

# On supporting nature-inspired modeling to optimize production of WBTs via a Human Mind Mapping

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## 1 Moulinette as a Human Mind Mapping environment for NIM

**Motivation:** As technology improves, the number of teachers (at schools, universities or in companies as well) using Web Based Training (WBT) is growing. Every day they have new and enhanced ways to meet their students’ needs. The nature is an immense source of inspiration to explain and to solve complex problems in WBT (individualization, optimization, etc). Unfortunately, Nature-Inspired Modeling (NIM), when used in an innovation of WBT productions, imposes new requirements and constraints. It requires great thought and concentration, takes much time and demands a multitude of skills, in particular technical skills. The challenge is that the teacher is an educator and a domain expert first; but not trained in required technical skills (web authoring, media creation, etc.). Hence, on getting things done in this case, semantic and didactic features of NIM risk to be diluted during WBT development due to the focus of the teacher on technical tasks and losing focus elsewhere. The purpose of this study is to present a methodology and a cognitively inspired environment (called Moulinette) that was conceived and implemented to support adequately innovative production of WBTs, particularly those based on NIM. In this work, we focus on two perspectives. First, we claim a collaborative production as a way to meet teachers’ skills for an optimized WBT production. Secondly, we point out the need of new process that imitates the teachers’ thinking from a macroscopic view (called Macro Design) in order to extend the existing way of content design by supporting teachers also in expliciting their intentions and design with respect to the desired NIM. As requirements, first the proposed approach should not impose a certain pedagogical model for the teacher to avoid any semantic mismatches between teachers’ intentions and their model mapping. Furthermore, guidelines are needed to determine how the teacher should express his NIM and supervise the whole production process [1].

**Building Blocks:** Many approaches were purposed to support the WBT production by tools but few suppose that this production is done in a collaborative way and fail usually to support NIM as stated in the previous section [1]. So, we postulate a phase in addition to content modelling, authoring and media creation that should be fully taken into account. This phase covers teacher’s ideas about what kind of WBT to produce and which a NIM to use (Figure 1). We found that teacher defines implicitly cognitive boundaries of main concepts of his WBT and semantic relations among these concepts. For example, NIM as a way of conceptualization is done in the mind of the teacher only. He could explain his ideas by speech or writing it down so far. Tool support starts in the content modeling phase nowadays [1]. Such modeling is done using the Table Of Content paradigm that is a very simplified model and could be used in content authoring only; but not to enhance sufficiently the expressiveness of NIM during WBT production. To do so, we have built an environment to support the *Macro Design* and to represent the proposed NIM without any overhead for the teacher. This environment is innovative and helpful in our case. First, it extends the existing way of content design by supporting teachers in expliciting their human expertise of cognitive nature that is often not captured. Second, it demonstrates the possibility to use adaptation of the Rhetorical Structure Theory, a semantic taxonomy of content we have developed and required ontologies as a communicative mechanism to support guidance of collaboration in a step-by-step manner and to give an explicit perception of the expected content through a specific NIM.

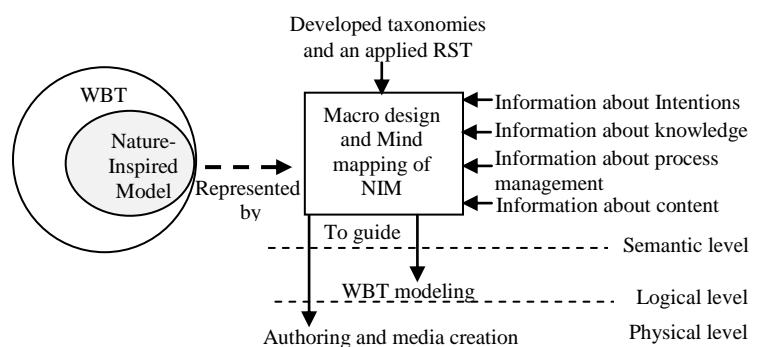


Figure 1: Using Moulinette to support WBT production based on NIM

**Experiences and overall conclusions:** As proof of concept, we have used our environment to produce and evaluate collaboratively two WBTs based on NIMs. The capabilities of our approach are compared to the existing ones. The first experimentation aimed to produce a WBT based on a NIM (inspired by Ant Colony Optimization (ACO)) that recommends optimized learning paths to a community of learners. This experimentation has shown that using both recommendations of the teacher and test results of previous learners stored by the ACO system is very useful to identify the most optimized path of navigation for learners (the path enriched by *Exercices* got 42% of success and was identified as the most relevant path). The objective of the second experimentation was to set-up an automated Web Based Assessment (WBA) based on using of a brain-Inspired model [2] for a better individualized blended training, particularly in Masters' training [2]. By using Moulinette for a conceptualization of his knowledge and for a particular modeling of Multiple Choice Questions (MCQ) according to his expertise (added to a fuzzy-modeling method), the teacher could emulate a distinguished assessment of learners almost similar to when it is done manually by himself: up to 92% of similarity between the human and the computing judgments during the assessment's practice (figure 4) [2]. The realized experimentations have validated our assumptions and demonstrated that the proposed framework and its design process provide an enhanced assistance during collaborative production of WBTs [1]. Users have found that Moulinette is familiar to their way of thinking and it is using usable web technologies. They have confirmed that it is easy, generic and does sufficiently support the design of WBTs, in particular the NIM-based. Finally, we have demonstrated the benefit of optimizing the production of WBTs using nature-inspired paradigms in.

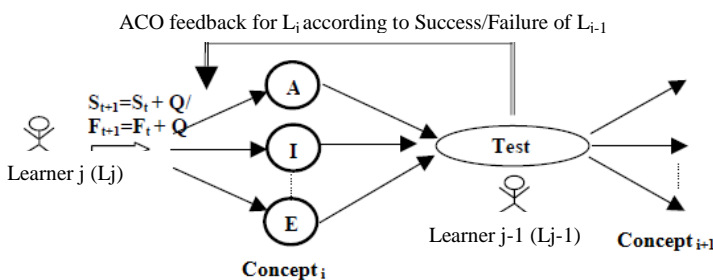


Figure 2: ACO model used in optimizing learning paths (1<sup>st</sup> experience)

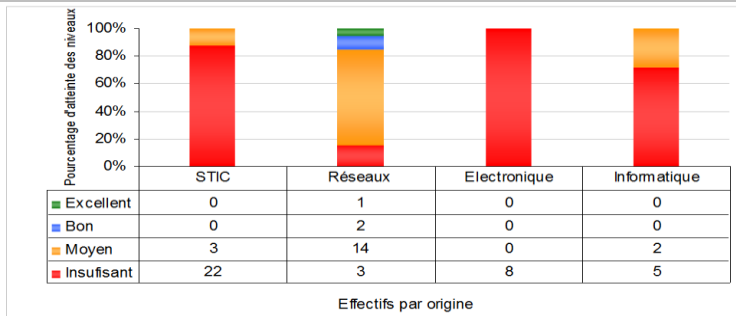


Figure 4: Results of a Web based assessment emulating a human judgment

Table 2 : Multi-views (Process, Knowledge, Semantic, Content) of the WBT project

Project views	Overview	Export
Process management	(1) Knowledge modeling (2) Semantic modeling (3) Content modeling (4) Web Export	
Knowledge modeling	Textual Mind map	WBT&learners Domains
Semantic modeling	Textual Mind map	XML Format RDF Format
Content modeling	Content modeling	XML Format PDF Format
Content Export	WEB View	Scorm (ZIP) PDF Format

Figure 6 : A view of the top-down approach to produce WBTs on Moulinette environment

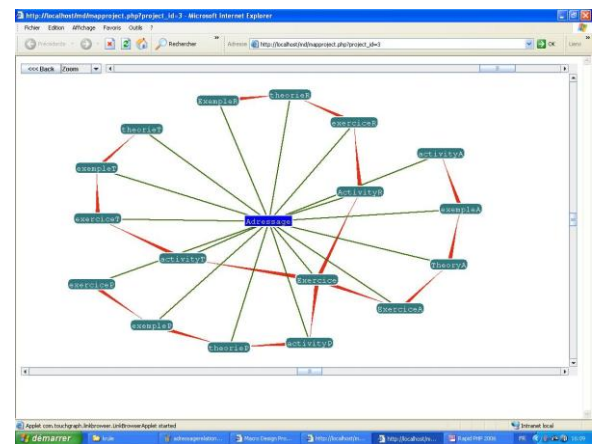


Figure 3: ACO modeling to produce a WBT on Moulinette.

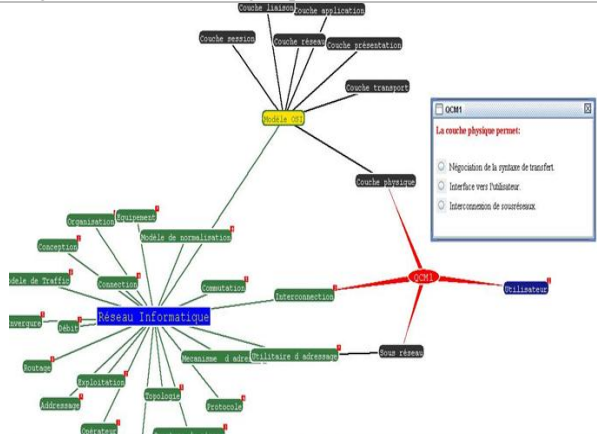


Figure 5: Human mind mapping and content modeling to produce a Web Based Assessment using Moulinette towards a machine emulation of a human expertise (2<sup>nd</sup> experience)

## 2 References

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[2] O.Laboudiya, A.Aqqal, N.Elkamoun (2014): A Technology-Enhanced approach to automate assessments for Master's trainings: perceptions, practices and track proposals, International Journal of Innovation and Applied Studies, vol. 6, no. 3, pp. 654–676, July 2014

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