A goal-oriented authoring approach to design, share and reuse learning scenarios

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Abstract. This paper presents our research works and our proposal : ISiS model (Intentions, Strategies, interactional Situations), a conceptual framework elaborated to structure the design of learning scenarios using Information and Communication Technologies by teachers-designers. This framework is based on a goal-oriented approach and proposes to clearly identify intentional, strategic, tactical and operational dimensions in a learning scenario. ISiS aims to favour sharing and reuse practices and is implemented within ScenEdit a specific authoring environment dedicated to teachers-designers.

1 Introduction

Since several years, a set of researches concerning Educational Modelling Languages (EMLs), aim to provide interoperable descriptions (called "learning scenarios") of the organization and the time scheduling of a learning unit. These scenarios integrate digital technologies and target precise goals in terms of knowledge acquisition. The main challenge of those languages, such as IMS-Learning Design [1], is the emergence of a neutral and shared formalism, able to express the widest range of learning situations and to be implemented more or less automatically towards Learning Management Systems. As noticed by IMS-LD authors themselves [2], an EML, which mainly aims expressiveness and interoperability, is not aimed to be directly manipulated by teachers or engineers. Specific authoring systems [3, 4] must be provided in order to allow designers to develop at a lower cost their own scenarios. Our observations [5, 6] lead us, not to propose an alternative solution to EMLs, but to complete them by offering models, methods and tools to sustain design and reuse for non computer specialists of learning scenarios using Information and Communication Technology.

2   Context and research work

The research presented in this paper is performed in collaboration between the Laboratoire Informatique de Grenoble and French Institut National de la Recherche Pédagogique. This collaboration closely associates panels of teachers in charge to co-elaborate and experiment specific models and tools dedicated to assist them in design by favouring sharing and reusing approaches. This work led us to study existing practices of sharing scenarios and to experiment with teachers different existing tools.

2.1. Characteristics of "teachers-designers"

Before describing this research, it is necessary to qualify more precisely the specific type of designers we focus on: teachers who are called to integrate digital technologies in academic context, more precisely in the French secondary educational system (pupils from 11 to 18 years). Our *teacher-designers* have a good knowledge of the knowledge domain to be taught and can be considered in a certain way as domain-specialists. They have followed a specific training to master didactical competencies (how insure appropriation of domain-specific knowledge for targeted audiences?) and pedagogical competencies (how to organize or regulate efficient learning situations?). They do not benefit of a deep training in computer science; however, they are supposed to master a certain range of basic competencies defined by a national certification. They are generally not assisted by technical specialists in charge of implementation. They have to use existing models, methods or tools in order to develop effective learning solutions, generally in a short time compatible with their job. They may belong to a teachers' community of practice, whose emergence is made easier by Internet, and which allows new possibilities of sharing and reuse between practitioner. They are frequently implied as actors of the learning unit they design; this particularity may have consequences on the design precision where decisions can be carried out at runtime phase.

2.2 Theoretical background

Our research concerns the teacher-designer activity and we base our approach on a set of complementary works concerning theory of activity:
- *organization of activity* [7] defines hierarchical levels (activity, action, operation) which allows to distinguish intentional, strategic and tactical dimensions;
- *situated character of activity* [8] insists on the importance of the specific context in which learning activities take place. Particularly we focus on relationships between activity and artifacts throughout the concept of instrumental genesis process use and continuous design during the use [9];
- *importance of routines or schemas*, that represents typical solutions given to recurrent problems in specific contexts. Those features have been particularly studied in the context of teaching activity [10].

We also take into account works concerning Goal-Oriented Requirements Engineering [11] where elicitation of goals is considered as an entry point of the

specification of software systems and more specifically MAP Model proposed by Rolland and Prakash [12]. MAP and ISiS are both model dedicated to design process in a goal oriented perspective. MAP is a more generic model, designed in order to sustain process analysis while ISiS is dedicated to a specific learning "business-process" and aims to imply actors themselves in design process.

2.3 Research question and goals

The research questions we address is to facilitate teachers' task in designing and implementing learning scenarios using Information and Communication Technology by providing them formalisms and tools satisfying criterias of understandability, adaptability and appropriability.
In other words, using a common formalism and elicitating intentions to afford a better understanding and context adaptation of learning scenarios within a community of practice. In this context, we aim to provide models, methods and tools allowing teachers-designers belonging to communities of practice to design their scenarios expressing intentions and educational strategies they adopt.

2.4 Methodology

In order to propose adapted formalisms and tools, we organize this work in four phases. After a preliminary phase where we defined precisely the targeted audience, the first phase consisted in analyzing current uses of share and reuse of scenarios. The obtained results allowed, in a second phase, to co-elaborate with teachers an intention-oriented model: ISiS which structures the design of a scenario. In a third phase we have experimented ISiS model with a pilot group of teachers by the means of textual forms and graphical representations. After evaluation of this experiment, we currently develop a graphical tool which will be next experimented in classrooms.

2.5 First experimentations

In our experimental context [6], we have confronted teachers-designers with concepts of intentions and strategies. By linking them to their regular uses, they were able to define two different articulated levels: a first didactical level deals with domain specific knowledge and a second pedagogical level deals with organizing and regulating learning situations. For each level, they were able to associate intentions and strategies. From this background, we have progressively co-elaborated a "business-oriented" model ISiS (Intentions, Strategies, interactional Situations) after a two-year project tightly associating teachers-designers. To reach our goal, we found necessary to provide users with sufficiently accessible conceptual terms. In the training of French teachers at secondary level, the concepts of "pedagogical intention", "learning strategy", and "learning situation" belong to the common vocabulary. It seems to be coherent to propose a specific model based on those terms.

After evaluation of different authoring solutions in learning design [2, 3], we have chosen to develop a graphical environment ScenEdit [13] based upon ISiS model.

3   Our proposal: ISiS model

ISiS model is a conceptual framework elaborated to structure the design of learning scenarios by teachers and to favour sharing and reuse practices between designers. ISiS model is based on four complementary principles arguing that design and exchange of learning scenarios must be facilitated by:

1. elicitation of context, particularly by distinguishing the knowledge context from the situational context of a learning unit;
2. elicitation of intentional, strategic, tactical and operational dimensions;
3. capability to provide flexible design processes allowing different combinations of design steps and to continue the design during the runtime phase ("on-the-fly" adaptation);
4. reuse of existing scenarios, components or design patterns which allow the teacher to design more efficiently his scenarios.
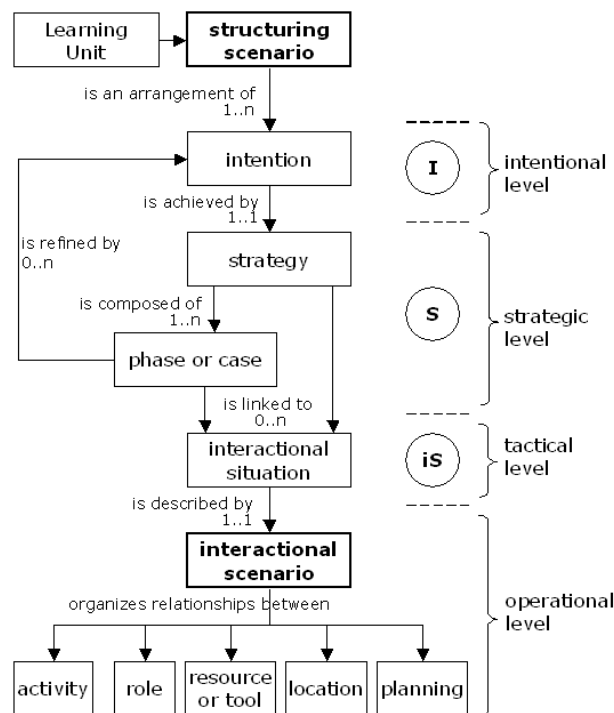

Fig. 1. An overview of ISiS model

Figure 1 provides an overview of ISiS model which proposes to structure the design of a scenario describing organization and planned execution of a learning unit.

According to ISiS model, organization and planning of a learning unit can be described with a high-level scenario, called *structuring scenario*. The *structuring scenario*, which reflects designer's intentional and strategic dimensions, organizes the scenario in phases or cases. An item (strategy, phase or case) can be linked to a suitable interactional situation. The *knowledge context* defines the targeted knowledge items (notions, competencies, know-how, abilities, conceptions or misconceptions, etc.), the audience characteristics or the prescribed duration of the learning unit. The *situational context* is characterized by a set of variables such as (1) resources that can be manipulated to support activities (document, tools, services), (2) locations where activities can take place, (3) planning elements in which activities must be scheduled or (4) number of learners, roles which can be distributed.

In the following paragraph, we describe each of intentional, strategic, tactical and operational levels. The I level (Intention) allows to describe the designer's intentions. In this case, intentions are closely linked to the knowledge context which defines a set of items associated to the unit of learning (knowledge, competence, ability, etc.). Intentions can be for example (a) to reinforce a specific competence in electricity, (b) to favour the discovering of a notion, (c) to destabilize a frequently met misconception, etc. The S level (Strategy) is related to strategic features. In order to reach goals related to the formulated intentions at I level, the designer opts for the strategy he considers as the most appropriate. At least three main kinds of strategies can be distinguished: (1) sequencing strategies organize the arrangement of logical phases[1], (2) distribution strategies plan different solutions for identified cases (for example, a differentiation strategy takes account of three possible levels of mastering) and (3) modal strategies allows to express a "style" that will be applied during implementation of an intention (for example, to favour collaborative working during phase of elaboration of a solution). Strategies can be combined by successive refinements: for example, a sequencing strategy may precise one of the case of a distribution strategy. At operational level, the structuring scenario organizes a set of interactional situations that can themselves be described by more low-level scenarios: an *interactional scenario* defines precisely their organization in terms of activities, interactions, roles, tools, services, provided or produced resources, etc. The interactional scenarios are the level typically illustrated with EML examples of implementation. The originality of our model is to elicitate the design process from the very beginning of the idea of a learning scenario, the knowledge context, the competences, the pedagogical and didactical strategies to it's organization in activities, roles…

4 Conclusion

In this paper, we have presented our research work and an overview of ISiS Model, a "business-oriented model" whose goal is to assist teachers in the design of learning scenarios and to favour sharing and reuse practices. The model, co-elaborated with panel of users, seems to be efficient, according to first experimentations [6]. It allows

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[1] For example a scientific investigation strategy can be modeled as a series of four phases : hypothesis elaboration, solution elaboration, hypothesis verification, conclusion

teachers to express more clearly their intentions and to better understand learning scenarios created by others.

The first version of the dedicated authoring environment ScenEdit [13] developed from our conceptual model is going to be experimented. This experimentation aims to validate the visual representation of a scenario we propose and to enhance the system with patterns or components of various levels (intentions, strategies, interactional situations) allowing new effective practices of sharing and reuse. These patterns of learning scenarios, pedagogical approaches and recurrent interactional situations will be elaborated from best-practices found in literature and with teachers within communities of practice. A further step, will consists in providing databases where users of our environment, will be able to save fragments of their own scenario, in order to share them with others or to reuse them further in close or different contexts.

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