Conception and implementation of rich pedagogical scenarios through collaborative portal sites

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Abstract

Recent interest for rich activity-based pedagogies that originate from various socio-constructivist schools of thought is tied up to the goal of creating deeper, better integrated and applicable knowledge. Students are expected to become better general problem solvers and group workers while their teachers are under pressure to make learning more interesting and even more fun. However, experiments made with learner-centered « new pedagogies » have shown that good results are not necessarily a guarantee that is why a good pedagogical design is crucial to succeed. We postulate that effective « new pedagogies » require the use of structured scenarios where the teacher has to fulfill a triple role as facilitator, manager and « orchestrator ». Moreover, learning should happen within a social space that provides intellectual and emotional support. Therefore, supporting technology, i.e. virtual learning environments, should be designed both as « scenario engines » and as « true virtual spaces » where the participants feel « present ». Our study aims to implement such systems with Community, Content and Collaboration Management Systems (C3MS) that have been developed for collaborative portal sites. Initial results from an exploratory educational engineering project suggest that C3MS-based learning environments provide the necessary « clear focus » (learning activity support, management and scenario orchestration) and « fuzzy edges » (community support). We suggest that this approach, despite some difficulties, should be further investigated.

Introduction : The challenge

Today does exist an increasing interest for so-called « active » and « rich » pedagogies that mostly originate from various socio-constructivist schools of thought (Bruner, 1973), but can also be found in other modern instructional theories (Ausubel, Novak and Hanesian, 1978 ; Reigeluth, 1999). Having these school of thoughts in mind, we hope to create deeper, better integrated and applicable knowledge knowing very well that at the same time we feel under pressure to make learning more interesting and even more fun so that the students become better general problem solvers and group workers. To attain that goal, we need a good and wide definition of socio-constructivism. First of all, we consider socio-constructivism as an understanding of learning that stresses the importance of constructing knowledge based on previous knowledge and interaction with the social environment, e.g. theories that have followed from constructivism (Piaget), socio-culturalism (Vygotsky, 1962) and situated learning (Lave and Wenger, 1991). Secondly, we perceive socio-constructivism as a set of pedagogies that use strategies like project-based learning (Thomas, Mergendoller and Michaelson, 1999), problem-based learning (Greening, 1998), inquiry-based learning (Aubé and David, 2003), case-based learning (Lundeberg, Levin and Harrington, 2000) or action learning (Revans, 1980). We call these new pedagogies « activity-based », since the students learn *with* interactive technology (instead of *from*) and since the teacher has to design, to facilitate and to monitor student activities. To insure effective results, we believe that a good pedagogical design including somewhat structured pedagogical scenarios as well as the teacher's role are crucial. In this perspective, the modern teacher has to fulfill a triple role of facilitator, manager and « orchestrator » and he needs adequate supporting environments since such designs can become very complex and costly. That is why we have chosen to describe a partial framework that we are currently developing and that has shown encouraging results from initial field tests.

1. Pedagogical design

Before presenting our practical framework we shall explicit a little more some of our pedagogical beliefs that are the foundations of our research. Student activities mediated through products and exchange are situated in the heart of a rich, active and open pedagogical scenario. In order to learn, students have to create and to discuss in a larger scope, i.e. to develop projects. « The reason that Dewey, Papert, and others have advocated learning from projects rather than from isolated problems is, in part, so that students can face the task of formulating their own problems, guided on the one hand by the general goals they set, and on the other hand by the 'interesting' phenomena and difficulties they discover through their interaction with the environment » (Collins, Brown and Newman, 1989, p. 487). Powerful pedagogical designs that aim at the development of general problem skills, deeper conceptual understanding and more applicable knowledge include, according to van Merriënboer and Pass (2003, p. 3), the following characteristics : « (1) the use of complex, realistic and challenging problems that elicit in learners active and constructive processes of knowledge and skill acquisition ; (2) the inclusion of small group, collaborative work and ample opportunities for interaction, communication and co-operation ; and (3) the encouragement of learners to set their own goals and provision of guidance for students in taking more responsibility for their own learning activities an processes. »

Effectiveness is not guaranteed if the teacher simply asks students to do projects, to engage in writing activities, to learn together or at least to profit from each other's ideas. We assume that the risk is quite high to observe that students cannot start, get lost or are otherwise unproductive. We therefore suggest to create semi-structured pedagogical scenarios that define an orchestrated sequence of learning activities. Such a scenario is often called a « script » in the literature, and in particular, in the field of Computer-supported collaborative learning (CSCL) that Dillenbourg, Schneider and Synteta (2002) define as a story or scenario that the students and tutors have to play just in the same way as actors play a movie script. Such pedagogical scripts can become very sophisticated : for each phase, the script specifies the tasks that students have to perform, the composition of the group, the way that the task is distributed within and among the groups, the mode of interaction and the timing of phase. Phases are ordered and connected, i.e. outputs of one phase become inputs of the next phase. Pedagogical scripts are mostly sequential, at least from the student's perspective. However, it does not mean that these are merely instructions that the learners have to follow. Tasks can and should often be defined as mere goals, e.g. that at some point the teacher can ask students to hunt out and to formulate definitions of the objects they will have to study although the way they do it is left open. In other words, when designing and executing pedagogical scenarios the teacher has to respect a harmonious equilibrium between the freedom left to students that is necessary for intellectual development and motivation on one hand, and certain guiding principles on the other hand.

To engage in a project and learn how to manage with open confrontation of ideas, one must be guided by structured activities and monitoring. Meanwhile the teacher should not overscript or overregulate since it might have negative effects on important educational factors like the development of general problem-solving, the meta-cognition capacities, the motivation, etc., that we have previously defined as major pedagogical goals.

Activity-based, collaborative, and construction-based pedagogies can be implemented at three different levels : (1) smaller pedagogical scenarios which can be either components for larger projects or self-contained mini-projects ; (2) long term projects, i.e. project-based courses ; and (3) the general study environment favoring student initiative and community building. While mini-projects (activities lasting only over a single or a few lessons) cannot reach the same goals as true project-based teaching, they can very well complement traditional instruction and are often the only realistic alternative in today's organization of the school and university system. We will now examine particular instructional design issues, first at the level of small scenarios, then for larger project-oriented classes and finally at the level of the overall environment.

1.1. Pedagogical scenarios / small projects

Structured activity-based teaching involves sequencing scenarios and therefore breaking the « problem » into parts so that the students are challenged to master as many tasks as they are ready to handle. From a more abstract perspective, scenarios evolve in cycles, e.g. a typical teaching/learning phase has more or less the following elements (in whatever order) :

1. Do
2. Deposit
3. Look
4. Discuss

Resources, tools and products play an important role in education. In fact, each time a student does something, there should be a product (even as little as a short message) that is deposited somewhere and can be looked at and discussed with others. The teacher's role as a manager is to make sure that certain loops are productive while the students produce something that is task-related. They engage themselves in meta-reflection (look critically at their own work) and they discuss and share with others. The teacher's role as a facilitator is to help students with their tasks, e.g. help them to select resources and tools, explain difficult concepts and procedures, « debug » when they are stuck etc. The teacher's role as an « orchestrator » is to design and to implement the scenarios as a sequence of clearly identifiable phases so that the learners can focus on a small number of tasks simultaneously and make sure that these tasks are not too difficult to be taken care of.

Let us have a look at a simple example scenario. For a given purpose, let us pretend that students need references for a project, this situation can be used as a pedagogical activity that includes the following steps :

1. The teacher introduces the theme, gives clues and asks students to consider the different aspects of the subject (Discuss).
2. Students start searching through the Web with various search engines and bookmark the links they find interesting (Look, Deposit).
3. Students then try to work out categories and sub-categories related to this theme (Look, Do, Deposit).
4. The results are put in common and a hierarchy is worked out (Look, Do, Discuss).
5. The approved categories are registered into a common space (e.g. the classroom wall, a piece of paper or in an electronic links management system) (Deposit).
6. Students classify, register and describe their links (Do, Deposit).
7. Teacher provides an evaluation (Discuss).

As this example may indicate, most activity-based, constructive and collaborative pedagogies do not necessarily need any special tools, but work can be made quite efficiently (after some adaptation period) and is certainly more powerful by using some support technology. Walls in a classroom are limited, paper can be lost and collaboration within the classroom is under heavy stress due to time constraints and scaffolding. Content needs to be managed, knowledge exchange must be organized, discussion tools must favor exchange of arguments, projects must run, and generated knowledge must be managed. Therefore defining a scenario is a problem of workflow design, but with the idea that pedagogical workflows are different from the ones in industry. In the industrial world the goal is the product while in the field of education the goal is apprenticeship, i.e. what the student has learnt after performing a set of activities.

What kinds of results could typically happen in such a workflow approach?

(1) Gathering and distribution of information : teachers and learners share resources and the activities are designed to help them gather information and make it available to all.
(2) Creation of collaborative documents : here the students can write definitions, analyze cases, solve problems, write documents and create illustrated documents together around specific themes.
(3) Discussion and comments about the productions : learners identify together facts, principles and concepts and clarify complex ideas. They formulate hypotheses and plan solutions, make links between ideas, compare different points of view, argue, evaluate... …
(4) Project management related activities : learners can decide work plans, share tasks and form groups, decide a schedule and so forth. Teachers can distribute and regulate tasks.

Let us now address the issue on how we combine multiple simpler scenarios into larger ones, i.e. we shall focus on the design of computer supported project-based courses. Similar designs can be made for other large-scale scenarios like problem-based learning.

1.2. Large scenarios for project-based courses

Project Based Learning is a teaching and learning model (curriculum development and instructional approach) that emphasizes student-centered instruction by assigning projects. It allows students to work more autonomously to construct their own learning, and culminates in realistic, student-generated products. More specifically, project-based learning can be defined as follows :

- Engaging learning experiences that involve students in complex, real-world projects through which they develop and apply skills and knowledge
- Learning that requires students to draw from many information sources and disciplines in order to solve problems
- Learning in which curricular outcomes can be identified up-front, but in which the outcomes of the student's learning process are neither predetermined nor fully predictable
- Experiences through which students learn to manage and allocate resources such as time and materials.

Projects are complex endeavors involving many different activities. In particular, students have trouble in (a) initiating inquiry and formulating coherent research questions ; (b) defining a research project ; (c) directing investigations ; finding resources ; (d) managing time ; keeping deadlines and estimating time needed to do a task ; (e) collaborating and giving feedback ; articulating work of others and giving regular feedback ; (f) following-up the project ; and revising products. In addition to the difficulty of setting clear goals for various phases, students have trouble relating data, concept and theory.

However, since the student is not only supposed to ask questions whenever he is stuck with a difficulty, and to limit his production to whatever he feels that he is able to do, we need both constraints and planning. A teacher should orchestrate a project into several scenarios more or less sequential, scenarios that he could then reduce to smaller phases. This will insure that learners will focus on smaller sub-problems, will do things in the right order (e.g. define research goals and operational research questions at the beginning of the project instead of doing it at the end), and we shall give an example about it later. A project-based learning design (even one of the structured kind that we advocate here) can be supplemented by traditional reproductive learning, since it is often not efficient enough to teach basic « know-that » and basic « know-how » knowledge by the means of a project, in other words, it is a fact that various pedagogical designs are often complementary.

1.3. The general study environment

The community factor is particularly important in open and distance learning situations. As formulated by e-learning practitioner Gilroy (2001) « E-learning should be first and foremost about creating a social space that must be managed for the teaching and learning needs of the particular group of people inhabiting that space ». While a large part of our knowledge comes indeed from formally planned learning scenarios, people learn a lot from informal exchange with fellow learners, with professors, experts, i.e. from exchange within tightly or loosely defined communities (Lave and Wenger, 1991). We can define communities as networks, made up of individuals as well as public and private institutions. They share a certain amount of practices, common goals and common language. They do have a social organization including formal or informal hierarchies and some idea of « social service » (members helping each other).

It is very important that teaching should generate enthusiasm, enhance concentration and favor creativity, which are very distinct, but somehow interconnected phenomena. Rieber Smith and Noah (1998) convincingly argue that learning process itself —and not just the result— should be interesting, if one seeks higher motivation among learners. « Serious play » or « hard fun » are intense learning situations where learners are investing a lot of « energy » and time, that provide equally intensive pleasure at certain moments which have been identified as « flow » or « optimal experience » by Csikszentmihalyi (1990). Flow situations have been defined as states of happiness and satisfaction that arise when « carried » by specific kinds of activities. It is interesting for teachers to be aware that « flow states » go along with the impression of discovery and of creation and that they boost performance in conjunction with important cognitive efforts. « Flow states » are therefore highly desirable, both for the individual student and for the teacher. Conditions in which « flow » happens are characterized in the literature by an optimized level of challenge, a feeling of control adapted to the learner, a touch of fantasy, and feedback of the system. There are multiple lessons that could be drawn in favor of the design of learning environments. An open, active and project-based learning is favorable to trigger challenge, curiosity, and to also leave some control to the student. « Flow » theory contains principles known from many « behaviorist » instructional designs, like optimizing the level of difficulty and providing fast and appropriate feedback or otherwise appropriate positive reinforcements. Since we do not argue that open and active learning should be « programmed » like an e-learning environment, the teacher has to make sure that at least some tasks should be quite affordable and lead to quick results. More importantly, quick and informative feedback should be provided by the system, co-learners or the teacher (whoever is considered appropriate).

Creativity is a very complex issue and its relation to flow is not obvious. « Optimal experience » has been described by gamers or programmers and it enhances without doubt productivity, but does not necessarily entail creativity. According to Feldman, Csikszentmihalyi and Gardner (1994), creativity should be studied and therefore facilitated by the teacher at three different levels : (1) the social field, e.g. a network of people who provide cognitive and affective support, instruction, evaluation, recognition, etc. ; (2) the domain (symbol systems of knowledge) ; and (3) the individual, i.e. intellectual traits, personal traits and cognitive structures. It is clear that education cannot influence all variables, but pedagogical design certainly can have a positive influence on individual dispositions that already exist. It can act upon conditions, i.e. on educational tasks and the general learning environment like the « class spirit » with the help of specially designed technology that we will introduce later on. By exposing students to open-ended, challenging, authentic and partly self-defined projects on one hand and by providing scaffolding and support on the other hand, the teacher does create situations where individual traits can be exposed and developed.

2. Tools

Information and communication technology (ICT) has a support potential for most of the functions provided by an educational system. Several pedagogical-technical models are currently available and sometimes in competition. Examples are « open-resource-based learning » (using simple Web technology), neo-instructionalism (e-learning platforms), collaborative learning (using computer-supported collaborative learning systems or groupware systems), tele-teaching (using increasingly sophisticated conferencing systems).

The history of the pedagogical use of Internet in the traditional institutions (schools and regular universities) shows a confrontation of two schools of thought, one that favors open and active teaching and the other one that favors traditional knowledge transmission plus homework. Pedagogical use of Web technology started out in 1993 with early adepts using the Web for innovative project-based « teaching and learning ». Web-based training systems inspired by traditional computer-based training (CBT) software started appearing on the market and formed the core of today's so-called « Learning management » or « E-learning » systems. While these systems anchored in the behaviorist tradition are making interesting progress as far as modularity of contents and standardization are concerned, they do not fundamentally seek to improve pedagogies by supporting rich socio-constructivist scenarios. As Gilroy (2001) has pointed out, « The emphasis of most e-learning programs to date has been on the accumulation, organization, and delivery of content. This is manifested in all aspects of how the new sector has been organized : in the business and operating models of the service and technology providers ; in the design and organization of the content and learning management systems that are now widely used ; and in the investments venture capitalists, publishers, universities, and corporations have made. »

Internet technology supports most open-ended, creative and active pedagogies, as long as students can also be producers (not just readers and exercise button pushers). While there is an interesting number of enabling software and while activity-based (e.g. project or problem-based) scenarios are quite popular (Reigeluth, 1999 ; Wilson and Lowry 2001), they are not supported by the same number of technologies as the scenarios inspired by more traditional instructional design (Reigeluth, 1983) are. Exceptions like the Knowledge Forum System (Scardamalia, 2003) are rare. Besides commonly used tools like HTML pages and forums, there exist quite a number of interesting tools like participatory content management systems (e.g. Weblogs), and collaborative hypertexts in various forms (e.g. Wikis). However, we like to push one step further, i.e. provide teachers with a fairly integrated configurable platform of tools. Technical requirements for active and rich pedagogies are not extremely demanding, but interesting results could already be obtained by providing the following sort of functionalities :

- Access to rich information sources (not just stream-lined e-learning blocks) by various means, e.g. browsing, searching by categories or popularity, searching by keywords.
- Affordable interaction with various types of information contents (including annotation).
- Rich interactions between actors, that are facilitated by awareness mechanisms (who did what, what is new, etc.)
- Simple integration of these activities through a « place ».

« Classic » teaching methods (which include main-stream e-learning) require that teaching materials be well prepared in advance (by either a teacher or a content expert) and be used « as is ». Learners usually are supposed to digest this material (repetitively if needed) in a rather isolated way. Activity-based pedagogies assign a better diverse role to documents used. Learners generally select by themselves the documents they need from a larger choice (which includes the whole Internet). More importantly, they actively participate in the production of documents, some of which can be reused later on. Ideally, they also should be allowed to annotate documents, i.e. enrich them by their own experience. Writing in this perspective concerns producing short texts in various genres (questions, arguments, links, definitions, etc.). These learner productions plus interactions are meant to provoke various meta-cognitive mechanisms beneficial to learning e.g. conceptual change and deeper understanding (Klein 1999). Therefore, a « socio-constructivist » Web server constantly changing requires awareness tools that put forward what has changed, what is new, what is popular, what is exciting, etc.

In general terms, activity-based teaching needs mainly a computer as a facilitating structure, a thinking, working and communication tool instead of a content transmission device. Accordingly, most student and teacher activities should be supported by computational tools and lead to new « contents ». Within this perspective we can see that activities and roles are defined in a collaborative expressive digital media framework.

We do not ask ourselves how to convey contents and how to control reading and exercising, but how we can support various knowledge production and exchange related tasks. To that effect, we now shall outline a partial, but operational solution that is presently available at a reasonable cost.

2.1. Community, collaboration and content management systems

Simple Internet technologies (Web pages, forums and e-mail) have been successfully used in education because they answered basic needs for information exchange, communication and collaboration needed for constructivist scenarios. In addition to being simple, yet powerful, the « standard » Internet lets the user (teachers) to have control. It is an enabling technology (Kynigos, in press). While simple Web technology allows for creative scenarios, it has 4 drawbacks : (1) Maintaining static Web-sites (including the student's pages) is time-consuming ; (2) simple discussion systems like forums or mailing-lists do not help knowledge management ; (3) more sophisticated scenarios (like co-authoring or work-flow) are badly supported ; and (4) there is no special glue for keeping all these together.

Community Web-sites actually face quite similar problems and seem to have found at least a partial answer. Within the last two years an impressive number of what the authors coin C3MS (Community, Content and Collaboration Management Systems) have sprung into existence. Inspired by personal Weblogs (also called blogs), slashdot-like Weblog/news systems, simple content management systems and various popular groupware applications, they offer a modular system for « configuring » interactive community Web-sites. Moreover, most of these systems provide documented extension mechanisms allowing third party persons to contribute some modules with additional functionalities.

C3MS systems are a form of Web portals. A portal gathers a variety of useful information and communication resources into a single, « one-stop » Web page (Looney and Lyman, 2000). A portal therefore is a collection of objects (information bricks) and services (operation on these bricks) that can be accessed from the portal (Web) page. When the user works with a specific resource, e.g. a collaborative hypertext, only a part of the interface changes. Therefore, a portal is a kind of « cockpit » where the central views changes, but the other instruments can be reached. Portals can be adapted for specific communities and sometimes users can tailor them to their needs. Moderately sophisticated systems like PostNuke offer a good set of core portal functionalities out of the box, such as a good user administration system, a news/journal system, Web links sharing, search, FAQs, Polls and more. In addition, an impressive amount of extra modules (many from autonomous developers) like collaborative hypertexts (Wikis), pictures galleries, simple content management systems, calendars of events, chats, project managers, file-upload, glossary management are available. Many Web-applications popular in education that existed beforehand as stand-alone applications (e.g. Forums and Wikis) are adapted for a better integration. Specific pedagogical applications based on the needs of teachers exist and others are being developed, e.g. by our own research team.

Table 1 shows a non-exhaustive list of standard tools available in a typical portal system and how they can provide support for various functions that a pedagogical information and communication system (i.e. a knowledge machine) should provide for activity-based teaching :

Table 1 : Functions and tools of the portal

Function	*C3MS modules (tools of the portal)*
Content management	News engine (including an organization by topics and an annotation mechanism) Content Management Systems (CMS) Collaborative hypertexts (Wikis) Image albums (photos, drawings, etc.) Glossary tool or similar Individual Weblogs (diaries)
Knowledge exchange	News syndication (headlines from other portals) File sharing (all CMS tools above)
Exchange of arguments	Forums and/or new engine Chats
Project support	Project management modules, Calendars
Knowledge management	FAQ manager Links Manager (« Yahoo-like ») Search by keywords for all contents « top 10 » box, rating systems for comments « What's new » (forum messages, downloads, etc.)
Community management	Presence, profile and identification of members Shoutbox (mini-chat integrated into the portal page) Reputation system Activity tracing for members Event calendar News engine

2.2. C3MS bricks

We use the term « C3MS brick » for a module (component) that takes care of a specific task, that can be easily separated from others, that can be configured and administered, that can be combined and orchestrated with others and all this through the main portal environment. These building bricks for educational scenarios are described in detail in the « TECFA Seed Catalog » available on our support site (Schneider, Chakroun, Dillenbourg, Frété, Girardin, Morand, Morel and Synteta, 2004). Table 2 presents, as an example, the « news engine » which is usually the C3MS brick by default shown to users when they connect to the portal.

Table 2 : Functional description of the news engine

Generic name(s)	News/Articles/Topics/Sections
Software names (PostNuke centric)	News, Submit_News, Story Submission Module, Topics Newsletter, NewsPortal, PN Submit News
Functional Description	Submit news, display the news on the index page, post new articles or stories or topics on the site. Functions : Submit, comment, edit, delete, rate, search, browse, moderate
Structural Description	This is a core module of most portals but there exist also some 3rd party ones with special features
Pedagogical interest	Interact by providing new information (to start a story, a project, an activity), comment information of others, asynchronous debate, present an

	expert's view on a theme
Construction process	Exists by default in the main menu
Other Notice	Can be commented
Support for activities	Brainstorm, IntroWork, SendFeedBack, SubmitStory, SubmitComment

Mostly, C3MS bricks are small tools, but powerful tools to manage little bits of information that allow the community to contribute with comments and sometimes votes. In addition, various applications provide self-ordering and awareness mechanism to the users, e.g. what is new, what is popular, etc. Therefore such portals are particularly useful to manage informally generated knowledge, e.g. the result of educational activities. Portals usually have incorporated search engines, and provide functionalities for rating information so that good information « floats » to the top. For more structured information, e.g. Web links, hypertexts etc. there exist special applications that allow users to make quick updates (instead of going through the process of editing HTML files and uploading them).

A simple C3MS brick usually offers insert - categorize - annotate - evaluate - sort - search functionality. Such features define the core of a « living documents » and knowledge management system and are essential to support student activities engaged in complex pedagogical scenarios. Besides these predominant and simple tools, more complex applications can be embedded into these portals. E.g. our team has developed an « ArgueGraph » (Chakroun, 2003), a Computer-supported collaborative learning (CSCL) discussion tool according to a model developed by Dillenbourg (1999) ; « PESC » a pedagogical scenario tool inspired by Moodle (Dougiamas and Taylor, 2002) ; ePBL, a pedagogical project management module (Synteta, 2003) ; « wTool » a simple workshop preparation tool ; « pnProdAct », that allows to list global productions of selected users and groups.

Various learner activities need to be integrated. Since C3MS currently do not provide any integrated workflow capabilities, the teacher must select one or two special tools in order to « drive » a scenario or a larger project. The easiest solution for scenario management (i.e. setting tasks, describing resources and providing feedback) is to use the News Engine, a Forum or a Wiki page. Our team has developed two additional tools : **ePBL** is a « Project-Based e-Learning » module and it provides the following functions : (1) Scaffold students during their projects by « forcing » them to fill in their project specifications (through an XML grammar) ; (2) help students write their final article and (3) help teachers monitor easily several projects in parallel and give them feedback on time. **pScenario** is a tool that allows teachers to define complete and rich scenarios for various pedagogical formats (face-to-face, at distance or mixed) and to associate student activities with other tools.

It is up to the teacher to clearly identify needed tools and to configure the teaching portal. Now, let us examine in more detail how we can « implement » pedagogical scenarios with the help of a C3MS.

3. Instructional implementation : A proposition

In the tecfaSEED Catalog (Schneider, Chakroun, Dillenbourg, Frété, Girardin, Morand, Morel and Synteta, 2004), we define structured scenarios templates that teachers can adapt to their needs. We shall firstly present the general concept and then discuss a practical example.

3.1. Scenario planning

Pedagogical story-boarding with a C3MS follows a simple principle. The teacher creates a pedagogical scenario (activity) by defining different phases of the work process. Each phase contains at least an elementary activity, which in turn should be supported by a tool (portal brick). Larger projects can contain several small scenarios. The scenario building bricks, i.e. elementary activities are something like « search on the Internet", « insert a link", « make a comment », « co-edit a text », « vote for something », « enter an item in a glossary ». It is needless to say that portals can not provide all the tools that can be imagined, e.g. on-line drawing programs are hard to find, but in order to insure discussion, annotation and reuse, at least the products of these activities should be posted on the portal. Let us now examine the example of a scenario called « references list » that we previously introduced and that has the following definition in the TecfaSEED catalogue :

Table 3 : The technical-structural template for a « reference list » scenario

Title	References list
Goals	Web search, classifying, conceptualization, synthesis...
Public	11 years old students and more
Description	The students have to work on a theme they don't master for a project. They have to create together a list of Web sites that will help them work in a later phase. These sites will have to be described and classified.
Duration	From several days to several weeks
Steps	• The teacher introduces the theme, gives clues and asks students to consider the different aspects of the subject. (« IntroWork » or « BrainStorm ») • Students search the Web with various search engines and bookmark the links they find interesting (« SearchWeb » or « KeepReference ») • Students then try to work out a certain amount of categories and sub-categories for this theme. (« CreateCategories ») • The results are put in common and a hierarchy is worked out (« CoEdit ») • The approved categories are registered in the portal (« CreateLinkSpace ») • Students classify, register and describe their links (« SubmitLinks » or « CommentLinks »)

Each scenario described in the catalogue is made of a certain number of steps that can be described in terms of generic elementary educational activities, which we labeled with a tag, like « BrainStorm » or « SubmitComment ». Technical « C3MS bricks » can also support most of these labeled generic activities**.** A teacher can therefore plan educational scenarios with the help of a more abstract vocabulary that will help him to choose from a set of supporting technologies. Here is an example taken from the catalog showing the definition of an elementary activity:

CoEdit : Creation and modification of collaborative documents. Available C3MS

Bricks :

- « Wiki » : Creation of collaborative documents that can be edited by all members. The identity of « actors » doesn't appear on the screen if they don't wish
- « CMS » : Content can be edited through forms and will be inserted into a menu structure, it will be possible for others to modify it but this will be less adapted to collaborative work.
- « Annotation » : Annotation of a given text (in various forms).

3.2. A complex scenario template at high-school level

Let us examine now a larger, but not too complex scenario template that illustrates the basic principles of scenario planning that could happen in a specialized biology class at high school level. Imagine a class where students have to study wild-life of the area. One could imagine an inquiry-based scenario (Aubé and David, 2003) in which each student could select an animal to study. Each project could be defined individually, but the very general approach should remain similar for all participants as expressed in table 4. There also could be a certain amount of collective activities, like the construction of a glossary that defines essential terms. If the teacher considers that making a glossary is important for reasons like « students will better understand terms if they search and write and discuss them » or « students really should put some effort into understanding the vocabulary of a domain before they work with it », then he can adapt our « glossary-making template » to his own needs.

Table 4 : PROJECT "study wild life"	
	Main activities (scenarios)
1	Learn how to use a portal
2	Make a common glossary (including links to resources)
3	Define research subjects
4	Make research plans (including research goals)
5	Field work
6	……

The template for the glossary activity can be found in the figure below. It is important to state again that we only make suggestions regarding the different phases and that we neither suggest a single mapping to elementary activities nor a single mapping of elementary activities to a technical module. In other words, the teacher must be in control throughout the whole design process. In this context, educational technologists should only offer « half-baked » solutions. Ideally, teachers have to adapt a pedagogico-technical implementation to their conceptual and technical skills and to what is available. There is also a technical compromise to make between selecting the best tools for each task and not to overwhelm the students with too many tools to be used in a scenario.

GLOSSARY activity *(scenario)*		
Phases		***Generic activities***
1	participants identify interesting “words”	IntroWork, **BrainStorm**
2	agree on a provisional list	EditGlossary or EditPage
3	search for information and share links	SearchWeb, EditLink
4	synthesis and editing	**CoEdit**
5	teacher feedback	CheckWork
6	editing of final definitions	CoEdit

Generic activities	***description***	***Available C3MS bricks***
CoEdit	creation of collaborative documents	Wiki, ContentExpress GlossaryTool
BrainStorm	generate ideas	Wiki, News Engine, forums, Bulletin Boards
...	...	...

After examining the situation, a teacher may, for instance, come up with the solution in table 5. As one can see, he uses 3 tools (Wiki, Links Manager and the News Engine) :

Table 5 : An instantiated glossary activity

Phase		***Tools***	***Instructions to students***
1	participants identify interesting « words »	Wiki	After discussion in the classroom, each student has to select three terms and enter them to the Wiki as homework (first come, first goes)
2	agree on a provisional list	Wiki	In the classroom, the list is discussed and cleaned up and each student will receive 3 items to work on.
3	search for information and share links	Google, Links manager	Each student has to produce 4 links (day 1) and comment 2 other links (day 2 of homework)
4	synthesis and editing	Wiki	Each student receives 2 links and has to edit them. Students are encouraged to link to other items and external links.
5	teacher feedback	News engine	Teacher writes a feedback article, which is also discussed in class.
6	editing of final definitions	Wiki	Students make final modification to their work and will be evaluated on it.

This example illustrates the structure of *exploratory* scenarios. Generally speaking, a typical inquiry scenario workflow contains the following steps :

- Activities should start with some sort of conditioning that will generate curiosity, interest, and motivation and also show the interest of ICT as enabling tool. The initial classroom discussion and the perspective of publishing a nice glossary on the Internet should this. In addition, entering 3 words on a Wiki is not very difficult and will make students familiar with the particularity of this tool
- Activities should give space to discovery by induction and therefore include exploration, search for information, experimentation and formalization of working

hypothesis that can be confronted with the others. Activities in phase 3 partly implement this.
- Learners should be active and creative, even when they are involved in seemingly simple tasks like glossary making. They should discuss and cooperate with their peers. Our glossary scenario has some « built-in » collaboration requirements.
- Feedback is important for each student activity. Therefore, we also suggest a formal evaluation of the final product (including a score). The teacher may also give bonus points for cooperative behavior, e.g. forum messages or helpful comments for the other's work.

After this outline of the principles behind scenario design with C3MS we shall briefly describe some of our field tests.

4. Field experiments

We conducted a number of exploratory field experiments inside and outside our institution and in various contexts from primary school to graduate school. These pilot implementations show that the general concept is well received, but there remain a number of implementation issues, particularly at the primary and secondary school levels.

4.1. Example of a « light-weight » Internet activity for children

Our team participated in several « Internet activities » that we designed together with auto-selected active teachers and/or non-governmental agencies and that concern extra-curricular activities like « water », « ecology of polar regions » or children's rights. We shall briefly report here on some lessons learnt from an annual two-month activity we are running with our « Terre des Hommes » partners since 2001 (see Website TDH). Pedagogical activities in the portal have been opened to any class wishing to participate. In the 2002 edition concerning the particular topic of « migration » we mainly worked from classes around Geneva and from Burkina Faso. In the 2003 edition, we worked on « water » with classes of students from Geneva, but also with different countries from the third-world.

The 2002 edition was designed to support the following activities from which the teachers could choose or make combinations :

- A discussion forum to initiate dialogue between different nationalities. Different topics were created according to various lines of reflection determined by the core group of « Terre des Hommes » volunteers and participating core teachers.
- Article sections contained stories about concrete migration experiences and were opened to discussion.
- A quiz section allowed testing knowledge about migration and legal programs. Teachers could submit their own quiz (including ones produced by their own class)
- Pupils could submit their own experience as stories.
- A poem tool allowed publishing and commenting poems.
- A photo album was meant to present classes to each other or to show pictures and drawings of other interest.

- In addition to this interactive tool, the portal contained various structured informations.

These types of activities are not particularly original , but when the occasion arises, some teachers created longer structured activities to integrate, as an example, the « children's rights » theme into a curricular context, in the French class. It is important to mention that most of the teachers in our area only used to produce Web pages and simple « threaded forums » with their classes. Therefore, our own goal was to make teachers familiar with the idea that a large variety of little interactive tools appropriate for different tasks exist, and that different tasks could be integrated into larger and richer scenarios. It turned out, that most of the teachers were only able or keen to implement shorter activities, preferably using the forum. However, each year we could observe a little increase in quality (richer scenarios that are also reflected by better productions in the portal). Teachers encountered many conceptual, organizational and technical difficulties and we shall discuss some of the issues in the section on Innovation and Change Management. In the 2003 version, which addressed the topic of « access to water », we overhauled the portal to improve the quality of student writing and exchange, e.g. we replaced the forums on « annotable » articles of the news-engine since modern Internet forums do not seem to « work » with children. By adding a scenario description tool accessible only to teachers, we encouraged them to define and exchange definitions of long and lasting scenarios and indeed a few of the more experienced teachers did participate in this game.

To resume the experience, we now think of Internet activities as a method to train teachers. We found out that more experienced teachers are inspiring teachers who are not familiar enough with this kind of activity. It takes at least 3 years to a community of motivated teachers to reach an interesting level of pedagogical design within the space of activities that a portal with a few simple tools can offer.

4.2. Example of a project-based course at university level

Computer-supported project-based courses can nicely be set up in a « blended situation », where face to face teaching is mixed with distance teaching. The methodology and techniques we are reporting here are developed and studied by Synteta (2002) as part of her PhD Thesis and have been tested within the author's own teaching. Variants of this model have then been carried out for 2 other classes in our unit and for 2 distance teaching courses outside our unit. We estimate that the methodology is ready to be used, although adjustments are needed in several areas.

The course that we shall briefly describe here was about « exotic hypertexts » and taught in a mixed format by the authors in 2002. It lasted 6 weeks, with a few initial half days in classroom and a 2 hour presentation of the projects at the end of the course to 12 graduate students in educational technology, who were from many different backgrounds. The students were given a large freedom of choice of subjects within the general theme. The basic requirements were to produce a research plan, to respect task schedules, to participate in mandatory collective work (including diary writing), then to execute the research plan and produce a draft on paper that presented results.

Several pedagogical goals were set, namely (1) Learning something about a specific topic related to more exotic hypertexts (Topic Maps, MOO spaces, Wikis, RDF/RSS syndication, etc.) ; (2) Learning XML ; and (3) learning how to run exploratory projects.

Table 6 shows the outline of the major students activities for which a certain number of tools had to be used by the students.

Table 6 : Major phases of the Staf-18 course on « exotic hypertexts »

	Major Activity	*Date*	*imposed tools (products)*
1	***Get familiar with the subject***	21-NOV-2002	links, Wiki, blog
2	***project ideas, QandR***	29-NOV-2002	classroom
3	***Students formulate project ideas***	02-DEC-2002	newsengine, blog
4	***Start project definition***	05-DEC-2002	ePBL, blog
5	***Finish provisional research plan***	06-DEC-2002	ePBL, blog
6	***Finish research plan***	11-DEC-2002	ePBL, blog
7	***Sharing***	17-DEC-2002	links, blog, annotation
8	***audit***	20-DEC-2002	ePBL, blog
9	***audit***	10-JAN-2003	ePBL, blog
10	***Finish paper and product***	16-JAN-2003	ePBL, blog
11	***Presentation of work***	16-JAN-2003	classroom

Project ideas have previously been discussed in the classroom. Then, the course starts with a « wake up » activity in which students had to fill in resources into the Links manager, and few definitions in the Wiki. The classroom activity also includes some traditional teaching, i.e. several introductory lectures plus some questions. The next step consists in formulating projects ideas as articles by the students.

Once they started working on a project, students had to use a special purpose project tool named ePBL, which stands for « Project-Based e-learning » (Synteta, 2003), they had to define particularly research plans with a specially made XML grammar. The required information did concern overall aim of the project, research goals and questions, work packages, etc. Students could upload these files to a server by the means of a « versioning » system. Since students had to work with a validating editor (of their own choice) the XML grammar reinforced the research plans according to some norms. More importantly, the grammar acts as scaffolding or thinking tool helping the students to produce and structure ideas. Contents of the uploaded project file are automatically parsed and summary information is made available in a students/teacher cockpit. Students were asked at regular intervals to update the project file (including workpackage completion information). Teachers then use the cockpit to annotate the project with comments and to register a more formal evaluation. After each audit the teacher also post a summary article in the portal. At the end of the course, students had to write a paper, using once more an XML grammar from which an electronic book containing all the work has been produced.

In addition to the above mentioned main activities, other interactions were carried out. Sometimes, articles about a course-related topic were posted (even spontaneously by students). The portal has also support forums (both technical and conceptual), it displays RSS news, and feeds summary of the news from other interesting sites. Some side blocks contain awareness tools (that is connected, that is passed by new messages in forums, etc.). A shoutbox (mini-chat) was used to reinforce the feeling of being « present » and for short messages from the teacher. Other tools include a calendar and chat rooms. Lastly, after each activity students had to make a diary entry (personal Weblog) that gave the teacher important information on encountered difficulties. The students have also used this tool and the Wiki as personal sounding board.

The main tool used by the teacher besides the ePBL project definition and monitoring application tool was the news engine. It was to be used to announce activities (at least one / week) and to provide feedback regarding activities or observations (namely major difficulties found in Weblogs or forum messages). The news engine therefore is a « heart- beat » tool that gives « pulse » to the whole process, which is considered as very important.

Results of this activity and several experiments with other teachers were very encouraging. We found that all students defined interesting projects (either some exploratory empirical studies or some technical developments) and that they came up with interesting results. The quality of the final paper in this specific course was not generally very good, but then only a draft has been required and we hardly could ask more in a period of 6 weeks. We found that by using this design, students worked harder and respected deadlines much better than others did in previous promotions. Class spirit was quite extraordinary and we shall comment on this later. It also turned out (and this is not surprising) that teacher involvement was a very critical variable. Constant pressure, but also rapid feedback and availability of both the teacher and his teaching assistant were judged to be highly positive in student interviews that we carried out.

We are therefore quite happy in claiming that this quickly outlined design seems to be a good instance of the teacher as facilitator, manager and « orchestrator » paradigm. There were, of course, difficulties encountered in our Staf-18 course, in particular, working with an XML grammar at the very beginning of their studies was both a culture shock and a technical difficulty for most students. They never encountered structured text before and had big difficulties to adapt to a knowledge-tree organization of text. They also had initial difficulties to work with several tools at the same time and to participate in collective knowledge sharing and confrontation activities. However, since activities were mandatory and tools were gradually introduced they very quickly (after about 2 weeks) felt even « at home » in the portal, and really appreciated learning together, a subject we will look into now.

4.3. Community, flow and creativity boosting with C3MS portals

Let us come back to « collective work » perspective. As we have shown before, C3MS portals provided rich « functionalities » for pedagogical « story-boarding ». They have been designed first of all as community portals and therefore are ideally suited to boost collective learning, creativity and optimal experience. Individual experience should always be exposed to the community who, in turn, can positively influence individual work. Collective support concerns several dimensions, some of which have always been of interest to the designers of virtual environments. It is clear that we cannot draw a neat line between activities that were triggered because they are built into pedagogical tasks and activities that happen more spontaneously. Finally, it is noteworthy to point out that the architecture described below could also nicely supplement « old-school » teaching or mainstream e- learning.

First, the portal should be a rich information space for « domain support » and it should encourage students to add their own contribution. Such a space also encourages exploration. The typical tools used are links managers, Wikis, news engines and RSS feed that keep users up-to-date about articles posted to other interesting portals or individual Weblogs. Intellectual support is provided *via* forums, annotations and articles. Student productions are always accessible to all (including visitors) and therefore provide for recognition. In our experience, it has been shown that students are more likely to contribute to an environment if they own an identity. In the student's partly automatically generated home page on the portal one can see their contributions, read public parts of their personal Weblog and conversely each production in the portal is signed with a clickable link to the author. In addition, we developed a tool that allows to list and display in detail all student productions throughout the various tools.

A successful teaching by projects pedagogy needs to provide strong emotional support and it is therefore important to encourage spontaneous, playful interaction and corners for humor that will augment quality of on-line life and contribute to class spirit. Tools like the shoutbox or a little quotation box can do wonders. Here is a little conversation extract in French from our students in the middle of the night (":frown" ":green" ":eek" etc. correspond to various smilies that are graphically rendered) :

```
bourgnon|YOUPI !!!! Posé !!! A demain les amis :)
sangin|belle nuit blanche en perspective. Deja que ai dormi que 3h les 2
dernières    nuit! :frown
rebetez|Mirweis tu ne retombes pas malade s'il te plaît ! :eek
gonzalez| :green  :D FINI !  :D  :green
rebetez|YEAH !! :green  :green  :green  :green  :green
duclaux|Il y en a qui ont de la chance !!!
sangin|conclusion!! go go!!  :red
sangin|un peu baclé mais fini! reste a uploader  :roll
sangin|j'aime pas les deadlines ...grrrrr !!!!  :frown
sangin|arg!oublié les références. C reparti!  :eek
sangin|bon ça suffit! On s'arrete la sinon dodo pendant les cours demain
 :red
sangin|arg! encore une nuit blanche presque  :frown
duclaux|ouf  :? ya plus ka bloger  :green
```

Last, but not least, a personal Weblog (diary) can stimulate meta-reflection, in particular if the teacher requires that students write an entry after the completion of each activity.

Our observations lead us to conclude that pedagogical portals should also be designed in the spirit of true virtual environments that have drawn a lot of attention in the last decade. They never met expectations, mostly because truly interactive pedagogical virtual « worlds » are either very difficult to implement or rather difficult to use in the case of simpler text-based environments such as the MOO. Let us discuss a few features outlined by Dillenbourg, Schneider and Synteta (2002) : A pedagogical virtual environment (VE) consists in a constructed virtual information space built with the appropriate tools as outlined above. A virtual environment (VE) is also a social space, where pedagogical interactions take place. Different spaces become places and the places are populated (Dieberger, 1999) and configure social activities. This is not actually true of portals, but it is possible to see at least who is connected, who « passed by lately » and who did what. The same is true for its geometry, virtual space is not truly represented in a portal, but « traces » left by students are a step in this direction. Students in a portal are not only active information users and exercise executors as in e-learning, but they do co-construct the environment. They may not add locations like in MOOs or certain online games, but they are at least co-architects of the information space. Virtual environments are multi-purpose, they do not just provide a container for specific activities, they can even be used inside the classroom and provide a number of functionalities that support multiple pedagogies, even traditional content transfer and quizzing if needed.

C3MS systems provide a lot of means for implementing a VE, but experience with interactive collective environments shows that technology itself does not necessarily provoke the emergence of a true on-line community where users are « present » and engage in rich interactions. In order to keep it « alive » the teacher really has to integrate at least some collective tasks into the pedagogical scenario (like co-construction of dictionaries, sharing of Web links, posting of great ideas found during project execution, rationale about certain concepts, etc.). Furthermore, the teacher has to insist that all the communications (except face to face) should take place inside the portal, e.g. he has to refuse to answer questions by e-mail and to insist that students use the forum. According to experience, only about 1/4 of all learners spontaneously use the community features of a portal, while another half can quite easily be convinced through the design of appropriate scenarios. Once the space starts building up (including their own productions) and once they have been through the experience of peer assistance and emotional support (1 hour before the deadline at midnight) they start to develop « a feeling to be at home ». Of course, to make this happen the most important variable is the teacher engagement. He has « to be there ». This is the reason, why we do not use the very popular term of « learner-centered pedagogy » for our approach. The pedagogies we advocate, are very much teacher-centered as well. The teacher's role as facilitator, manager and « orchestrator » is far more prominent than the one he has as simple content presenter and exercise monitor in a « traditional » pedagogy.

5. Innovation and change management

Our survey on educational use of community portals came up with few hits when we started the project, however awareness of their educational potential (and in particular of Weblogs) is growing among various stake holders like software providers (Fox, 2000 ; Gilroy, 2001), teachers, researchers (Ashley, 2002 ; Baumgartner and Kalz, 2004), educational technology support (Davies, 2002). It is also noteworthy to point out that exist thriving niche markets for specialized applications like Wikis which have and can be easily used for a wide range of rich scenarios (Collaborative Software Lab, 2000). What we can learn from this CoWeb/SWiki CSCL-as-authoring-experience (Guzdial, Rick and Kehoe, 2001) is that teachers are very open to radical new pedagogies provided that the technology be simple and effective and under their control.

5.1. Towards a scenario and modules economy ?

Since C3MS systems have a modular and an extensible architecture they can be adapted/ combined/configured to many specific usage in the scenarios. Our hope is to create some sort of educational modules economy with the PostNuke platform in order to gain an initial experience in this area and then to help creating an international « street » standard over few years which later (in 5-10 years ?) may lead to more formal standards (Koper, 2001) and tools. So far, these « scenarios and portal modules » economy did not happen outside a larger local community. However, the idea has been well received as discussions through our scattered activities have shown. It is also noteworthy to mention that the « C3MS » label that we invented at the start of the project in 1991 (Schneider, Frété and Synteta, 2002a ; Schneider, Synteta and Frété, 2002b) turns up an increasing number of hits in search engines, talks and even publications (Baumgartner and Kalz, 2004).

5.2. Technology and teachers

Technology should appeal to teachers with different levels of technical competence and different levels of « activeness » in order to be acceptable by the teacher community. We discriminate five levels of use with respect to how they are appropriate to learning technologies : (1) Reusing — Teachers who appreciate ready-to-use material : In our case, this is a scenario that has been « instantiated » with content, typically through a so called « Internet activity » ; (2) Editing — Teachers who feel the need to modify the content of a scenario they appreciate ; (3) Designing — This means in our case to compose completely new scenarios by re-assembling basic components. Teachers can set up the portal from an increasingly large set of « core » or 3rd party modules and over time, modules specially made for educational purposes will appear from various authoring communities apart from our own. (4) Repurposing — Teachers can adapt modules developed for another purpose. For example, in one of our teacher portals, the tool used to describe pedagogical scenarios was originally designed to describe food recipes. All we had to do was to change labels for display ; (5) Programming — Some teachers like to program and we can expect them to develop modules. The same teacher could borrow objects at levels 1, 2, 3 or 4 at different times according to his availability, his familiarity with the environment, and his involvement in the community. Our C3MS approach allows teachers to have a lot of control according to their level of experience. However, unlike the Wiki approach it is not as simple as we found out in our field experiments, since the teachers do not just need to be convinced, they also need to be trained, as we have seen in our experience at least for one week to reach level 2 and several project-related extra-days to reach level 3.

Our local strategy is also to train local ICT support persons in the school system ; to sponsor Internet events led by specially motivated actors (teachers, NGOs, etc.) where other teachers can « just participate » to whatever degree they wish ; and to propagate the use of portals for community purposes (e.g. school Web sites). We are aware that this « new language » which involves both new pedagogical behaviors and appropriation of collaborative Internet tools can only be introduced very gradually (over several years !) to a larger audience. In addition, it will take several years to make this technology user-friendlier than it is now. However, there are many good examples that were implemented by teachers themselves without much help from our research laboratory and we hope that they will inspire other local teachers.

5.3. Teacher communities

We also should point out that community portals are becoming popular in other contexts. Increasing familiarity with this tool and perception of its general usefulness for « real life » will help introducing it to education (like the successful use of « ordinary » word processors to teach creative writing). Success stories of new technologies in education are often related to the teachers' ability to insert it into existing knowledge. In other words, it is easier to promote change when teachers can relate to « models » they know, even if they are not necessarily related to teaching. Teachers who are able to understand the meaning of simple bricks through their own experience might be more willing to use them for pedagogical scenarios, i.e. teachers must have an operational awareness (von Glasersfeld, 2001) in addition to operational control. Moreover, sporadic initiatives exist for building school or campus portals that are actually useful to the community and not just a presentation/information tool designed by some central service as window to the outside world. Such portals could add support to teaching activities by giving each teacher his own C3MS space. We managed to give support to teacher portals (one counting over 1000 members) without actually being the driving force behind it. Some teachers who are active in these portals are now aware of this technology and are much more ready to use them with their own students.

Portal technology is also a tool for networking between communities. Groups of individual teachers can run their very own portal according to their precise needs and still be connected to other portals. Automatic syndication (RSS feeds) allows members of one portal to be aware of what happens in another portal or even in individual Weblogs. Teacher's portals can also feature news summaries from research portals like TecfaSEED or even official ones (provided that their administrators understand something about RSS). By this way, communication flows are insured and teachers remain in control over their own virtual presence, being therefore much more motivated.

5.4. Difficulties

While conducting our field experiments, which are run according to collaborative design principles we ran into many difficulties. Some of these are major and we briefly shall discuss the ones encountered at primary to high school level in the official school system. Before going into details, we care to mention here that teachers are not particularly slow. The same kinds of difficulties we will describe are faced by all organizations that try to introduce in a milieu new behavior patterns and new technology. We therefore feel that it is perfectly normal that ideas expressed in this chapter will take about 2 or 3 years to « get across » to willing teachers and probably 10 times as much to the whole system. Let us now examine the four major issues we have identified :

(1) **Few users (teachers and learners) have** « **portal literacy** ». Spontaneously, most of them only use a fraction of the offered functionalities that are available. Frequently they do not even have the technical know how, e.g. we were very perplexed to observe that modern and very popular forums like PhBB can lead to near-disasters in Internet activities, since neither teachers nor students are used to a « boxed » forum model. Some of these problems are clearly related to ergonomic issues, but the problem remains even with well-defined interfaces. We therefore are facing a new digital divide that is more than technical. To express it in a bluntly manner, the modern interactive Internet that makes use of complex « cockpits » is largely unknown to education.

Our first strategy is to install portals, even if the task does not require it. This way, students and teachers get familiar with the typical layout of a portal, even if they only use a single tool like the forum. These portals had other tools configured for activities, like the news engine , a poem editor, a glossary editor or a picture album. Some were just passively consulted, but not actively used in class. However « looking-at » demonstrates what more experienced users can do, and after a year or so teachers are willing to invest into diverse interactions with the system. As we mentioned before, a related strategy is to help teachers to run teacher community portals and we encourage them to syndicate news among them so that they can see what happens on other portals in other places. In the beginning, « our » teachers wished to work with very minimal configurations, but quite soon they started to experiment with additional tools, e.g. a Links manager or a Wiki. They also can be quite enthusiastic about « fun tools » like a random quotation engine, a shoutbox, or mini-surveys.

Finally, we offer technical help including hosting and training courses. According to our experience it takes a least an intensive training week to help a teacher to start thinking about pedagogical « story boarding » with ICT and to master the required technology. Even after such an initial training, few are actually doing anything « of scope » immediately after, but after a certain maturation period that can last up to two years they start experimenting and need assistance again. This is a well known pattern from innovation research.

(2) **Pedagogical scenario planning (**« **story boarding** »**) and execution** is unusual and very few teachers can « spontaneously do it ». The TecfaSEED catalog and other resources that can be found on-line are useful, but they are by no means sufficient. Either formal training or open and patient support on a peer-needed basis is quite essential. However, teaching ICT and new pedagogies to teachers in a classical way is fairly useless (it has been done not so successfully over the last decade). The right strategy is more about helping teachers to fix themselves innovative pedagogical goals and then to assist them, because we do respect the central role of the teacher and let him decide. At the same time, we clearly try to convince them that they should listen to new

ideas and not be afraid to experiment and re-experiment. New ICT-supported pedagogies also can be introduced gradually like our « Terre des Hommes » example shows. Not surprisingly, after two or three experiences spread over time, « things start rolling ». Again, we repeat that peer-to-peer support is crucial and we, therefore, support teacher-run teacher-portals and teacher-led initiatives as much as we can.

Another issue concerns overscripting. Constructivist theory points out that students need some space of liberty, do have to formulate goals and finds, do have to make errors, otherwise they will not develop general problem solving capacities, i.e. meta-cognitive capacities, which is a clearly stated goal of active, and rich constructivist pedagogy. As a corollary, teachers must expect breakdowns and reasons leading to opportunistic scenario adaptation. Larger projects usually contain different pedagogical goals and according to this, students may encounter several preparation activities throughout the project. Often, they should be choosing their subjects, their working strategies themselves and formulate their own goals. In this case, the teacher should prepare and master a certain number of path breaking inputs and give advice according to the needs of the learners. These rather retroactive inputs differ from the proactive strategy of a more traditional instructional design approach.

In other situations, more precise goals are given (e.g. « enter 6 glossary items » or « define a list of sound research questions »). In this case, students may not carry out the expected actions that require new regulatory inputs, e.g. the teacher could post an article with feedback and advise to the news board. He may even formulate new pedagogical goals and adapt his « script » accordingly. A so-called regulatory input is described in Dillenbourg (2002) as a part of a « phase » in a larger scenario. He allocates five attributes to a phase : the task that students have to perform, the composition of the group, the way that the task is distributed within and among groups, the mode of interaction and the timing of the phase. A regulatory input can contain all five elements but can also consist of a single part of it. If learners pass from one presumed activity (or action) to the next, the teacher input is not mandatory. Regulation is a subtle and individual intervention that needs to be adapted to every single learner as far as possible. It is one of the most important guiding tools. Such short inputs can range from encouragement to reorientation.

For many teachers it is quite difficult to find a principle of « harmony » between freedom and control, between construction and structure. They often cannot accept that some intermediate products do not need to be « finished », that students may ignore instructions regarding products that do need to be finished and that scenarios elements may fail, etc. According to our little experience, the only way to teach scenario planning and its realization to teachers is to have them go through such an experience themselves. It can't just be « explained ».

(3) **The most difficult factor is time**. As we said before, teachers can be sensitized to new approaches rather quickly in less than a two-year period (comprising maybe a training course and at least one or two participations in « Internet projects »). But the organization of school life into isolated lessons above primary school level and the absence of project-based teaching in the curricula make it very difficult to organize interesting and longer lasting activities. There is not much we can do about this as a research team, except to make life as easy as possible for teachers on the technical side

and to provide them some conceptual support and encouragement.

There are a few possibilities to « beat time ». One is to encourage cross-curricular activities, but this is not an easy task since teachers are used to work alone. Another strategy is to integrate extra-curricular project-based activities into mainstream activities like language teaching and to « smuggle in » traditionally difficult and time-consuming activities like grammar and writing. Finally, after a recent pedagogical reform in upper secondary (high school), teachers can conduct intensive specialization courses where they enjoy a lot of freedom. The most creative experiments we have observed did happen in biology classes where complex Wiki activities have successfully been conducted (Lombard 2004 ; Notari, 2003). The same school reform also requires students to do an « end of school project » of their own choice, which would be an ideal area to do experiments. The worst situation clearly concerns highly structured lower secondary school and we remain quite uncertain about our contribution to that milieu.

(4) Despite all these difficulties, interesting experiments happen at all levels of school. But unfortunately teachers who « can and want », face **administrative resistance** and we do not mean official school policy that in principle does favor creative experiments with ICT. First of all, teachers have to face hostile and frequently incompetent PC managers, for example, Internet ports are censored by lazy and sometimes equally incompetent network administrators. This means that teachers cannot use creative applications like SWiki servers or MOOs. In some areas (Switzerland's education system is decentralized) very strong forms of censorship exist. In order to add contents to official school servers, teachers have to pass it through a reviewing committee and it requires a lot of time. Because of pedophilia it is sometimes strictly forbidden to put children's pictures on the Internet, and that denies them identity and therefore motivation. Finally, it is sometimes very difficult to host teacher-selected portals on official servers for multiple reasons, e.g. fear for loss of control, or sometimes laziness and incompetence of systems administrators.

Our solution here is quite simple, we either host these projects or we teach them how to install portals with a private provider. Since Switzerland is a democracy and since teachers have permanent jobs they do not run into trouble with this strategy, provided that they obey official guidelines requiring, for instance, that parents be consulted if pictures of children are to appear on the Internet.

We just add a short comment about the university level. We do not face the same issues here, since a professor can pretty much run a course like he pleases to do so. The issues concern simply pedagogical training and resources. Changing a teaching strategy and running high quality project-based courses require indeed a lot of investment that does « not pay » in terms of a career, while it is a sort of requirement that teaching be « decent », pedagogical excellence and deep involvement to tutoring are not rewarded at all. In addition, recent programs that sponsor ICT in university education with quite substantial grants require that funds be funneled into content production and « accreditable » distance teaching (main stream e-learning). It turned out, that almost none of the actually financed projects would be sustainable as distance teaching courses and that anyhow most projects adopted a « blended » learning perspective. Therefore, there might be hope that in the near future decision makers will invest money to improve the quality of teaching and to sponsor interesting blended learning formats.

Finally, it is important that university teachers can gain intrinsic value from such courses. Allowing teachers to teach at least one project-based course on a changing subject of interest to the teacher-as-researcher where student output could become input for research would be an interesting solution to increase teachers' motivation.

Conclusion

We do believe that there are new opportunities for socio-constructivist scenarios such as the ones we have described here and in our evolving TecfaSEED catalog (Schneider, Chakroun, Dillenbourg, Frété, Girardin, Morand, Morel and Synteta, 2004). Community, Content and Collaboration Management Systems (C3MS) present functionalities that teachers are keen to have, like news/comments, forums, simple CMSs, Wikis and others. These tools offer support for the accumulation, organization and display of contents as well as many forms of user interaction. This allows creating rich and flexible pedagogical « workflow » scenarios. In addition, a well-configured C3MS portal is a community engine that transforms a pure work tool into a collective and collaborative « place » that boosts class dynamics and organizational learning within the group (Paavola, Lipponen and Hakkarainen, 2002 ; Stahl, 2002). In our opinion, a pedagogical portal should have a « clear focus » but « fuzzy edges » (Rieber, 2001). As we design it, a pedagogical portal marries the more rigid « workflow » approach often encountered in modern socio-constructivism with the spirit of open virtual environments that provide a feeling of « place » with identities, social rules, multiple activities, and therefore what is often called « presence ».

Often, one will associate new rich and open pedagogies with « learner-centered », but we believe that being « learner-centered » is not sufficient. Mainstream eContent-centered eLearning also rightly claims to be learner-centered, since students can look at contents and do exercises and tests at their own speed. Good learner-centered pedagogies may also be very teacher-centered, since the role of the teacher can become very complex and quite demanding. Let us recall the three principal roles that we attribute to the teacher-designer of structured, but active, open and rich educational scenarios :

- His role as a manager is to ensure productivity, i.e. that learners do things.
- His role as a facilitator is to help them in their choices and to suggest resources and tools that will help them to solve problems and get tasks done.
- His role as an « orchestrator » is to create « story-boards », i.e. to break down projects into scenarios, and scenarios into phases. He also may decompose problems into manageable sub-problems or alternatively encourage and help students to do so themselves.

In our philosophy, a teacher should think of himself primarily as a « land-scaper » who uses ICT to build places where learners can « sculpt » according to some rules and with as much help as needed. Because of their modular architecture, a well-trained teacher can configure portals and its « tools » according to his own needs. He can also hunt down new modules. He can re-purpose tools, e.g. he could use quizzes which are normally planned for assessment as discussion starters. He can also suggest to the increasing number of technical support people that can be found in the school system to develop new tools. Since this technology is focused on « orchestration » and not content delivery, we believe that it will spread in the near future with almost the same ease as Web pages did, but it will bring new functionalities. Teachers should have control over their environment and they should share their experience within teacher portals using the same technology. Both statements fit the C3MS philosophy. Finally, C3MS may be a chance to promote the open and sharing « Internet Spirit » to education, that is threatened by the philosophy of the closed so-called « educational platforms », e-learning systems or whatever are called today's mainstream systems sold to the educational system. According to our initial experience, and despite many difficulties — like administrative hurdles, the time it takes to accommodate new pedagogical strategies, the disputable ergonomics of some software that we will have to overcome— teachers who engage themselves « love it » and their students too.

Practical information :The TecfaSEED teacher's catalogue and the Tecfa community portal

This small portal is a bilingual (English and French) low traffic center for exchange and collaboration on educational technologies. In addition, we also use it for some of our teaching activities. You are encouraged to submit News, use the forums, add or consult Web links, or any other application open to the public. We also provide a limited form of conceptual and technical support in the forums.

URL of the community portal : http ://tecfaseed.unige.ch/door/

- Downloads section : interesting PostNuke modules, include the ones developed by our research team.
- The evolving TecfaSEED catalog : a pedagogical and technical cookbook for the pedagogical designs we advocate in this chapter
- Pointers to open Internet activities for schools (like « Terre des Hommes ») and observable project-based learning classes (like STAF-18) we described here.

Related Websites :

- http ://tecfaseed.unige.ch/tdh03/ (TDH 2003 Internet activity)
- http ://tecfaseed.unige.ch/tdh/ (TDH 2002)
- http ://tecfaseed.unige.ch/staf18/ (STAF-18 project course)

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