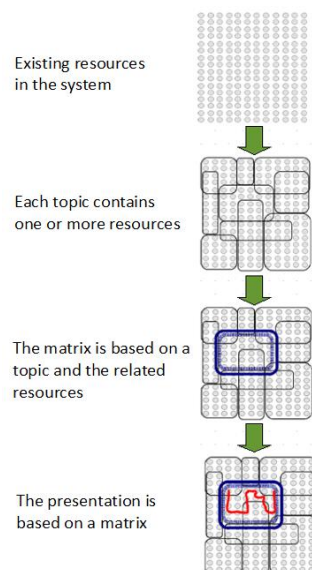
B. *Practically*, looking for means strengthening the narrative evidence, 2D/3D granular video units had been prioritized. Although fundamental, 2D/3D videos are not exclusive: multimedia resources of different formats (images, texts, sound recordings, etc.) should also be considered, under various combinations with videos, as elements supporting narrative functions. In the system, they all have to be dealt with uniformly. On the other hand, the scope of possibilities should virtually be unlimited: such presentations may be set up for almost any topic (whether it is artistic, scientific, technical or even commercial).

C. *Functionally*, two core scenarios have to be distinguished. They both derive from two main user categories likely to use the system: i. the mediation tutor (who sets up a mediation strategy or proposal; typically, a curator, a professor, etc.) and ii. the mediation addressee (an individual or a group who takes advantage of the mediation activity, by receiving what the mediation tutor proposes; typically, visitors, spectators, students, etc.).

### 2.1. The matrix of grains: the cornerstone of the presentation variety

As we already mentioned it, the system is based on the elementary concept of “grain”, which stands as the fundamental mediation-oriented unit. The

grain is, somehow, the element which updates a narrative function. Technically speaking, the grain takes on some characteristics of Learning Objects (Friesen, 2005; Leslie, 2005). Cornerstone of the intended storytelling, a grain presents i. an indivisible narrative autonomy and ii. a stated educational and mediation purpose, in the sense of (McGreal, 2004). It is actually the smallest content that can be found in a database of resources, available for any user in the role of a presentation creator. It is a reusable unit, interchangeable, manageable, depending on user's presentation target (Polsani, 2003). It is a "narrative elementum", but not atomic (a part of a grain may be used, elsewhere, as a grain as well), with compositional capacity. A resource is not necessarily a grain: what achieves the grain essence is its implication in a narrative intention. Thus, grains can be reshaped and assembled in many ways, almost endlessly. Moreover, they may be used to maximize user involvement and motivation (Smith & Nash, 2005). However, the system invites to focus on the customization of these grains by offering specific benchmarks for organizing the whole content. By the combination of grains the system allows the construction of a compositional narrative structure, which supports various mediation rhetorics.



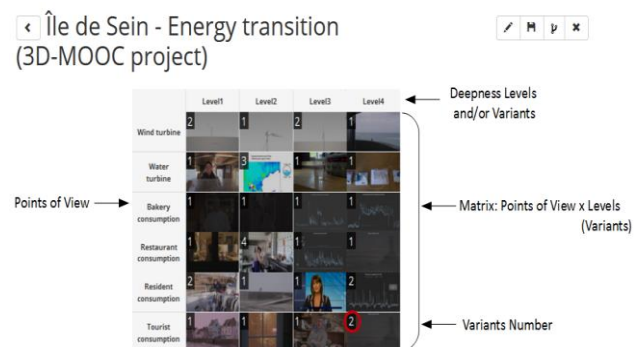
**Figure 1: The structural succession: resources (grains), topics, matrix and presentations. Resources are gradually organized according to the themes they belong to. For a theme, one can construct one or more matrix (i.e. templates), that represent the basis of the presentations to be created later. A matrix supports several narrative routes (and thus, presentations).**

The system, which is principally an authoring tool, allows the reuse of grains in the creation of different presentations. This is done in two steps:

Firstly, the mediator-user constructs a "matrix of grains", containing:

- a list of *points of view* (each point of view proposes an (ontologically) different analysis of the topic engaged in the grain);
- a list of *depth levels* (levels allow the gradual discovery of the proposed subject, depending on the degree of difficulty or refinement of grain's content);
- a list of *rhetoric variations* (grains may have the same coordinates "point of view/depth level" in a matrix; but still propose different ways of dealing and/or presenting the same point).

Technically, the matrix represents the repository containing rich pedagogical resources that are defined by a defined mediation or learning intention, in the sense of (Bradeley & Boyle, 2004). This matrix stands as the operational corpus of grains on which a particular presentation will be downstream built up. It is the critical part of the back-office of the system, as far as the creation is concerned. It is a working space or a "reading guide", likely to support a variety of presentations; i.e., it gives ground to various storytellings about the chosen subject. Defined by the designer of the presentation, it is also an interpretive framework, exploitable for one or more interpretations. His/her mediation intention determines the content of this workspace, in relation to the addressed domain and a public.



**Figure 2: Matrix setting up. Numbers in cells indicate how many grains are included in each.**

The system supports an arbitrary number of such matrices (for every subject). Indeed, it is possible to define as many points of view and/or depth levels as one wishes.

Firstly, in each cell of such a matrix, the mediator-user (actually, the designer of a presentation) slips one or even more "grains" (video clips, sound recordings, images or texts) that are upstream indexed by type, name and domain. When the matrix is completed, it enables the creation of a set of presentations by choosing a series of such grains. Thus, the presentations are freely tuned according to different profiles, cognitive requirements, reception capacity and learning or cultural objectives.

Secondly, the mediator-user specifies what the final presentation will be. The presentation is the privileged place to realise an adapted interpretive act. By combining the resources picked up from the matrix in a linear order, she/he can create multimedia playing lists supporting (or even replacing) (dis)courses.

## 2.2. Setting up a (guided, semi-guided or free) presentation

Each presentation draws on the grains in the matrix defined (positively, it is a selection of grains over this matrix). The user chooses the grains of interest for her/his public and sets up incrementally the presentation she/he wishes (possibly readjusting their order). The process is similar to a composition of a narrative. Moreover, she/he can import original resources (not already existing in the library of the system) and integrate them in her/his presentation. She/He can even create and share her/his work in a purpose-built space, common with other users.

When creating a presentation for an audience, it is possible to propose a double reading list: a main presentation (let us say, containing basic, mandatory knowledge that has to be firstly transmitted and appropriated), and a suggested presentation (containing enhancements, or alternative routes to undertake in order to deepen the initial part).

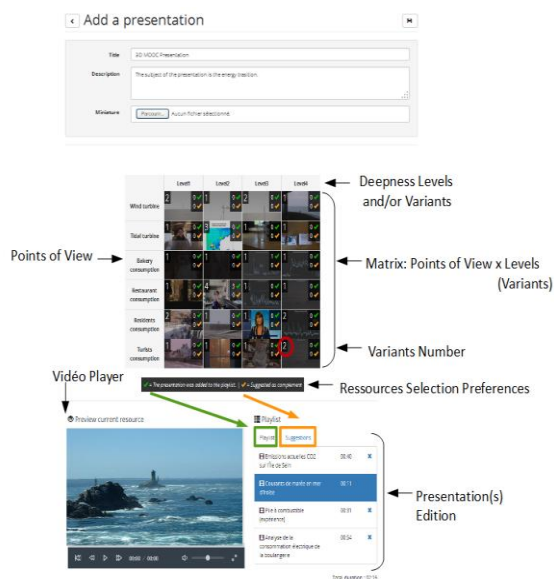


Figure 3: The creation of a double reading list is based on the combinatorial capacity of the grains contained in the matrix. Each list contains at least one possible story.

The mediation addressee (i.e. the presentation recipient) is not reduced to some passive spectator. Digital storytelling gives many opportunities to users not only to be good listeners/readers/spectators, but also (and perhaps mainly) receptive and/or reactive narrators. Indeed, the need of active participation inverts the traditional transmission schemata

into symmetric interactions; the public may wish some other version of the narration; it may also wish to build up its own conception of the story (Wand, *op. cit.*). Precisely, an *ad hoc* completion algorithm is implemented allowing the listener, reader, spectator, etc. to refine or extend an initial presentation adjusting it to her/his needs or to the story that she/he wants to receive. Such complements are not structured in a linear sequence, from beginning to the end, but they are generated contextually, on the basis of what such a user has already viewed. This approach is based on a computational perspective, in the sense of (Koenitz & al., 2015). The purpose is clearly to provide a rational support giving the opportunity to any addressee to choose between branching alternatives of the story, and to complete actively, gradually and consistently her/his reading path. As (Aarseth, 2005) notices, the major challenge of this multi-path narrative is to point out the aspects that a public could miss during the presentation, by redirecting its attention and interest towards these aspects. Also, to help public to target, accurately and rather quickly, the contents considered as relevant (or simply, interesting).

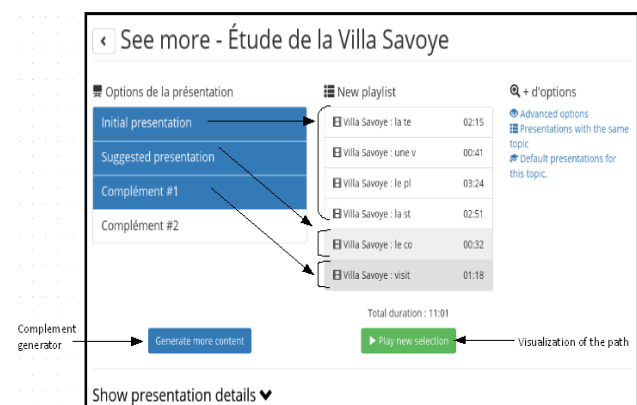


Figure 4: Choosing the preferential route. The recommendation system offers several supplements, in addition to the initial presentations (mandatory and suggested). At each click, a new supplement is proposed, extending the play-list. It is made up from grains that complement (refine or extend) the already viewed grains.

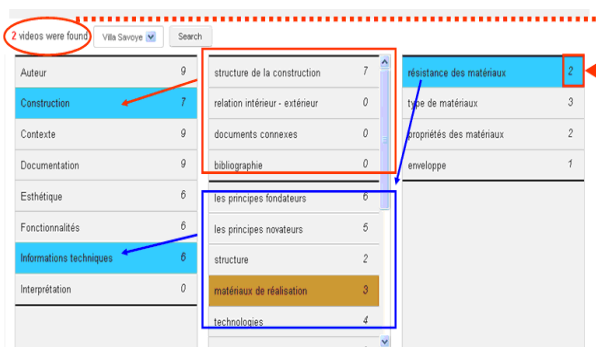
## 2.3. Indexing and (multi-criteria) research solutions

Clearly, any user must have the possibility to seek grains through the library. Among the various approaches to knowledge organization reviewed in (Hjørland, 2008), we followed the one that guides users in accessing content in a knowledge-guided way, in the sense of (Boyce & Pahl, 2007). In order to achieve this objective, the system provides an internal search module, designed so that it can establish a tight correspondence between the user search needs and the internal organization of knowledge (local

ontologies corresponding to the considered points of view) so that her/his search is fully optimized. The user has not to have a precise idea about the knowledge structure: the system leads her/him to discover, gradually, the concept hierarchy.

As the conceptual space is normed and generally restricted, as performance is required and the quality of responses stabilized, as, finally, there is no need of reasoning, ontologies are of a simple hierarchical form; they are directly implemented following a data base conception (we explain more the reasons of such a choice in (Kanellos & al. 2014)). The whole system is rooted in a such specific knowledge structure; a dedicated interface allows the user to build more intelligent access within grains libraries making it possible to move freely from the ontological space to the content space. These design ideas join the requirements of (Qin & Finneran, 2002) and (Staab & Studer, 2009), between others.

To such a purpose, a specific module allows the creation and the edition of the knowledge structures concerning a grain (or a class of grains). This module allows the definition of attributes and relationships between elements of the structure.



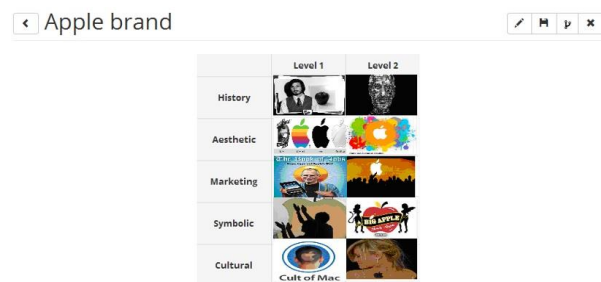
**Figure 5: Multi-criteria search.** To perform a multiple research (the example taken concerns Villa Savoie, a modern French architectural monument), the user can simultaneously select two or more points of view and one or more categories and sub-categories of these points of view. The visual representation illustrates the order of the choices made. Here, two videos were found using such a multi-criteria search.

Being the basis of the indexing procedure, these knowledge structures give grounds to the search module. Generally, each resource is indexed by type (video, text, audio and image), by name, through a textual description and a set of conceptual categories and subcategories. Levels of refinement and rhetoric variants are voluntarily left outside the indexing process as far as they are context-sensible and depend on mediation conditions. This fortifies the internal consistency of the system and promotes its adaptability, in terms of architecture, layout and content.

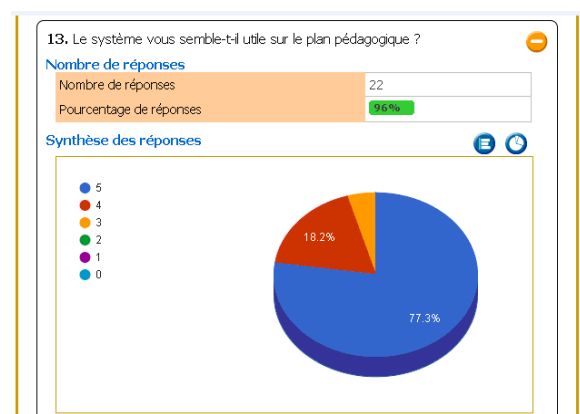
In the current development phase, the library contains resources from several fields: architecture, painting, geology and environment. The application examples that we present here concern i. a scientific and a cultural mediation, addressing presentations for courses on energy transition and ii. a fine arts case, the *Judith and Holofernes* theme. Given the difficulty of access to the meaning wealth and complexity implied in each, these subjects lend themselves well to an individual and intelligent assistance exemplifying the interpretive power of the system.

### 3. EVALUATION

We had to evaluate: i.e the interpretative argument (that gives evidence to our approach), ii. the project goal (in stimulating users' motivation and in fostering their interpretative skills during a study, an observation or an exploration of a work, an object or a theme), iii. the effectiveness of interactive digital story structure (that opens toward mediation and understanding), iv. the generality of the system (the kind of rationalization the system offers providing benchmarks for the organization of knowledge and the progress in reading and interpreting) and v. the ergonomics of the system.



**Figure 6: Matrix on the Apple brand.** Example of system uses for marketing purposes (design: Isabelle Thiébau; HST master of the UBO, 2015).



**Figure 7: Analysis of the results reveals that the proposed environment is perceived as useful (4/5 for 18,2%) or very useful (5/5 for 77,3%) in different pedagogical contexts.**

It is what it was shown through 4 successive and independent evaluations. The two initial were done

in a school environment (secondary school and high school); the evaluators were professors and evaluated essentially the pedagogical interest of the system. Their critiques allowed us to enhance the initial functionalities of the system and upgrade it for larger uses.

The third one has done in the university, in a class of Master in Cultural, Scientific and Technical Mediation. Through this evaluation we tried to circumscribe the application limits of the approach. Students were asked to apply the system to any domain and theme they wished (they chose topics related to history, painting, advertising, photography, etc.). They all found the system quite practical and applicable to a mediation intention.

Finally, a more technical evaluation has been made, concerning the functional, ergonomic parts of the system. It has been performed in an academic institution, with 23 persons (students and/or professors). They had to effectively use the system in creating a presentation and answer to 28 questions of a MCQs test.

For instance, some questions were about the usability of the system (Q9: "Are the system functionalities helpful?"); other about the educational applicability (Q16: "Can the system support different educational paradigms, such as flipped classrooms, MOOCs, Lecture, etc.?"); and others referred to its social acceptability (Q22: "Do you think the system is socially acceptable, for teachers, mediators, students, parents, etc.?"). The answers we obtained gave a positive (4/5) or very positive (5/5) apprecia-

tion for almost all questions (with scores varying from 75 to 95%).

#### 4. CONCLUSION

The first evaluation results seem to indicate that, thanks to its flexibility, the system allows ease and efficient combination and interchangeability of "narrative grains". It thus facilitates mediation potential of digital stories, in accordance of what is required in (Rossiter & Garcia, 2010). In the educational field, the testers point out i. its ability to guide the consulting of resources and ii. its capacity to boost attention and participation, as well as its entertainment value. These last points join the demands described in (Wand, *op. cit.*). Moreover, it is reported that, by supporting adapted presentations (exhibitions, lectures, courses...) the system allows the users to develop a range of literacy skills, which joins some of the specifications of (Robin, 2011). The evaluations show that it is able to effectively supervise the observation, study, deepening, etc. of the targeted themes. For a studied theme, it also gives rise of a systematic aspect, making it appear more accessible. As such, it can be used both in a school setting (primary, college, high school or university) and in a broader cultural context, such as museums, libraries or any cultural institution that has to operate mediations intended for target populations. It can also be used as an adaptive extension for SPOCs (Small Private Online Courses) and even for MOOCs, upgrading them to 2.0 forms, i.e. rendering them able to integrate reusable social contributions, balancing the roles of tutor and student.

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