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Preface

During the last 20 years, following the development of new technological tools, coupled with the increasing need for life-long learning, e-learning activities have drawn widespread attention. The interest towards e-learning, in turn, has given rise to a considerable amount of activities, experiences, and research on the application of technological support to learning activities - especially in higher education. Thus, Open and Distance Learning (ODL) and Information and Communication Technology (ICT) in education have progressively become important fields of interest, both for scholars and for practitioners involved in learning activities.

The multi-faceted character of e-learning allows for a multidisciplinary field of inquiry, which includes psychology (educational, social and cognitive psychology), learning sciences (pedagogical and didactic sciences), computer science (educational technology, artificial intelligence systems), and communication sciences.

The conference was an opportunity to present the results of recent work, and to discuss research findings with other scholars.

Maria Cristina Matteucci

About collaborative e-learning

Felice Carugati

Department of Education- Alma Mater Studiorum Università di Bologna

By definition, collaborative e-learning activities imply that participants perform their work together with other individuals, i.e., other participants, tutors, and teachers. Although there is significant empirical evidence that the cognitive processes that are necessary for learning and knowledge construction occur in social interaction, and that "collaborative learning" is the "royal road" to knowledge acquisition, putting two or more people in the same context is not a warranty neither that they will be able to collaborate, nor that they will be able to learn.

From the very beginning of research in social psychology (Triplett, 1897) it is well established that the mere presence of another is enough to modify the way an individual works, and a huge amount of empirical results have been collected: facilitation, competition, collaboration, group dynamics are only few examples of notions put forward for understanding the variety of phenomena documented; some of them if favor of beneficial effects, other against naïve interpretations that *two people are better than one*. As in many other phenomena both in everyday life and science, on-off interpretations are misleading if not wrong.

At the same time of the beginning of 20 century, the cultural historical approach to development and learning was proposed. it is not room today for discussing the vicissitudes the how and why this approach became for decades a part of what I propose to mention as the *underground psychology*, like the geological phenomenon of karst for rivers.

Puzzling enough since the seventies, psychology blossoms with a huge amount of notions and metaphors, referring to cognition and learning as a construction, social construction, participation, situated, collaborative. At the same time, computer becomes not only a metaphor for cool /cold cognition, but also a partner, a mediator, artifact, tool, and so on.

One could wonder whether the mirror effect between computer/mind (or cognition) in computer science and artificial intelligence and between computer /human being in other domains of psychology is a way of exemplifying the effort scholars witness for trying to operationalize the study of influence of various artifacts on learning.

Both computer/internet and a peer (a tutor, a teacher) should be conceived as partners, as the Other: Thus the presence of other people in the same situation, even in absence of any kind of communication, is per se a factor that leads to focalization of the subject (student) on the interpretation of situation (the meaning of situation), i.e. on the content (the task) and the relation to the partner (be it human or computer or internet devices). What kind of information/interpretation becomes salient, relevant? What kind of task and goal individuals should approach?

I propose two main theoretical tools for empirically cope with these questions: the theory of conflict elaboration and the performance/ learning goals approach.

Summing up a complex body of results, genuine learning is more suitable when the architecture of situation allow partners to enter in a confrontation with different initial solutions, to avoid performance goals, and to solve the conflict between different solutions, focusing on the way to integrate them, instead of entering into a relational conflict with the partner (even it be a computer):

who is right? I am right, you are wrong. It is well documented that conflict of viewpoints may be solved in relational ways (i.e., individuals seek for a compromise, avoid deepening the discussion, or simply try to overrule the partner in order to defend their positive self image), and in this case no positive cognitive gain occur. Conversely, when conflicts are solved in a epistemic way (i.e., by means of in-depth negotiation of information and critical examination of both partners' contributions), social interaction becomes fruitful for progress in acquisition of cognitive tools.
Research in social psychology has been describing some of the dynamics that effectively sustain cognitive activities in collaborative activities.

Let us briefly remind some major issues.
As for confrontation among students, an important pre-condition are the quality of their social skills, namely the ability to negotiate the use of different viewpoints as well as the willingness to give mutual support, as the result of the perceived quality of their social relations: it has been documented that friends are more open to deeply discuss about their divergent solutions without entering in competition dynamics.
Another major point is the partners' real or perceived status / role.
As an example of status reciprocal perceived expertise plays a major influence; research on identity threat is a case in point.
As for the partners' role it is important to underline the influence tutors /teachers play: if we take the Bronfenbrenner's ecological approach, concrete interaction between partners could be seen as a micro-system, while tutors/ teachers play their role as inserted in the eso-system of the learning activity. The reason I propose this theoretical framework (others of course are completely plausible!) is to suggest the opportunity to discuss and sharing, during this conference, the theoretical framework each of us is inspired by, besides the results of empirical research.

Another issue does concern the students' achievement goals. Moving from emphasis on motivation as an inner property of individuals, recent social conceptualizations about achievement goals (Dweck & Elliot, 1983; Elliot & Mc Gregor, 2001) have shed light on the positive/negative effects of goal pursuit in learning contexts. Briefly stated, goals have been differentiated between mastery/learning goals ("my aim is to improve as much as possible") vs. performance goals ("my aim is to perform well/better than others"). It appears that holding (or experimentally inducing in subjects) mastery goals positively influence persistence in effort, self-regulated learning, open-mindedness, as the goal is not simply to perform but rather to profit as much as possible from learning opportunities. The effects of performance goals are more complex. Holding "performance-avoidance" goals (trying to avoid failure) induces negative emotions and cognitions, low persistence in effort, withdrawal, and it is negative related to achievement; holding "performance-approach" goals (seeking for good performance and success) is related to high achievement when intermediate feed-backs are positive, but is related to negative emotions and withdrawal in case of ongoing negative feed-backs.
These results are important since it has been shown that goals are not only a property of individuals, but they are inserted in the educational policies of all school systems and stakeholders: I only quote today the emphasis in results of OCSE- PISA 2006 surveys and the inter-countries comparison, which sound like an amazing football European champions league: when some students will be awarded with a gold book, instead of a gold football?

it seems very clear and even trivial that in everyday academic systems performance goals not only are prevalent, but they are positively marked. In my opinion the issue of achievement goals could be adequately and theoretically conceived as a part of the macro-system of learning activities in Bronfenbrenner's terms, or put in another theoretical framework, as a constitutive component of social representations of education, which play a major role in inspiring both teachers and students, and permeate everyday life of school systems. Moreover achievement goals have been empirically manipulating with interesting results.

When interacting on a learning task, individuals may experience two different goals: Understanding the problem, or showing each other their competences. When a conflict (confrontation of divergent propositions) emerges from this interaction, it can be solved either in an epistemic way (focused on the task) or in a relational way (focused on the social comparison of competences). The latter is believed to be detrimental for learning. Moreover, research on collaborative learning shows that when they share identical information, partners are led to compare to each other, and are less encouraged to collaborate than when they share complementary information. I only quote an example of this research. An epistemic vs. relational conflict *vs.* no conflict was provoked in dyads composed by a participant and a confederate, working either on identical or on complementary information. Results show that, if relational and epistemic conflicts both entailed more perceived interactions and divergence than the control group, only relational conflict entailed more perceived comparison activities and a less positive relationship than the control group. Epistemic conflict resulted in a more positive perceived relationship than the control group. As far as performance is concerned, relational conflict led to a worse learning than epistemic conflict, and—after a delay—than the control group. An interaction between the two variables on delayed performance showed that epistemic and relational conflicts were different only when working with complementary information. Summing up, the importance of the quality of relationship when sharing information during cooperative learning, a crucial factor to be taken into account when planning educational settings.

Classical studies on socio-cognitive conflict (Carugati, 2004) have shown that interaction with peers (rather than with experts, adults, teachers, etc.) may be beneficial for acquiring more advanced cognitive skills. Moreover, a huge amount of studies has proposed that minority influence (i.e., being exposed to a source of influence that is minoritarian in our groups of reference) is more likely to promote deeper scrutiny of information, creative and divergent thinking, falsificatory approach to hypothesis testing in deductive reasoning, knowledge transfer and generalization of learning.

On the other hand, majority influence has been proved to stimulate convergent thinking, restriction of attention to elements already present in the cognitive field (focussing), confirmatory bias in formal and informal reasoning, tendency to protect one's own points of view rather than considering alternatives (either in formal reasoning or in argumentation. Anyhow, for minority influence, or peer-to-peer confrontations to be effective, it is necessary that all participants engage in the group activity, put forward their point of view, and are encourage to sustain their claims even if they are minoritarian in the group, and they appear to be incorrect at a first sight. On the one hand, because holding minoritarian or "loosing" position is not easy under group pressure, participants who find themselves in such situations may be likely to retire from group work, or to conform to the positions of the majority. On the other hand, the majorities may be likely to rule out participants with different points of view. In both cases, confrontation becomes a matter of relational power, and the beneficial effects of social interaction would be lost.

I should close, but let me quote a brief part of a paper I recently read whose title is

If Socrates had a PC:

If Socrates had a PC, there is no doubt that he would have mastered the nuances of the device without reluctance, as he once stated, 'Wisdom begins in wonder.' According to Socrates: There is only one good, knowledge, and one evil, ignorance.

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Social networks and knowledge construction promotion in e-learning contexts

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Abstract

The presentation concerns the "Minerva" project co-financed by E.U. aiming at identifying and promoting "good practice" in the design and delivery of e-learning courses (i.e., activities that teachers/tutors may use to foster social dynamics allowing participants to advance in knowledge construction). Accordingly to the principles of action-research, the project has been implemented in four subsequent phases, starting from October 2006, up to the end of October 2008: 1) an exploratory study on a sample of noteworthy e-learning experiences (on the European scale); 2) design and delivery of e-learning courses – in academic domains - based on emerging "good practices;" 3) process and outcome evaluation of e-learning experimental courses; 4) identification of "guidelines" intended to foster good practices useful to promote knowledge construction through social interaction and 4) dissemination activities (international meeting, web-diffusion, etc.). Principal findings will be presented during the conference.

Keywords: Socrates-Minerva action, European Commission, good practice, guidelines, social dynamics, e-learning.

1. INTRODUCTION

In the last 20 years the development of new technological tools and the increasing need of life-long learning, led to a growing attention on online education , that is e-learning activities. In turn, the interest toward e-learning has given rise to a considerable amount of activities, experiences and research on the application of technology for supporting learning activities - especially applied to higher education. Thus, Open and Distance Learning (ODL) and Information and Communication Technology (ICT) in education have become more and more a field of interest both for scholars and practitioners involved in learning activities ("providers" of education at different level and in different contexts).

Globally, this phenomenon has attracted a rapidly growing amount of research facing up technology-supported learning from different theoretical perspectives (for a review: Larreamendy-Joerns & Leinhardt, 2006; Resta & Laferrière, 2007). Moreover, its multi-facet character made e-learning a trans-disciplinary field of inquiry, including psychology (educational, social and cognitive psychology), learning sciences (pedagogical and didactic sciences, educational technology), computer science (artificial intelligence, agent-based systems), and communication sciences.

The increasing interest and use of online education gives rise to a vast panorama of experiences having in common the use of technologies within learning activities. Now a teacher or tutor aiming at organizing an e-learning course can wonder if all learning experiences using technologies are effective at the same level, i.e., which are the most effective strategies to adopt when planning and realizing e-learning activities, in order to foster knowledge acquisition in learners.

Starting from this emerging interest and demand from the field, applying a sort of "knowledge transfer" approach, the European project **"Social networks and knowledge construction promotion in e-learning contexts"** (http://minerva.ing2.unibo.it) has the main aim to provide ICT-practitioners with good practices and guidelines drawn from empirical research in psychology of education focussing in particular on the idea of social nature of knowledge and abilities developed especially in the Vygotskian tradition. In detail, based on research evidence concerning the complex relationships between social interaction and cognitive activities, we aim at detecting, describing, and suggesting educational practices and technological artefacts which may foster the beneficial effects of social interaction on knowledge construction.

Accordingly to the principles of action-research, the project will be implemented in four subsequent phases, starting from October 2006, up to the end of October 2008: 1) an exploratory study on a sample of noteworthy e-learning experiences (on the European scale); 2) design and delivery of e-learning courses – in academic domains - based on emerging "good practices;" 3) process and outcome evaluation of e-learning experimental courses; 4) identification of "guidelines" intended to foster good practices useful to

promote knowledge construction through social interaction and 4) dissemination activities (international meeting, web-diffusion, etc.).

2. RATIONALE

In the panorama of online education, three major education perspectives has been detected (Larreamendy-Joerns & Leinhardt, 2006): the presentational view, the performance-tutoring view, and the epistemic-engagement view. In the presentational and performance-tutoring views persists the pedagogical model based on single learner interactions with content, by means of the web-based system. In these cases (e.g., those based on accessible and standardized Learning Objects) "obsolete" uni-directional forms of knowledge transmission from the teacher (the expert) to the learner (the novice) are reproduced. Attention is devoted to the designing and delivering of high-quality didactic contents, which should ensure proportionate high-level learning outcomes. Interaction is mostly conceived as the possibility to perform effective exchanges between a learner and a technological environment that is supposed to provide the learner with all the best possible supports.

Educational research over the last 20 years has indicated that learning is a social process, a co-construction of knowledge process, enabling learners to become a member of community of practices through active participation (Lave, 1997). According to Larreamendy-Joerns & Leinhardt (2006), the epistemic-engagement view, based on the socio-costructivist approach and sociocultural theories of learning, relies on social interactions and considers that the learning process takes place in the context of social interaction. In this approach, social interaction (in a three-polar view of the learning process involving students-teacher-content) more than student-content interaction (a bi-polar view), is viewed as the privileged occasion for learning.

In fact there is ample empirical evidence that cognitive processes necessary for deep learning and information retention occur in social interaction and that "collaborative learning" is the "royal road" to knowledge acquisition (e.g. Kreijins et al. 2003). Experimental studies on social influence, argumentation, and reasoning suggest that these advanced cognitive outcomes are more likely to appear when participants are engaged in specific interaction situations (peer-to-peer interaction, minority influence, active cliques in virtual social networks, etc.), whereas other and more diffused social dynamics (teacher-

centred networks, etc.) are more likely to promote superficial information scrutiny and passive reproduction of delivered knowledge.

Summing up, despite the accumulation of research on the effectiveness of collaborative learning, learning and co-construction of knowledge are not an inevitable consequence of allowing students to interact with each other (e.g. Cacciamani & Mazzoni, 2006; Hoadley, 2004; Lehtinen, 2003; Mandl et al. 2006) and just placing students in groups does not guarantee collaboration: social interaction does not take place automatically just because an environment makes it possible from the technological point of view. Thus, although the power of social interaction and of collaborative learning, deeming social interaction as an instructional precept that requires no further explication and that constitutes itself a guarantee of learning is a pitfall to avoid (Kreijins et al. 2003).

Now we could wonder how stimulate social interaction fostering collaborative learning, which actions or practices can be carried out?

3. AIM OF THE PROJECT

The aim of this project is to recognize "good practices" and practical guidelines which may facilitate collaboration and support it in e-learning courses i.e., activities that teachers/tutors may use in order to foster the emergence of social dynamics that allow participants to engage in deep scrutiny of information, divergent thinking, and advancement in knowledge construction.

4. OVERVIEW

In the first phase of the research an exploratory study on a sample of noteworthy e-learning experiences (on the European scale) was conducted. In the second phase we designed and delivered e-learning courses – in academic domains – aiming at applying examples of "good practices". Finally, we identified "guidelines" and practical tips aimed at fostering practices and activities promoting knowledge construction through social interaction.

5. THE EXPLORATORY STUDY

Aiming at identifying which pedagogical and technological tools, activities or strategies are useful to enhance the effectiveness of social interaction in e-learning contexts, we conducted an exploratory study on a sample of noteworthy e-learning experiences on the

European scale. 78 experiences have been collected in several European Countries. The 74.4% have been realized within University courses or within life-long learning experiences.

Several aspects involved in the design of e-learning courses have been examined, in order to identify and to illustrate various examples of activities that teachers/tutors may use, in order to encourage the emergence of social dynamics that may allow participants to engage in the deep scrutiny of information and divergent thinking in order to advance learning.

In particular, the study explored several aspects, which are considered fundamental to the realization of successful e-learning courses based on effective online collaboration (for more details: Matteucci, 2007).

5.1. Questionnaire

A questionnaire has been created *ad hoc* to study some noteworthy e-learning experiences (on the European scale), and for identifying example of practices which may be considered existing "good practices" intended to foster knowledge construction through social interaction. The questionnaire consists of five main dimensions: General data (concerning *structure, procedure, and didactics,* the e-tutor, the course, and the participants), technical aspects (platform and most effective tools, features and technical possibilities to collaborate), organization of the group work and giving feedback and collaborative activities. Each of these dimensions is further subdivided into more specific aspects. In particular, as for the collaborative activities, drawing on the assumption that cognitive processes occur in social interaction (Doise & Mugny, 1984), we explored the design of the learning environment. As for the **cognitive** aspects of collaboration, the questionnaire included items concerning the learners' online discussion, argumentation and different perspectives contemplation, collaborative problem solving and knowledge exchange. As for the **social** aspects of collaboration, the questionnaire asked if dysfunctional phenomena of group work happened during the course (i.e., group conflicts, superficial discussions, dysfunctional competition, ignoring minorities, diffusion/lack of responsibility, and pursuit of personal goal) and the practices used to solve these problems.

5.2. Results

As for the cognitive processes, it became evident that tutors value collaboration very important. It should be noticed that the cognitive aspects of the collaboration processes are rated much more worthy of attention by e-tutors, compared to the social dynamics beyond the collaborative interactions. Therefore, most interventions, which were put into practice in e-learning courses, deal with the promotion of the cognitive functioning of individuals, rather than with the support of effective social interactions.

In particular, online discussion and exchange of knowledge seem to be the most important processes (M=5.19 and M=5.23 respectively) and the former, probably because of its more general character, is also the aspect in which e-tutors intervened most (80.8%). Collaborative problem or case solving is, on the contrary, the least important aspect (M=4.70), although the high variance of the score indicates that a number of e-tutors rate this aspect as much above (or much below) this average score. A possible explanation is that e-tutors who adopted problem-based learning are likely to consider this aspect as very important, while the other respondents consider it less important.

As for the social aspects of the collaboration process, the majority of e-tutors did not intervene, and the main motivation is that intervention was not necessary. Two principal interpretations can be formulated: 1) dysfunctional phenomena in collaboration were either not present or not noticed in several experiences; 2) in other experiences these social phenomena- if present -were not considered as a significant problem for e-tutors. The only aspect, which saw the majority of interventions by e-tutors, was actually the learners' tendency to turn to the e-tutor, in order to ask for content-related information, and to wait for answers, instead of posing questions to their peers. This may be explained with the fact that in these situations, e-tutors are directly involved in the phenomenon, since they have to do something in reply to learners' request/wait.

The most interesting and recurrent methods of intervention used by e-tutors to promote various cognitive and social processes of collaboration are similar, as far as practices are concerned. They consist in the creation of groups, roles/responsibilities assignation, use of rules/scripts, different forms of feedback (also of provocative nature) and various types of activities for learners (e.g. collaborative construction documents, discussions on peers' problem solution, ePortfolio, etc.)..

6. E-LEARNING COURSES AND EMERGING PRACTICAL GUIDELINES

After the exploratory research, in the next step of the project we designed and delivered e-learning courses based on emerging "good practices". Afterwards, the project foreseen to evaluate the processes and the outcomes achieved in the experimental e-learning courses and to identify practical guidelines useful to conceive and realize successful e-learning activities based on effective collaborative activities (following the principles of action-research,).

6.1. E-learning courses

Seven e-learning courses have been realized involving in total more than 440 students. They have been realized in university contexts. The courses intended to promote student construction of knowldge by means of different strategies (see table 1).

Table 1

	Institution	*Title*	*Target group (N)*
1	University of Bologna -Fac. of Psychology (I)	"Goal orientation in e-learning courses"	Adult Students (240)
2	University of Bologna -Fac. of Psychology (I)	"New technologies and training"	Adult Students (30)
3	University of Bologna -Fac. of Psychology (I)	"Promoting the quality of argumentation in forum discussions: an experience in a full distance statistics lab"	Adult Students (35)
4	University of Bologna - Depart. Electronics (I)	**"**Promoting student collaborative work in a software engineering course"	Adult Students (80)
5	University of Neuchâtel Faculty of Humanities (CH)	"Reasoning on data analysis for psychology and educational science"	Adult Students (20)
6	University of Neuchâtel Faculty of Humanities (CH)	Academic competencies on psychology and education (a course to foster studying competences)	Adult Students (87)
7	Ludwig Maximilian University – Fac. of Psychology and Pedagogy (G)	"Cognitive and social activities as well as tutorial support in a virtual seminar"	Adult Students (15)

6.2. Practical guidelines

Following the exploratory study and the e-learning courses we realized, we identified some practical guidelines functional to the practical realization and implementation of e-learning activities which foster knowledge acquisition and effective collaborative activities. As a matter of fact, the teacher/tutor especially influences the design of her/his e-learning course

and the support of the learning processes. Other factors influencing the learning process are input variables like individual or group characteristics. Practical guidelines identified concern the different design possibilities and support methods and the way how specific processes could be supported. In specific, we distinguished guidelines concerning the input, the process and the outcome of the design of the learning environment.

As for the **input,** we identified guidelines about how to design effective learning environments: and particularly, which kind of learning task provide and which didactical design employ. The group composition has been considered as well, in terms of group composition and organization. Guidelines about design principles concern also the role of the computer which is necessary as tool to provide information, to give individual feedback and to allow collaboration, as well as to technically realize collaboration.

As for the **process**, practical guidelines about hot to promote effective cognitive and social activities have been identified. Cognitive activities in collaborative e-learning courses comprise all activities which are related to knowledge or information exchange between the collaborators. The social dimension of the process is concerned as far as, by definition, collaborative e-learning courses imply that participants perform their cognitive activities together with other individuals (i.e., other participants, tutors, and teachers). In specific, we identified strategies and tips about how to foster sharing knowledge and online discussion in group work, to stimulate argumentation and the exchange of different perspectives, to support the organization and planning of group activities, to foster collaborative problem/case solving. As for the social side of the process, we outlined guidelines focused on how to foster constructive confrontations among students and conflict regulation, to promote motivation and to monitor group achievement goals orientation, to organize effective participation among students in group work, how to organize the group in terms of expert guidance and peer-to-peer active collaboration. Teachers' feedbacks have been object of analysis as well and we identified tips about content-specific feedback and feedback on collaboration.

As for the output, we presented a technique for monitoring and analyzing individual and collaborative actions in collaborative e-learning environment : the Social Network Analysis. Finally, we presented some guidelines about the technological issue, particularly about how to choose an e-Learning platform that may support social interaction.

7. CONCLUSION

The main aspire of the project was to promote the development of educational practices, and particularly of Open and Distance Learning, on the basis of innovative experiments and of the principal results of the socio-educational psychology. In particular, we intended to promote understanding among teachers and decision-makers and the public at large of the weight of social interaction in e-learning activities, and to suggest effective design principles. We hope to have attained our main aim by means of the good practices identified in a sample of European e-learning experiences and of the guidelines that we outlined at the end of this two-years work. We consider these findings as a step forward to the attainment of the Council Resolution relating to educational multimedia software, adopted on 6 May 1996, which emphasised that the use and evaluation of ICT in education must lead to an improved approach to meeting teaching and learning needs and introduce new methods which take full account of the evolution of the role of the teacher, give pupils and students a more active and participatory role, personalise learning, encourage a cross-curricular approach and foster collaboration and multidisciplinarity.

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Collaborative online learning: A heterogeneous phenomenon

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Abstract

This paper investigates the virtual seminar "Education and Socialization in Early Childhood" at the Ludwig-Maximilians-University, Munich. In this seminar, we focused on the group collaboration, which was evaluated by the students three times over the period of one semester, and on whether this evaluation changed over time. It was assumed that evaluation scores decrease over time as online collaboration is very demanding. Group collaboration was measured with the FAT questionnaire (Kauffeld, 2001) with the four dimensions "goal-orientation", "task-completion", "cohesion", and "taking responsibility". Results show that overall group collaboration is very high, but also very heterogeneous evaluated. While groups 2 and 4 evaluated all dimensions almost on a similar high level, evaluation scores decreased in groups 1 and 3 over time. This is due to the fact that in group 1, one group member left the course without further explication at the third point of time and group 3 showed an inadequate task solving strategy. Furthermore, group size is an essential indicator for group functioning.

Keywords: Heterogeneous collaboration, online learning, task solving strategy, group size

1 Introduction

Collaboration in online learning is an increasingly used learning method. It is assumed that during collaboration, learners have to elaborate on their knowledge in more detail (Webb, & Palincsar, 1996), solve socio-cognitive conflicts, which arise when learners have conflicting knowledge (Piaget, 1977), and exchange arguments about the best group solution (Andriessen, Baker, & Suthers, 2003). But this is only the case, if the group is socially functioning, what means that no dysfunctional group phenomena occur (Salomon & Globerson, 1989). There are especially four crucial criteria for efficient group collaboration: goal-orientation, task completion, cohesion and taking responsibility (Kauffeld, 2001). As online collaboration is more demanding for groups, it is possible that these four criteria will decrease over time.

2 Theoretical background

Online collaboration is more demanding for learners as they mostly have almost no experience with this new way of learning. Especially the norming and storming processes are virtually much more costly than in face-to-face collaboration, because in presence the collaborative work can be more easily modified. To see, whether virtual collaboration shows difficulties over time, there are mainly four different criteria that are relevant for collaboration: goal-orientation and task-completion on the task-level and cohesion and taking responsibility on a social-level.

Goal-orientation is based on the goal-setting theory (Locke & Latham, 1990). In this theory the goal serves as a motivator, because the goal causes people to compare their present capacity to perform with that required to succeed at the goal. When people succeed in meeting a goal, they will feel competent and successful (Mento, Locke, & Klein, 1992). Having a goal

enhances performance because the goal makes clear exactly what type and level of performance is expected. But goal-orientation also implies that people are committed to this specific goal. In collaboration, goal-orientation means that group members know their goals, that they are committed to these goals, and that they assign specific tasks to achieve these goals.

Task-completion is the main reason why groups are built as it is assumed that they carry out the task more effectively. Therefore, understanding the content of the task and considering adequate task solving strategies are important for a successful collaboration (West, 1994). In this context, reflecting on the strategies for task-completion in respect to achieve high effectiveness and changing them if not is also part of it.

Cohesion describes the dynamic process reflected in the tendency for a group to stick together and remain united in the pursuit of instrumental objectives and/or the satisfaction of member affective needs (Carron, Brawley, & Widmeyer, 1987). Group cohesion is very important as it is a main predictor for group performance.

Taking responsibility is central for the whole collaboration as there is no group success without responsibility for the task solving process (Kauffeld, 2001). Since taking responsibility guarantees that all group members contribute to the group solution, it avoids phenomena like social loafing or free riding (Salomon & Globerson, 1989).

3 Research Question

How do groups evaluate their group collaboration over time? As collaborative online learning is more complex and demanding for learners, it is assumed that this also influences the evaluation of collaboration. In the beginning, all learners are usually motivated and engaged, but when groups realize that the task solving process is more time-consuming or the group is not as effective as supposed to be, the evaluation may decrease. This is especially the case when all group members do not contribute the same way, group members do not stick to the group rules or groups have no effective task solving strategies. In such cases, groups have to reflect on their task solving process and change it accordingly.

4 Method

In this case study the interaction and collaboration among the students in a virtual course were measured. Therefore a definite questionnaire was used to measure group collaboration.

4.1 Course description

The study was carried out at the Ludwig Maximilians-University in Germany at the faculty of Psychology and Pedagogy in the seminar “Education and Socialization in Early Childhood”. The virtual seminar took place in the winter semester 2007/2008 from mid October to mid February. The main objective of this course is how socialization and education processes are organized and what influences and effects they have on the development of children in early childhood.

4.2 Sample/Target group

The participants were especially undergraduate students who studied pedagogy as main subject. Altogether there were 15 participants in the course, consisting of 14 female and one male. The participants were divided spontaneously and voluntarily into four groups. Groups 1 and 2 had three members, group 3 consisted of five members, and four participants were in group 4. All students had one tutor. In group 1, one group member left the seminar in the end of the semester, so that only two group members remained in this group.

4.3 Duration

The duration of the course was 14 weeks, two hours per week throughout the semester lasting from mid October to mid February. Students were supposed to interact in their virtual groups, and complete written assignments once a week.

4.4 Study resources

The learning materials of the seminar were twofold: First of all, every week, the participants received a deeply elaborated PowerPoint version of the main content of the respective topic. Second, there was further literature illustrating and deepening the excerpt. All materials were web-based, so that the participants were able to download them after logging-in.

4.5 Design of the study

The evaluation of the seminar was a longitudinal survey with three points of measurement. The analysis was conducted during winter semester 2007/2008 at the Ludwig-Maximilians-University. The first data collection was conducted from the 22nd until 29th of November, 2007, five weeks after the beginning of the virtual seminar. The subsequent data was collected two more times every four weeks using an online questionnaire. The second point of measurement was from 21st until 28th of December, 2007. The last point of measurement was from 31st of January until 7th of February, 2008. The students received an online questionnaire per e-mail. In the same way they were supposed to return the filled in questionnaires (see figure 1).

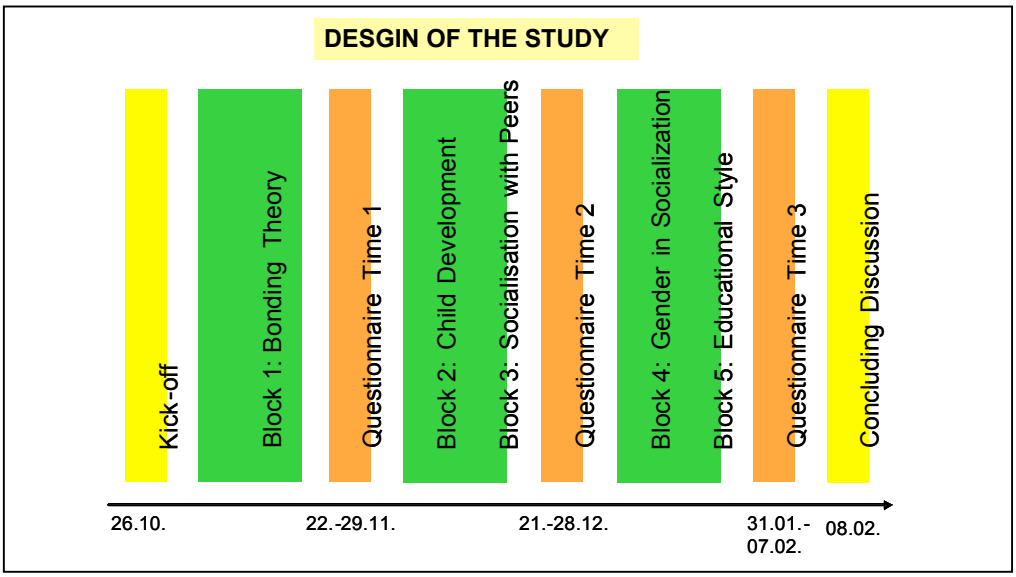

Figure 1: Design of the study

The participation in this study was part of the seminar. 14 of 15 course members took part in this investigation. The data collected during the study was handled anonymously, so the personal information of the students was protected.

4.6 Technical design

The virtual learning environment was technically based on an integrated Campus Solution by e/t/s. All members who were participating in the course “Education and Socialization in Early Childhood” received access to the virtual learning platform. The students could work from any computer that had Internet connection at their own convenience. The learning platform was equipped with different functions. First of all, there was a content section for delivering the main content on “Education and Socialization in Early Childhood”. All the documents

were uploaded in digital format, so the students could download the learning material and print it out themselves. There were two components how the material was presented to students. The first component comprised the most important content of every topic in the form of a PowerPoint presentation. The second component included additional literature for the respective topics.

Second, there was the possibility of communication in every group with help of group forums or group chat function. The forum was the main communication and collaboration tool for the groups. The tutor also had access to the group forums and could answer questions or intervene in necessary cases. Furthermore, the group members could use private e-mail outside the virtual learning platform for communication.

Third, there was a forum of the seminar all groups and the tutor had access to. This seminar forum included sub-forums for task solutions (of every group), for feedback on the group solutions, for questions, for information and feedback on the seminar. The e-tutor and the participants could post important dates and write announcements. This forum was used for the communication between the groups and the tutor, but also between the different groups. Communication via e-mail was still possible and commonly used.

4.7 Didactical design

The content was didactically presented in a problem-based manner. Almost every topic was introduced with a case. This case was designed as authentic problem, which had to be solved by every group. Every working group had approximately one week to elaborate their ideas. Every member was supposed to present his or her ideas and post his solution on the learning platform to guarantee different perspectives on the group solution. Every group appointed a moderator who was in charge of collecting all the offered solutions and producing a common group solution that he later on was supposed to upload to the virtual learning platform. The social context was realized through the group work and the instructional context was given through the power-point presentation as well as through additional literature and specific help of the tutor if necessary.

4.8 Support arrangements for learners

The support for the learners included three methods: The definition of group rules, which were obligatory to every group member, the definition of a student moderator who rotated every week, and the feedback on group solutions, which were given by the tutor every week.

4.9 Data Sources

To collect data, the students evaluated the online collaboration via the standardized FAT questionnaire (*F*ragebogen zur *A*rbeit im *T*eam), authorized by Simone Kauffeld. The questionnaire comprises four scales with 22 items. The first scale, which asks for "group cohesion", comprises 8 items with reliabilities between .89 and .94 (Cohen's Kappa), e. g. "We communicated openly and freely." The 2nd scale asks for "taking responsibility", which had 4 items (e. g. "We permanently tried to improve the joint group solution") with reliabilities between .79 and .91 (Cohen's Kappa). The 3rd scale measures "goal orientation" with 6 items, e. g. "I identified myself with the group goal". The reliability was between .64 and .84 (Cohen's Kappa). The last dimension measures "task completion" with four items and a reliability between .90 and .93 (Cohen's Kappa). An example item is "The priority was the task solving".

All written contributions in the forum of the seminar as well as in the group forums were used to get a deeper insight into the interaction process. These observations were used to explain the evaluation of the collaboration.

5 Results

The evaluation of group collaboration included goal-orientation, task completion, cohesion, and taking responsibility. Looking at the overall mean of the four groups, all dimensions are evaluated on a very high level, even though they decreased from time 1 to time 2 and from time 2 to time 3. This means that in the beginning, group members rated their collaboration better than in the end. Looking at the dimensions individually, goal-orientation decreased from a mean of *4.73* (SD=*.76*) to *M=4.57* (SD=*.83*) and *M=4.48* (*SD=.94*), task completion from a mean of *5.68* (*SD=.62*) to *M=5.07* (*SD=1.03*) and *M=4.84* (*SD=1.09*), cohesion from a mean of *5.12* (SD=*.95*) to *M=4.95* (SD=*.97*) and *M=4.62* (*SD=1.19*), and taking responsibility from a mean of *M=4.73* (*SD=1.28*) to *M=4.13* (*SD=1.49*) and *M=3.86* (*SD=1.65*).

5.1 Goal-orientation

All groups showed almost the same high evaluation rates in goal-orientation. All groups were very interested in achieving the group goals, which was the solving of diverse tasks to get a certain degree. Only in group 1, the evaluation decreased in the third point of time, because one student skipped the course so that there were only 2 members remaining (see figure 2). Post hoc contrasts between the groups according to Bonferroni showed no significant effects.

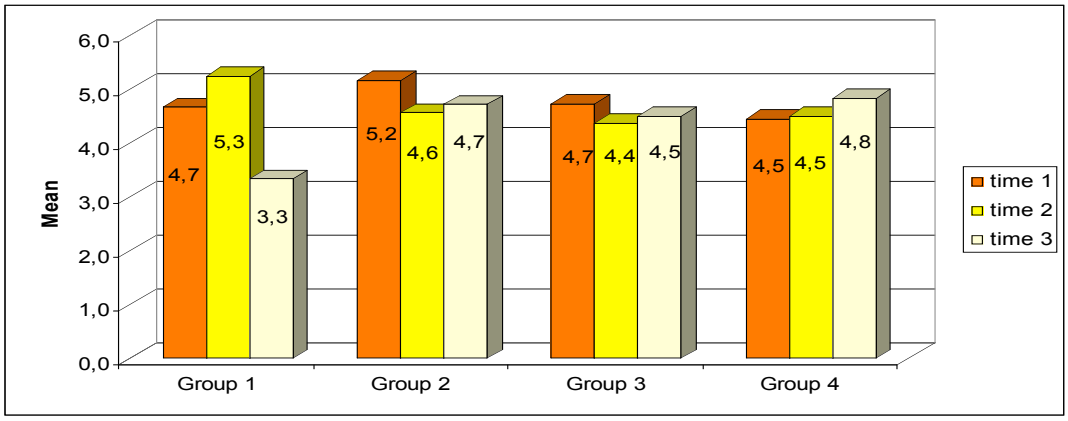

Figure 2: Mean of goal-orientation per group and point of time.

5.2 Task-completion

Regarding task-completion, groups 1, 2 and 4 evaluated this dimension on a very high level, while group 3 was definitely lower. Again group 1 showed a decrease in the third evaluation, because at this time, one group member left the group (see figure 3). Post hoc contrasts according to Bonferroni showed no significant effects.

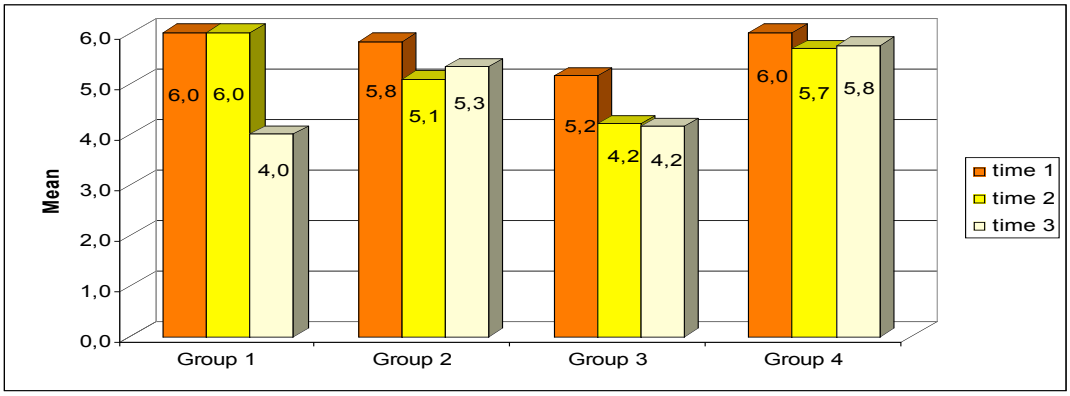

Figure 3: Mean of task-completion per group and point of time.

5.3 Cohesion

Regarding cohesion, groups 1 and 3 showed a decrease, while groups 2 and 4 stayed almost stable in their high evaluation. Groups 2 and 4 evaluated their group cohesion on a high level, group 1 in the beginning very high and in the third point of time considerably lower, while group 3 showed lowest rates in all three points of time (see figure 4). Post hoc contrasts according to Bonferroni showed no significant effects.

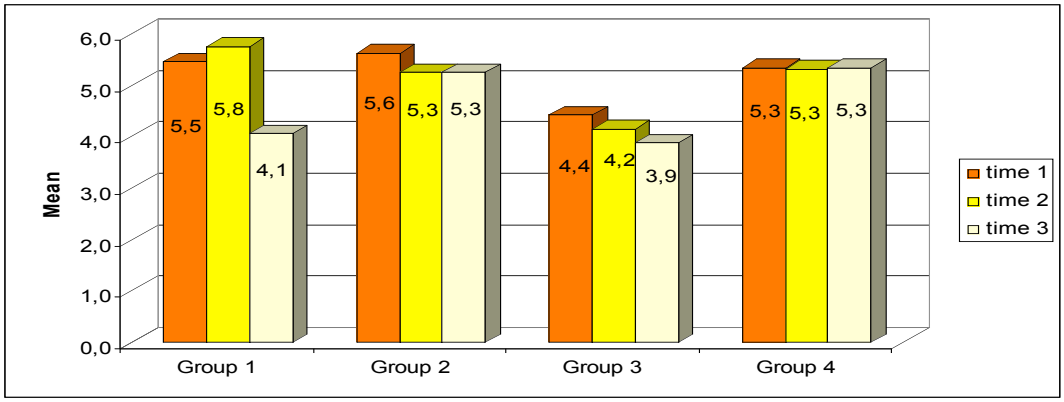

Figure 4: Mean of group cohesion per group and point of time.

5.4 Taking responsibility

Looking at the groups taking responsibility for their task, two main phenomena could be recognized: First of all, again groups 2 and 4 show a relatively stable and high evaluation even though, both evaluations decreased at the second point of time and again increased at the third point of time. Second, groups 1 and 3 both show a decrease at the third point of time, even though, the overall evaluation rates are much higher in group 1 than in group 3. Group 3 shows again the lowest rates (see figure 5). Post hoc contrasts according to Bonferroni showed significant effects between group 3 and 4 at time 3 ($p=.02$).

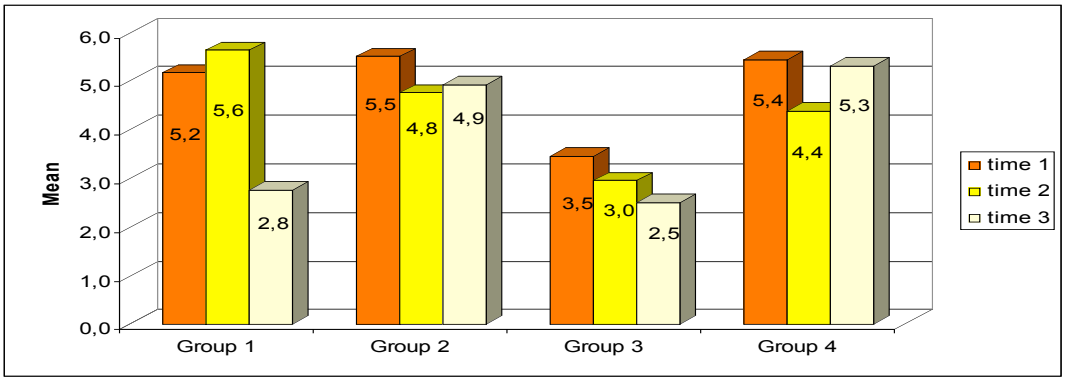

Figure 5: Mean of taking responsibility per group and point of time.

6 Discussion

Overall, the hypotheses could be confirmed: The evaluation of the four indices on collaboration decreased over time, but this overall decrease was on a very high level and was due to the decreasing evaluation of groups 1 and 3. These groups show some difficulties and problems in their online collaboration.

Group 1 shows a very steep decrease at the third point of time. The reason for this is due to the fact that one of the group members suddenly left the group without any further explanation. According to the data, the two group members remaining in the group were not able to compensate the contribution of the third group member, because group dynamic changed radically. Eventually, then the group size was too small. Therefore, all four dimensions enormously decreased about 1.5 to 2.8 points.

Group 3 shows that collaboration was not very satisfying. Even though all group members wanted to achieve the goal of the seminar (goal-orientation stayed almost the same), task-completion, cohesion and taking responsibility decreased much more. Especially taking responsibility was on a very low level. This could be explained with the task solving process of the group, in which one group member had to start with the solution, and all other group members added their opinion and perspectives with a different colour. As there were always the same persons starting with the solution, the impression occurred that some group members were free riding (Salomon & Globerson, 1989), because in the end of the task solving process, there was almost nothing to add or change. Therefore, the group members starting with the solution had much more work than those reading the solution in the end and just comparing it with their information. That means not all group members equally participated in the group collaboration, and not all took the same responsibility for their work. This effect was supported by the group size of five persons – a number that eventually is too big for all group members taking their responsibility.

Groups 2 and 4 also showed a little decrease, but on a very high level – probably because when working over a longer period of time, a more realistic picture of the work load and of the collaboration partners occur. But overall, these groups showed an effective and efficient way of collaboration. These groups sub-divided the task in sub-tasks when possible so that all group members had the same work load and all knew their goal to achieve. This also may be due to the fact that the groups had a group size of three, respectively four persons, which seems to be an optimal number for online collaboration.

To conclude: Online collaboration is a heterogeneous phenomenon – dependent on the way group members organize their task solving process and on the group size. Furthermore, a group member leaving the group frustrates the remaining group members – an occasion that happens much easier in online than in face-to-face learning. These results are relevant for the tutor in two ways: First, building groups of 3 or 4 members seems to be most efficient, and second, stressing the organization of the task solving process is very important as it is directly connected to the efficiency of the group work.

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Agent-Based Collaboration Systems: a Case Study

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Abstract

Existing distance learning systems provide collaboration tools (like forum, chat, wiki, etc.) presenting some limits that reduce the effectiveness of such tools from the standpoint of collaborative learning. Accordingly, a conceptual framework is needed that bridges the gap between the interaction forms characterising collaborative learning and existing learning collaboration tools. In this context, Multi-Agent System (MAS) seems to be a suitable paradigm to engineer such systems as it promotes effective collaboration. This paper shows how the Agents and Artefacts (A&A) meta-model for MAS could be exploited to build a conceptual framework for collaborative learning systems.

Keywords: collaborative learning, computer-supported collaborative learning, Multi-Agent System, Agent and Artefact meta-model.

1 Introduction

Collaborative learning — where students participate in small-group activities and take responsibility for learning, whereas the teacher is more a facilitator than a "sage on the stage" (Resta et Laferrière, 2007) — leads to deeper level learning, critical thinking, shared understanding, and long term retention of the learned material than more traditional approaches (Kreijins et al., 2003). For such reason, collaborative learning and its supporting technology have collected a growing interest.

However, existing distance learning platforms often provide collaboration tools (like forum, chat, wiki, etc.) that present some limits: *i)* they are often juxtaposed and not truly integrated with one another, so collaborating people are exposed to a series of problems that come from the visually and functionally separate nature of such tools (Mühlpfordt et Stahl, 2007); *ii)* most of them provide statistical data related to on-line social interactions of students, but often they not provide an automatic analysis of such interactions. This lead to some drawbacks because teachers are subject to an added overhead if they want to make a quantitative and / or qualitative analysis of such data; *iii)* they do not share a common conceptual framework, so as to make it difficult to exploit them altogether in a coherent and effective way (Nardini et al., 2008).

As a consequence, a conceptual framework is needed that features an integrated set of tools for supporting collaborative learning and automatic analysis of student social interactions, so as to improve learning process in students and facilitate the work of teachers. In this context, *Multi-Agent System* (*MAS*) (Omicini et Poggi, 2006) represents a suitable paradigm to engineer distance learning systems promoting effective collaboration and overcoming the aforementioned limits.

Accordingly, in this paper, after we show some limits of today's collaboration environments (Section 2), we discuss how meta-models like the *Agent and Artefact* (*A&A*) (Omicini et al., 2008) — a framework that aims at directly modelling and engineering the MAS *environment* — one could exploit as a conceptual framework to design collaborative distance learning systems (Section 3). Finally, in order to prove the efficiency of the meta-model for solving the mentioned issues, we show a case study that integrates the *chat* service of the Moodle platform — a wide used platform in e-learning that is web-based and open-source (The 1st Report of Minerva-RESET Project, 2007) — with the corresponding *wiki*

service, and monitors student activities making automatically a quantitative analysis of student collaboration activities (Section 4).

2 Collaborative Learning Environments

Accordingly to (Dimitracopoulou, 2005), by focussing on *social interaction* — the key element of collaboration (Kreijins et al., 2003) — and *collaborative learning*, existing e-learning platforms — a comprehensive list of the most adopted platforms for collaborative learning can be found in (The 1st Report of Minerva-RESET Project, 2007; Online Collaborative Learning in Higher Education, 2007) — usually address this issues by providing collaboration environments that include two main necessary spaces of interaction:

- *Task space*, that is where students interact with task objects (e.g. a graphical or a textual workspace). Accordingly to (Dimitracopoulou, 2005), on the basis of the task space, two kinds of collaboration system can be identified: *i*) *action-oriented collaboration systems* — systems where students interact with the task objects producing knowledge. The knowledge produced represents itself a subject of discourse; *ii*) *text-production-oriented collaboration systems* — systems where students mainly produce a written text in a collaborative way.

- *Discourse space*, that is a mean of dialogue (Dimitracopoulou, 2005) (e.g. a chat, a forum, or a audio channel). Discourse spaces provide either an asynchronous or a synchronous communication mode. Usually, systems — either action-based or text-based — all provide one or more dialogue tools. In fact, according to (Dimitracopoulou, 2005), dialogue tools are considered crucial not only for collaboration but also for learning. In (Dimitracopoulou, 2005) Dimitracopoulou states that: *i*) "*externalization achieved through written dialogue that is conducted during collaborative activities may have significant effects, especially for conceptually rich learning activities*"; *ii*) "*interactive linguistic exchanges among people play an essential role in the elaboration and perpetuation of concepts, while the primary use and mechanism for acquisition of these concepts is the result of social interaction*".

Accordingly to (Mühlpfordt et Stahl, 2007), the activities in task space and discourse space are typically related to one another but often, this two kinds of space provided by e-learning platforms are physically and functionally dissociated (The 1st Report of Minerva-RESET Project, 2007; Mühlpfordt et Stahl, 2007; Nardini et al., 2008), so, for example, according to (Dimitracopoulou, 2005; Mühlpfordt et Stahl, 2007), it is hard for user to track and specify content and temporal relationships between the dialogue and the actions in the task space. In particular, Mühlpfordt and Stahl in (Mühlpfordt et Stahl, 2007) identify three main issues: *i*) *Deictic references* — the referencing of objects in the task space from the discourse space. This is an important feature that has to be provided by platforms because in virtual environments the gestural pointing is not possible; *ii*) *Decontextualization of action and messages* — whereas often the discourse space history represents the complete temporal sequentiality of the discursive contributions, the same does not often hold for the task space. This is another important aspect that has to be taken into account by platform developers in order to preserve the workspace context at various time instants and represent its evolutionary process making possible reflection on the whole collaborative construction. Space history is important not only for group members, but also for other groups that want to observe and exploit the built knowledge. In other words, space history can promote an effective reuse of the knowledge generated by different groups: this is viable with respect to groups belonging to different courses; *iii*) *The coordination of communication and interaction* — different participants can simultaneously be typing and posting message in the discourse space or

producing objects in the task space. In collaboration, these various activities are interrelated, so the awareness of the activities of the other people is a prerequisite for the construction of common ground.

Accordingly, most existing distance learning systems provide the task and discourse spaces that do not share a common conceptual framework, so as to make it difficult to exploit them altogether in a coherent and effective way in order to overcome the previous-mentioned limits (The 1st Report of Minerva-RESET Project, 2007; Nardini et al., 2008).

In addition, most of the e-learning platforms provide statistical data related to on-line social interactions of students. Often such statistical data consists in log files that collect information like student access time and the time spent by students in the e-learning system (The 1st Report of Minerva-RESET Project, 2007). As a consequence, to make a quantitative and / or qualitative analysis of such data — useful for the sake of student-interaction analysis in order to evaluate students and give them feedbacks (Dimitracopoulou, 2005; Dimitracopoulou et Komis, 2005; The 1st Report of Minerva-RESET Project, 2007; Nardini et al., 2008) — teachers often have to adapt the information provided by log files and adopt external systems to the platform. This lead to some drawbacks because teachers are subject to an added overhead.

As a consequence, a conceptual framework is needed that features an integrated set of spaces and tools for supporting and monitoring collaborative activities in an effective way.

3 The A&A Meta-model for Collaborative Environments

Distance learning lacks a conceptual framework aimed at designing integrated collaboration spaces (both task and discourse spaces) and tools for monitoring collaborative learning by an automatic analysis of student social interactions.

In this context, *Multi-Agent System* (*MAS*) (Omicini et Poggi, 2006) — a set of autonomous, pro-active, and interacting computational entities called *agents*, situated in an *environment* where they interact typically producing a coherent global system behaviour — seems to be a suitable paradigm to engineer distance learning systems. In literature, MAS paradigm has proven to be a suitable paradigm for dealing with the engineering of complex software systems like distance learning systems, which are interaction-oriented, distributed, dynamic, and open (Omicini et Poggi, 2006).

In particular, the *Agents & Artefacts* (*A&A*) meta-model (Omicini et al., 2008) seems to be a suitable framework for supporting the development of MAS-based collaboration environments.

The A&A meta-model takes inspiration from *Activity Theory* (AT), which is aimed at studying collaboration activities in human organisations (Nardi, 1996). According to AT, human activities within an organisation are always mediated by some kind of *artefacts* — either physical or cognitive tools that *enable* and *constrain* human activities. In particular, by means of the artefact abstraction provided by the A&A, a designer could design, through *function* elements, mediation instruments for human collaborative activities. Moreover, if we look at the A&A meta-model from the standpoint of *Distributed Cognition* (Kirsh, 1999) — which proposes that human knowledge and cognition are not confined to the individuals, but is instead distributed by placing memories, facts, or knowledge on the objects, individuals, and tools in our environment — each artefact can work as a repository of the knowledge built through collaborative work of human beings, which is then properly stored, organised and effectively reused. In addition, artefact properties make it possible for software agents automatically to monitor collaborative activities of human beings and perform an automatic analysis of student social interactions.

As a consequence, the A&A meta-model seems to be a natural candidate as an effective and consistent conceptual framework since it provides a set of suitable abstractions for

modelling systems supporting human collaborative activities. Accordingly, as showed in the next Section, through an appropriate design of artefacts, it is possible to frame collaboration spaces and monitoring tools as artefacts, then, by exploiting artefact properties and the agent abstraction (Omicini, 2006), integrate such re-framed tools in a conceptually uniform collaborative environment, in order to overcome the aforementioned limits.

4 A Case Study

Moodle — a wide-used, open-source, Web-based platform in e-learning (The 1st Report of Minerva-RESET Project, 2007; Ardito et al., 2004) — provides several tasks and discourse spaces that are physically and functionally dissociated. Moreover, Moodle allows to access statistical data related to on-line social interactions of students, but does not provide any tool for automatic analysis of such interactions.

In order to show the effectiveness of the A&A meta-model as a conceptual framework to design collaborative learning systems solving the aforementioned issues, we exploited the meta-model to re-frame and integrate two Moodle tools with each other: the *chat* tool — a discourse space that allows learners to communicate to each other in a synchronous way and coordinate their collaborative activities — and the *wiki* tool — a task space that encourages students to mainly produce written text or reports in a collaborative way. Moreover, we provided Moodle with an automatic analysis of student social interactions.

4.1 Moodle Design Abstractions vs. A&A Meta-model

Moodle is a Web application that does not lie on top of a conceptual framework providing the abstractions suitable to develop collaboration tools. Accordingly, it is complex to extend the functionalities provided by existing collaboration spaces. In particular, it is hard to integrate two distinct collaboration spaces from the functional and user interface standpoint—user interface is usually represented by a browser. Indeed, even though in this kind of Web-based, e-learning platforms, tools are conceived in terms of services — a set of functionalities — to be provided to platform users, the way such services are actually designed is left to designers. In particular, Moodle realizes the abstractions of service in terms of Web pages. Since a Web page is strongly related to what shown within a user's browser application, it does not seem to be a viable support to reify a service. In fact, it is difficult to concretely represent concepts that describe a service, like *service interface* — set of functionalities provided by the service — and *service behaviour* — how the service implements the provided functionalities —, by adopting a service implemented by Web pages.

On the other side, according to (Ricci et al., 2006), the A&A meta-model provides a set of abstractions allowing to explicitly model both the concept of service interface and that of service behaviour by adopting the abstraction of *artefact*. In fact, an artefact allows to model any collaboration tool in terms of *user interface* — by which an artefact can act for a specific purpose, i.e. the set of operations provided by an artefact — and *structure and behaviour* — representing how the artefact is implemented in order to provide its function (Ricci et al., 2006). Moreover, using the artefact property called *linkability* (Ricci et al., 2006) — allowing artefacts to invoke operations of other artefacts — it is possible to functionally integrate to one another the collaboration tools designed as artefacts (Nardini et al., 2008).

In addition, to realize collaborative environments able to automatically monitor social interactions arising within collaboration tools by students of a same group, it is fruitful to adopt abstractions that allow at design time to explicitly model the entities able to observe in a proactive way such interactions. On the one hand, this can be exploited in order to automatically analyze social interactions among students as a useful means to both evaluate students and give them feedback. On the other hand, it can be exploited to realize one of the necessary aspects to integrate different collaboration tools: the *awareness* on the activities

performed by each member of a collaborative group, that is crucial for communication and interaction coordination as described in Section 2.

While the Web page does not represent a viable abstraction to explicitly model the aforementioned entities, A&A provides the *agent* abstraction (Omicini et Poggi, 2006; Omicini, 2008) introduced in the Section 3. Agents are autonomous and proactive entities that can exploit some interesting artefact properties, in particular *inspectability* (Ricci et al., 2006) — the capability of observing and controlling artefact structure (state) and behaviour at runtime. Such a property can be hence exploited by an agent to monitor the interaction occurring among student of each group within an integrated collaboration.

4.2 Improving Moodle through A&A Meta-model

For the sake of simplicity, visual integration is not treated in the paper as it would require additional technologies that are out of the scope of this work and will be matter of future work. Accordingly, here we focus on a functional integration between two collaboration tools provided with Moodle: wiki and chat. In particular, integration consists of giving an user the possibility of making a reference between a chat message and the wiki content object of the chat discussion the message is part of (see Figure 1). This makes it possible to solve the problem pointed out by Stahl as *deictic references* (see Section 2), which is due to the fact that gestural pointing is not possible in virtual environments. This makes it possible to solve also the problem known as *decontextualization of action and messages* described in Section 2. Indeed, since chat messages represent the complete sequentiality of a discursive contribution, references between chat and wiki allow to make a complete sequentiality also among contributions added to the wiki.

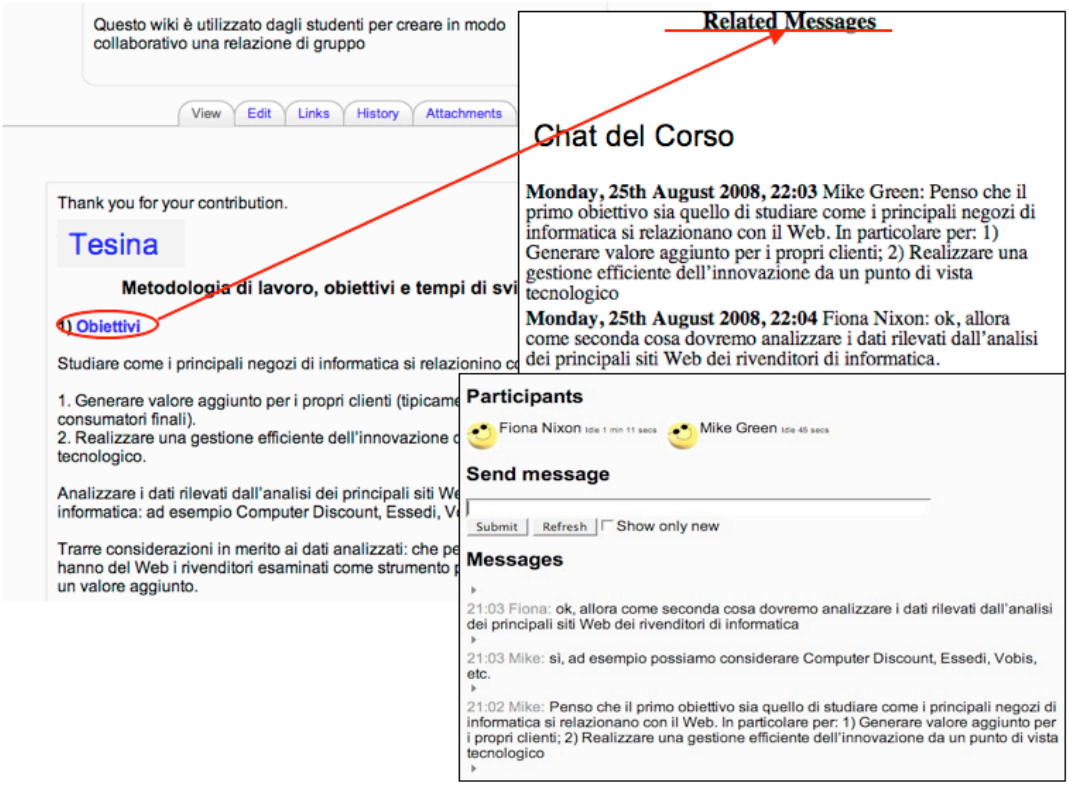

Figure 1. Relation between wiki content and one of its related discussions

To get into the details of the integration realized between chat and wiki, we defined three artefacts:

- *HttpMon*, which observes the HTTP requests coming from client browsers. In particular HTTP requests related to chat and wiki are translated in events that are sensed by the agents in charge of managing chat and wiki. To this end, *HttpMon* exploit *situation* (Ricci et al., 2006; Omicini, 2006) — i.e. the artefact property of being immersed in an external environment, and being reactive to environment events and changes so as to make it possible to intercept the requests coming from client browsers regarding chat and wiki targeted to Moodle server.

- *Chat*, which reframes the Moodle chat as an artefact managed by a *chat agent*. When such an agent perceives from *HTTPMon* an event concerning the insertion of a new chat messages or a request to create a new references targeted to a specific point of wiki content, it respectively registers the chat message and the reference into the artefact. In particular, when chat agent requests to create a new reference, the artefact exploits *linkability* (Ricci et al., 2006) with wiki artefact in order to know whether the point of wiki content to be referred exists. If such a point does not exist yet, the reference is not created. In addition, when perceiving from *HTTPMon* an event requesting to access references of a message, chat agent can exploit chat operations so as to get such references and inserts them as HTTP parameters of the request to be sent to Moodle server.

- *Wiki,* which reframes the Moodle wiki as an artefact managed by a *wiki agent*. When such an agent perceives from *HTTPMon* an event concerning the insertion of a new wiki content, a point of wiki content to be referred by a chat message, or a new reference to chat messages referring a point of wiki content, it respectively registers the wiki content, the content point to be referred and the reference into the artefact. In particular, when wiki agent requests to access references of a specific content, it can exploit wiki operations so as to get such references and inserts them results as HTTP parameters of the request to be sent to Moodle server. On the other hand, the artefact exploits *linkability* with chat artefact in order to obtain the list of all the chat messages pointing to that particular content. Linkability is also used when a content is to be deleted from wiki. In this way it is possible to delete the chat messages referring to the content to be deleted before proceeding with content deletion.

As a second aspect of this work, we focus on the analysis of social interactions occurring among the members of each student group by collaboration tools. In particular, as a reference example, we show how it is possible to automatically perform a quantitave analysis of interactions by means of *Social Network Analysis* (*SNA*) (Calvani et al., 2005). To this end, the most remarkable collaboration tool is *forum* (see Figure 2) since it makes it possible to know both the sender and receiver of a message. On the contrary the chat and wiki tool provided by Moodle do not allow to clearly know the sender and the receiver of a message; each interaction involves all group participants. As a consequence, the subsequent SNA analysis would be meaningless.

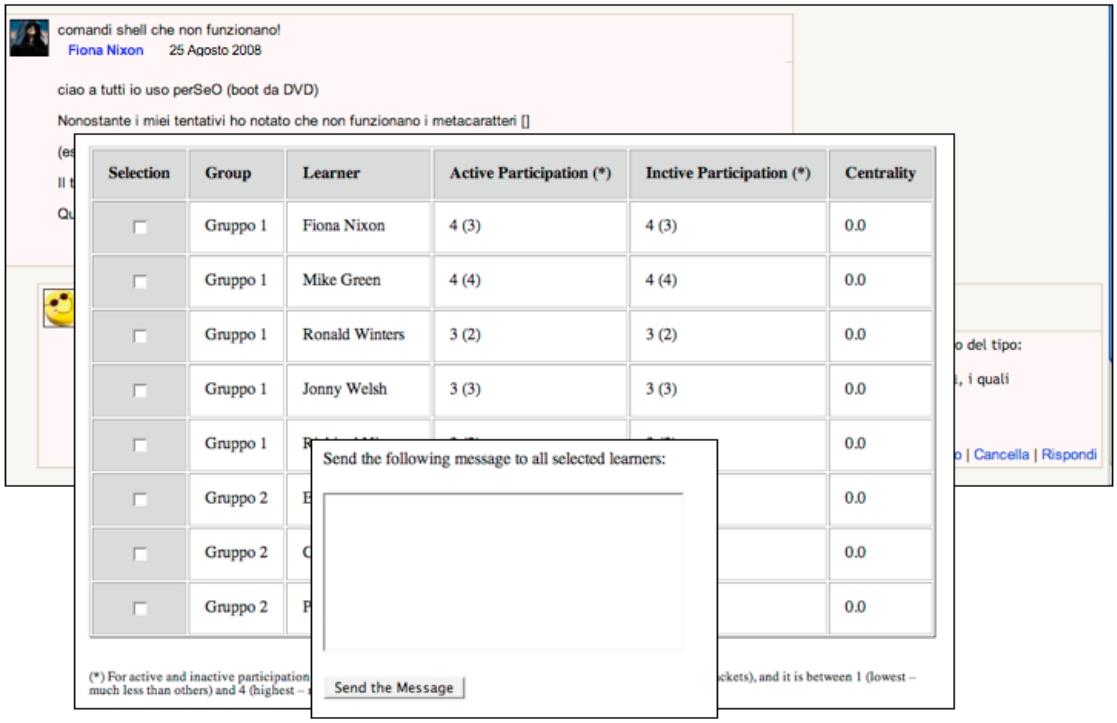

Figure 2. An automatic analysis of social interactions occurred through Moodle forum

In order to devise an automatic interaction analysis of the interaction occurred through forum, we developed the following components:

- *HttpMon*. Other than translating in events the HTTP requests related to chat and wiki, HttpMon translate the HTTP request related to forum in events that are sensed by the agent in charge of managing forum.

- A *Forum* artefact, whose goal is to reframe Moodle forum as an artefact. A *forum agent* is associated with such an artefact with the task of insert new forum message in the artefact itself.

- An *Interaction Analysis* artefact, having the goal of storing all the necessary data to actually perform interaction analysis. This artefact is as well managed by a specific agent that, when perceiving from *HTTPMon* an event requesting interaction analysis results, inserts analysis results as HTTP parameters of a request to be sent to Moodle server.

- A *Forum Analysis Agent*, whose goal is to observe the state of Forum artefact so that to insert into the Interaction Analysis artefact the data to SNA analysis on forum activities.

5 Conclusion and Future Work

In this paper we focused on some of the required features of collaboration systems in distance education. In particular we considered functional and visual integration of collaboration tools as well as automatic interaction analysis (see Section 2). As distance learning systems often provide collaborative tools not integrated with each other and not sharing a common conceptual framework, an effective and integrated exploitation of such tools becomes difficult. On the other hand, such systems allow only to access statistical data about student

social interactions, which often consists of log files. As a consequence, analyzing such a data in an automatic way becomes impossible if one does not rely on external tools.

Accordingly, in this paper we sketched a possible conceptual framework defined in terms of the *A&A* meta-model in order to allow the development of collaboration tools conceived as *artefacts* that can be easily exploited altogether in a coherent and effective way. Furthermore, A&A provides also *agent* abstraction, which can ease the monitoring of student social interactions by observing the artefact counterpart of collaboration tools.

In order to provide an example of the applicability of A&A to this scenario, we have reframed *chat* and *wiki* tools of Moodle e-learning platform in terms of artefacts. Moreover, to give an example of automatic interaction analysis, Moodle *forum* was rethought is terms of artefact and by defining a few agents, developed a prototype of *Social Network Analysis*.

How showed in Section 4, even though integration of Moodle's chat and wiki is still feasible without the adoption of artefacts, nonetheless the exploitation of artefact can make integration more scalable and efficient especially as regards dynamic scenarios. Moreover, as far as *awareness* of group members' activities (see Section 2) and *automatic analysis of social interactions* among students is concerned, Moodle technologies appear inadequate: indeed, even adopting dynamic HTML technology on the client side, server side still need to be designed in terms of proactive entities (like agents) able to observe the activities each group member is involved in (see Section 4).

Visual integration of Moodle collaboration tools was not addressed as well since it would require a complete reengineer Moodle user interface. In the end, we think that a complete redefinition of collaboration tools in terms of A&A would provide more advantages than integration of existing collaboration tools. This will be matter of future investigation.

6 Acknowledgements

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Le web 2.0 et les musées des sciences : quel accès à la culture scientifique ?

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Abstract

In a context of increase in content and actors on the Internet, museum's websites are publishing resources for diffusion of arts and sciences, but also for their promotion and for communication.
The option to limit interactivity is taken to provide verified data, included in a slow temporality compared to the temporality of the Internet and more recently of the web 2.0, but this is made without debate in most cases.
On the websites which offer web 2.0's services, on platforms such as YouTube, Flickr, MySpace, blogs and wikis, the contents of Internet users are spreading in altruistic or fun dynamics.
In response to the flood of these applications, scientific museums are wondering about ways to capture these new forms of publication and create spaces to accommodate the contributions of Internet users, amateurs and laymen. As they invite them to participate, they must tolerate productions without scientific rigor, to open new access to science and increase the outreach of scientific culture.
Do These new uses lead museums to conceive their mission of mediation to the scientific and technological culture in a new way on the Web? With the Web 2.0, is it possible for the museum institution to be satisfied with a unidirectional model of knowledge disseminated by specialists to a receiving public ?
Or must it devise new models of hypermediation to a participant public? As an authoritative broadcaster of legitimated content, does the museum face a risk in opening participatory spaces for contributions by laymen Internet users? Can we consider these spaces as tools allowing forms of learning in an informal context?
On the basis of socio-constructivist theories, we will present an analysis of a corpus composed of national and international websites of museums which are on the way to appropriate Web 2.0 applications, and of non-institutional platforms seizing museum subjects, in order to show different dynamics of actors, and to display contributive Internet as a vehicle for developing scientific culture and for informal learning.

Résumé

Dans un contexte de multiplication des contenus et des acteurs sur l'internet, le web muséal publie des sites ressources relatifs à la mission de diffusion des arts et des sciences, tout en visant un double objectif promotionnel et communicationnel. L'option de limiter l'interactivité vise à offrir, sans débat, des données vérifiées, inscrites dans une temporalité lente, comparativement à la temporalité tous azimuts de l'internet et plus récemment celle du web 2.0.
Sur les sites institutionnels offrant des services relevant du web 2.0, sur des plateformes de type YouTube, Flickr, MySpace, des blogs ou encore des wikis, les contenus d'internautes se répandent dans une dynamique altruiste ou ludique. Ainsi, face à la déferlante de ces applications, les musées scientifiques s'interrogent sur les moyens de s'approprier ces nouvelles modalités de publication et de créer des espaces permettant d'accueillir les contributions des internautes amateurs éclairés et profanes. S'ils les invitent à participer, ils doivent tolérer des productions excluant la rigueur scientifique, pour diversifier l'accès aux sciences et augmenter le rayonnement de la culture scientifique.

Ces nouveaux usages conduisent-ils les musées à repenser leur mission d'éducation des publics et de médiation de la culture scientifique et technique sur le web ? En effet à l'heure du web 2.0, l'institution muséale peut-elle se contenter du modèle unidirectionnel de la connaissance diffusée par des spécialistes vers des publics-récepteurs ? Ou bien doit-elle inventer de nouveaux modèles d'hypermédiation vers ses publics-participants? En tant que diffuseur de contenus légitimes et faisant autorité, le musée court-il un risque à ouvrir ainsi des espaces participatifs aux contributions d'internautes profanes ? Et peut-on considérer ces espaces comme des outils permettant des formes d'apprentissage dans un contexte informel ?
En nous fondant sur un cadre théorique socio-constructiviste, nous présenterons l'analyse d'un corpus composé à la fois de sites de musées nationaux et internationaux qui commencent à s'approprier les applications du web 2.0 et de plateformes non-institutionnelles s'emparant des sujets muséaux, dans le but de faire apparaître les différentes dynamiques d'appropriation des acteurs, et afin de nourrir notre réflexion sur l'internet contributif comme vecteur de développement de la culture scientifique et de l'apprentissage informel.

Keywords : Web 2.0, museum's websites, scientific and technological culture, informal context of learning, socio-constructivism

Mots-clé : web 2.0, sites internet de musées, culture scientifique et technique, apprentissage informel, socio-constructivisme

Dans un environnement de plus en plus technique dans lequel les sciences, et en particulier les technosciences jouent un rôle prépondérant, l'expert apparaît comme une des figures dominantes d'un savoir qui est source de pouvoir et de profit pour les acteurs qui le détiennent (Roqueplo, 1974). La mise en partage du savoir scientifique et technique représente un véritable enjeu pour la société. Les musées en tant que médiateurs ont un rôle à jouer pour le mettre à disposition, le vulgariser et le partager. Garants des contenus médiatisés, les musées ont une expérience d'une douzaine d'années sur l'internet et se positionnent comme diffuseurs légitimes sur le réseau. Les fonctions et outils que l'on désigne communément sous l'étiquette web 2.0[1] offrent aux musées l'opportunité de dépasser la simple diffusion de la culture scientifique et technique pour engager, avec des publics étendus, un partage des savoirs.

Les actuels usages des applications web 2.0 par les musées renouvellent-ils l'accès à la culture scientifique ? Notre propos est d'articuler ce questionnement centré sur les rôles et pratiques des institutions muséales à celui centré sur les rôles et pratiques proposés aux internautes et notamment les modalités d'apprentissages informels concernant la culture scientifique et technique que permettraient les ressources web développées par les musées et autres acteurs associatifs ou amateurs.

L'étude d'applications web 2.0 comme environnements d'apprentissages informels peut tirer profit d'un cadre théorique constructiviste pour la conception d'hypermédias de médiation (Rojas, 2007)[2]. Les théories socio-constructivistes, dans la lignée des travaux de Vigotsky (1978), en établissant l'origine sociale de l'apprentissage, peuvent offrir un cadre pour étudier les modalités de médiation de l'apprentissage qui utilisent des environnements techniques et valorisent la collaboration, tout en restant prudents concernant les usages réels.

Une vingtaine de sites de musées nationaux et internationaux et de plateformes non-institutionnelles s'emparant des sujets muséaux constituent notre corpus[3] pour analyser[4] l'internet participatif et

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1 Le web 2 rassemble des technologies, des applications (blog, rss, tags), des plateformes d'édition et d'échange de contenus (wikis, YouTube, Flickr, Facebook, MySpace).

2 L'analyse fonctionnelle est définie par les relations et interactions du sujet aux objets, aux savoirs, à l'institution et aux pairs.

3 Citons : Le Conservatoire National des Arts et Métiers, le Palais de la Découverte, la Cité des Sciences et de

contributif comme vecteur de développement de la culture scientifique. Un nombre important de sites web muséaux présentent collections, activités, expositions, tandis que d'autres commencent à s'approprier les technologies web 2.0 visant différentes fonctions.

L'accès aux informations

La fonction d'information (sur l'institution, ses projets, ses activités, ses collections, ses expositions) constitue le plus petit dénominateur commun de présence des musées en ligne. Tous les sites institutionnels s'en acquittent avec des pages web qui manient communication, publicité et médiation[5]. Mais quelques sites de musées s'orientent vers d'autres modalités de diffusion de l'information avec les fils RSS[6], les lettres d'informations, les blogs, les sites de partage de vidéos et les réseaux sociaux[7]. Certains vont jusqu'à jouer le jeu des pages profils de réseaux sociaux en mettant en scène une personne fictive qui représente l'institution (le musée du Quai Branly sur MySpace) ou réelle (André Maris Ampère du CRHST sur Facebook[8]).

Le musée s'appuie ici sur les compétences informationnelles des internautes, dans un but de diffusion d'informations sur lui même, mais aussi pour tisser des liens de complicité avec les internautes, considérés comme des publics potentiels du musée.

Pratiques documentaires et personnalisation des ressources

Les musées tendent à développer des centres de ressources en ligne, avec des fonctions de recherche évoluées et des espaces personnels, services qui étaient auparavant réservés aux scientifiques. C'est le cas de l'évolution[9] du site du Museum national d'Histoire naturelle de Paris (MNHN) et de la préfiguration d'Anthroponet[10], un centre de ressources pour le nouveau Musée de l'Homme, qui met à disposition des contenus scientifiques ayant servi à élaborer l'exposition « Naissance ».

Des dispositifs permettent aux usagers de réaliser une «visite » personnalisée, dont les contenus émanent de la base de données garantie par le musée. Ainsi, l'exposition « Traces du Sacré » (Centre Pompidou) permet de personnaliser sa visite grâce à la sélection de commentaires audio et à

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l'Industrie, l'Exploratorium, MNHN/GGE , Musée de l'Homme (projet en cours AnthropoNet), Musée de l'air, le Musée du Quai Branly, le CCSTI Les Champs Libres, ScienceMuseum (London, Grande-Bretagne), American museum of natural history (New York-USA), National Museum of Nature and Science-Japon, sites d'associations comme Objectif Sciences ou EthnoWeb.

4 La grille d'analyse est composée de variables fondées sur les spécificités participatives web 2.0 : écrire/modifier, lire/déposer/télécharger, co-existence des contenus (musées et internautes/amateurs/experts), modérations, innovations en médiation (musées et savoirs), temporalité (des publications/participations). La grille prend également en compte les modalités d'accès aux documents en ligne (texte, audio-vidéo), leur stabilité (patrimoine et savoirs), l'accès en particulier à la culture scientifique et les nouveaux accès à la fonction enseignement et éducation.

5 Concernant notre corpus ainsi en est-il des sites du Musée de l'air, du National Museum of Nature and Science (Japon).

6 Sur le site du Musée National des Arts et Métiers, quatre fils RSS sont disponibles. Le site Objectif Sciences, proposent également des lettres d'informations et des fils RSS.

7 American museum of natural history (NY) a plus de 1000 fans sur Facebook (fin juillet 2008) : http://www.facebook.com/pages/New-York-NY/American-Museum-of-Natural-History/13259856990?ref=s
L'Exploratorium sur Second life présente des expositions. http://www.exploratorium.edu/worlds/secondlife/index.html

8 Page publiée par le CRHST centre de recherche en histoire des sciences et des techniques de la Cité des Sciences et de l'Industrie (CSI) avec le CNRS http://www.facebook.com/profile.php?id=1193283249

9 Le site du MNHN a tout d'abord proposé dans les années 1990 des bases de données scientifiques destinées à ses pairs, avant de développer des contenus éditoriaux destinés au grand public, au début des années 2000 et bâti actuellement un portail documentaire.

10 http://iens-compas.org/Anthroponet.aspx

l'enregistrement de ses propres commentaires, à partir d'un PAD délivré au musée.

S'appuyant sur les compétences documentaires acquises sur les réseaux et les lecteurs audio et vidéo nomades, certains musées proposent de télécharger[11] des podcasts[12] ou webcasts de conférences[13] avec des scientifiques. Et sur les sites web 2.0, les productions institutionnelles telles que les bandes-annonces des expositions (le Musée du Quai Branly et la Cité des Sciences et de l'Industrie sur Dailymotion) côtoient les documents des amateurs, de qualité inégale et parfois peu reliés à la culture scientfique.

Les internautes peuvent aussi créer des mots-clés à des contenus en ligne pour faciliter leur indexation en dehors des sites institutionnels Avec Del.icio.us, l'un des plus populaires sites web 2.0 et réseaux de tags (relevant du social-bookmarking), on saisit une discrète présence des musées scientifiques[14]. Le projet STEVE[15] permet aux internautes de tagger les objets de collections de certains musées.

Ces services en ligne marquent une évolution dans la manière dont les musées partagent leurs ressources documentaires, atténuant le clivage entre contenus destinés aux publics experts et profanes. Ils s'appuient en outre sur les compétences documentaires des internautes qui sont invités à qualifier, indexer, diffuser, commenter les contenus.

Susciter le dialogue : la culture scientifique en débat

Les blogs sont des lieux d'échanges pour discuter des expositions. Ceux-ci sont soit tenus par les membres des musées, comme ceux de l'Exploratorium, soit par des usagers inscrits quand ils ont la possibilité de créer leur blog sur le site du musée. Les commentaires sont parfois permis pour livrer des avis dans des blogs, rédigés par des amateurs mais également sur des sites de musée, à la manière des livres d'or. Le blog de musée, visant à promouvoir de futurs musées ou une rénovation, engendre généralement peu de commentaires. Le Musée de l'Homme accompagne sa rénovation d'un blog, intitulé « Sagablog », qui présente des contributions de l'équipe projet, de scientifiques et de visiteurs livrant leurs impressions. Vigilants, les musées préviennent d'éventuelles confusions entre informations institutionnelles et celles émanant des publics.

Les forums modérés par les professionnels des musées visent à faire participer temporairement les publics, avec des informations fiables pour éclairer le débat, comme ceux proposés ponctuellement sur le site de la Cité des Science set de l'Industrie. Les sites d'amateurs organisent également des forums pour des rencontres avec des professionnels, comme ceux de EthnoWeb. Pour solliciter l'expression des publics, la Grande Galerie de l'Evolution du MNHN propose régulièrement des

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11 Le téléchargement rend les contenus échangeables, permettant un autre rayonnement des contenus muséaux.

12 Le Palais de la Découverte propose un « coin audio, vidéo », l'Exploratorium : « explo.tv » qui donne à consulter ou télécharger des émissions. Les associations d'amateurs des sciences aussi misent sur l'audiovisuel, c'est le cas de la « Plateforme Multimédia Collaborative - Recherche Scientifique et Education aux Sciences ». d'objectif-sciences.tv.

13 Le Museum d'Histoire naturelle de Londres propose des conférences avec les scientifiques www.nhm.ac.uk/nature-online/nature-live/index.html. Les podcasts de l'Exploratorium visent à maintenir l'intérêt pour les thématiques scientifiques rejoignant souvent la catégorie « popular science », notamment pour les expéditions.

14 A partir du mot-clé sciences 45235 références sont listées : la Cité des Sciences et de l'Industrie est mentionnée en 21ème position, beaucoup plus loin le Collège de la CSI, encore plus loin le site « La main à la pâte », opération lancée à l'initiative du professeur Georges Charpak, prix Nobel de physique 1992 et de l'Académie des sciences. Si l'on essaie la recherche avec les mots-clés : sciences + museum, on peut lire des références de sites de musées américains et on retrouve en 6è , 7ème et 9ème positions la CSI, en 8 ème position l'Exploratorium. Le site du MNHN arrive en 18ème position. Les musées européens sont peu taggés.

15 Nommé aussi the Art Muséum Social Tagging et piloté par des professionnels de musées américains et de grandes institutions muséales.

espaces d'expression par le vote, comme avec son exposition « Mouches », reliant le web et l'exposition réelle[16].

Dynamiques contributives

La contribution est une autre étape de la communication des musées, quand les internautes sont invités à créer des contenus pour nourrir un projet, une exposition. L'exposition « Dragon » de la Grande Galerie de l'Evolution (GGE) du MNHN invitait les internautes à envoyer une carte d'un dragon personnalisé, tout comme l'exposition « Mammouth », qui recevait des dessins de mammouths. L'association Objectif Sciences laisse la possibilité de publier ses reportages sur sa « plateforme Multimédia Collaborative ».

Avec le signalement des oiseaux bagués[17], ou l'Observatoire des papillons des jardins lancés par le MNHN, des amateurs collaborent avec les scientifiques via des dispositifs qui visent à recenser la biodiversité, ou encore à observer le développement des espèces invasives, avec la campagne sur le frelon asiatique[18]. Dans la plupart des cas, la collaboration s'effectue par l'intermédiaire de protocoles en ligne précis, et les résultats des collaborations sont restitués en ligne aux internautes amateurs[19] qui contribuent ainsi à la science en construction et peuvent voir les résultats de leurs apports.

En guise de conclusion nous relevons le rapport aux sciences via des services web 2.0 comme vecteur de rayonnement de la culture et de l'apprentissage informel. En effet, les technologies web 2.0 utilisées par les musées ouvrent la voie vers de nouvelles formes de médiation et de relations entre musées et publics, tout en poursuivant les missions du musée. Nous n'en sommes qu'au début de l'appropriation du web 2.0 par les musées séduits et en même temps réticents face aux contenus des internautes.

Ainsi, lorsqu'il utilise les pratiques web 2.0 pour sa communication, le musée reproduit avec les nouveaux outils les modalités classiques de ses relations avec ses publics. Avec le développement de centres de ressources et de l'indexation sociale, il offre aux profanes des services proches de ceux réservés aux scientifiques professionnels. Ces usages participent d'une redistribution de la compétence documentaire du professionnel vers le profane et rendent possible un rapport plus actif et personnalisé aux contenus en ligne proposés par les musées. L'internaute peut s'approprier et paramétrer un environnement, mais également commenter, débattre, participer à la diffusion, voire à l'élaboration de contenus. Ces pratiques, en multipliant les modalités d'actions avec/sur les contenus, sont susceptibles de favoriser l'apprentissage, la connaissance résultant de l'interaction de l'individu avec son environnement (Piaget, 1937). Corrélativement, celles-ci tendraient à renforcer l'engagement cognitif et affectif du sujet, autre facteur clé d'apprentissage (Papert, 2003).

Cette diversification des modalités d'interaction avec les contenus s'accompagne d'une diversification des interactions sociales entre institution et amateurs et entre amateurs des sciences. Les outils et pratiques présentés proposent en effet des rôles aux internautes, prescrivent la participation, la collaboration et la contribution suivant des règles précises. Ce cadre socio-technique favoriserait à la fois la construction de représentations relatives aux contenus, et celles

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16 L'expérience du forum Pique Prune du MNHN (Vidal, Parent, 2003) confirmait déjà la tendance à ne pas considérer les internautes uniquement comme des visiteurs potentiels, grâce aux activités similaires sur le web et dans le musée.

17 http://www2.mnhn.fr/crbpo/spip.php?rubrique4

18 http://inpn.mnhn.fr/isb/index.jsp

19 http://www.noeconservation.org/index2.php?rub=12&srub=31&ssrub=98&sssrub=261&goto=contenu

relatives à la position et aux relations du sujet au sein de cet environnement, en accord avec les écoles socio-constructivistes (Vigotsky, 1978 et l'école genevoise notamment). En effet ces dernières mettent en avant la primauté de la dimension sociale de l'apprentissage, et l'importance pour le sujet de se représenter sa position dans cet environnement. Par ailleurs, les théories de l'apprentissage situé[20] qui valorisent les contextes et situations réalistes (Lave, 1988) vont également dans le sens de l'hypothèse du potentiel pédagogique de ce type d'environnement non formel d'apprentissage.

Ainsi, le « potentiel cognitif » (Depover et al., 2007) des services web 2.0 mis en œuvre par les musées favoriserait le développement de compétences de traitement des situations complexes, d'articulation de dimensions cognitives, sociales et métacognitives, de combinaison de savoirs déclaratifs et procéduraux. Cependant, passer de l'étude de ce potentiel à celle de son actualisation réclamerait l'étude des usages effectifs, mais aussi celle des usagers pour déterminer si ces environnements favorisent la conquête de nouveaux publics, enjeu important pour les musées. Par ailleurs les musées veulent encore garder le privilège de désigner les savoirs et de les formuler[21], et l'institution n'a pas toujours les moyens (humains, économiques) suffisants pour la mise en œuvre de ces nouvelles médiations en faveur du développement de la culture scientifique.

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20 L'apprentissage situé recommande de placer l'apprenant dans un contexte similaire à celui dans lequel les compétences seront utilisées, et consécutivement pointe le caractère peu opérationnel des connaissances acquises en milieu scolaire classique.

21 De plus, nous constatons des usages des musées techniques et scientifiques quelque peu en retard par rapport aux musées d'art, retard plus accentué en France qu'aux Etats-Unis, et par rapport à certains sites d'associations d'amateurs.

The construction of knowledge through gaming. How to engage university students in the understanding of the historical developments of knowledge and scholarship via playing and networking

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Abstract

Game-based learning is an acknowledged and valued teaching approach in children's education and is gaining increased acceptance in some sectors of professional training. However the educational value of games is still sometimes questioned in academic circles. On the other hand evidence of use of games in university teaching reveals that students welcome the idea of adding games to their portfolio of learning opportunities. The article investigates the current status of game-based learning in education; introduces the theoretical framework supporting game-based learning; presents an example of a Flash game developed for the higher education sector. 'The Secrets of Biblioland' is a web-based educational interactive game designed to enable university students to develop information literacy skills and awareness of the historical developments of scholarship and publishing, of the role of libraries and knowledge repositories, of cataloguing resources, using libraries and searching engines, producing appropriate referencing.

Keywords: game-based learning, information literacy.

1. Academic literacy and knowledge construction. New learners, new media, a multiplicity of information literacy domains

Academic literacy entails the acquisition of sophisticated levels of competency in gathering, cataloguing and handling information from a variety of sources. University students are also expected to rapidly familiarise themselves with academic traditions such as referencing correctly from books and academic journals. Traditionally students have been invited to spend their time in libraries and encouraged to read print sources such as academic books and journals. However communication technologies have introduced new ways to access information; the means for acquiring and sharing information are now global and networked, print media is now only one of the many tools available to students and researchers. "Printed paper provided the primary means for the dissemination of literate scholarship and became the primary medium of academic communications…However, for at least the last150 years, the hegemony of printed paper has been increasingly challenged by other media (photography, sound recording, film, television, etc.)." (Ingraham et al., 2007, p.166). Digital media, the Internet, e-books play an increasingly important role in learning and teaching strategies in higher education. Nevertheless the history and traditions of academic knowledge construction still constitute the starting point of the students' academic journey; it is therefore essential to find innovative ways to engage the new generations with such traditions, using the type of media that is more familiar to them. The new generations of learners that are now engaging with academic literacy are avid and expert media users. The "digital natives", as defined by Marc Prensky (2001b), move comfortably through different digital media platforms and expect to find and exchange information quickly and effortlessly. Their experience of information literacy is not exclusively based on print media: "In the modern world print

literacy is not enough. People need to be literate in a great variety of different semiotic domains…Furthermore, and more important, people need to be able to be literate in new semiotic domains throughout their lives." (Gee, 2003, p.19). Computer games are an important aspect of such variety of semiotic domains. Over the last decade digital games have become a mainstream form of entertainment, successfully competing with films and television. But games are not just a way to entertain teenagers and young adults, they can also become highly effective educational tools for the "digital natives" generation.

2. The use of games in education. The theoretical background to game-based learning

Game-based learning methods are widely accepted in children's education and have become an important part of interactive educational packages (De Jong, 2003). The professional training industry has also been keen to exploit the learning potential of digital games. Corporate training has made use of such games for a variety of staff developing purposes. Marc Prensky has been advocating game-based learning for professional training as well as for academic studies; he has identified the US military establishment as an enthusiastic early adopter of training games (Prensky, 2001). Games are now gaining more credibility as educational tools; well-established commercial games such as SimCity, The Sims, and other management and strategy games are used in business studies, sociology and other academic disciplines (Hays, 2005; Foreman et Borkman, 2007). Research projects on the educational value of games are now exploring the potential use in academic settings, expanding from the mere evaluation of individual projects to the more theoretical aspects of game-based learning. Richard Van Eck has examined the factors involved in the implementation of game-based learning in higher education; he argues that "Many serious game proponents have been conducting research on how games can best be used for learning, resulting in a small but growing body of literature on DGBL as it embodies well-established learning principles, theories, and models." (Van Eck, 2006, p.18). The theoretical background to game-based learning maps very diverse traditions, including game design theory (Crawford, 1984; Salen et Zimmerman, 2003), audience analysis, narratology and ludology (Frasca, 1999; Mateas et Stern 2006), instructional design and learning theories (Aldrich, 2005). The relationship between game-based learning and pedagogical issues is crucial to the success of educational games. Katrin Becker has identified strong links between the learning activities occurring in commercial games with the learning theories of Jean Piaget and other important educationalists. She has drawn parallels with, among others, Gardner's theory of Multiple Intelligences and David Kolb's and Roger Fry's theory of Learning Styles (Becker, 2007). The recent literature on game-based learning for adult education is exploring issues about the design and development of learning games, their educational value, the learners' profiles and expectations, the impact of games on students' learning and especially the problems associated with producing ad hoc games for the education sector (Hays, 2005; Michael et Chen, 2006).

3. *The Secrets of Biblioland* game

The Secrets of Biblioland is a web-based interactive game designed to support university students in developing academic information literacy skills and awareness of the historical developments of scholarship and publishing, of the role of libraries and knowledge repositories, of cataloguing resources, of using libraries and searching engines, of producing appropriate referencing. The game should be used as a component of a blended learning strategy intended to complement the traditional teaching of academic skills that usually takes

place in the first year of undergraduate programmes. The game takes the students through the discovery of such tradition by taking on the role of the champion of the *Lost Reference*. The gamers embark on an adventure to seek the *Lost Reference* prompted by a request from a member of the *Fellowship of the Seekers*. During their journey they visit ancient and contemporary libraries and are confronted with the historical development of knowledge and learning. The game story and mechanism lead the students/gamers from Socrates to the Library of the Future via Ancient Alexandria, medieval abbeys, an encounter with Johannes Gutenberg, and a visit to the British Library. The game characters introduce the players to the developments of writing technologies, discuss issues about access to knowledge and learning, about authorship and about the role of libraries. In the Plagiarism Cellar students have to confront the debate about referencing, plagiarism and academic misconduct.

3.1 Narrative, identity and community: gamers actively participating in the perpetuation and construction of knowledge

The Secrets of Biblioland is designed according to the typical adventure game structure: a quest, a call to take up the challenge, a journey disseminated with obstacles and puzzles, the final test and the conclusion of the quest. The story is at the centre of the pedagogical construct of the game. It is via the historical excursus through the various libraries that the gamers learn about the changing nature of knowledge repositories and about the role played by writing technologies in the transmission of knowledge. Therefore the story becomes an integral part of the gameplay and links to the additional learning materials distributed on the associated website and blog. Gamers are playing as Biblioland champions, they are constantly reminded of their fundamental role in the survival of Biblioland, in the preservation of the old traditions but also in the construction of new knowledge. In their role as members of the *Fellowship of the Seekers* they learn by doing as well as by collecting evidence, reflecting and making choices. They become active participants in the fate of Biblioland and, conversely, in the traditions that Biblioland represents. Upon completion of the game students gain access to the associated blog, where they can continue their experience with the *Fellowship of the Seekers*. The blog is intended to support a community of learners where students and tutors can open a debate about issues on academic writing, researching tools and skills, referencing and especially plagiarism. The game also has a presence in the *Second Life* virtual community, the development team is currently exploring ways to export some of the game elements in *Second Life* and as mobile phone applications.

3.3 The Secrets of Biblioland, the production choices and challenges

Designing and developing ad hoc games for the higher education sector, as opposed to exploiting commercial games, presents a number of difficulties due to the scarcity of available funds, the limitations of resources and expertise and issues about accessibility and usability. However there are distinctive advantages in producing ad hoc educational games: a clear focus on the subject matter, the possibility to embed relevant educational content and links with other online learning materials, direct control over the game structure and aims, a strong academic input in designing the educational aspects of the game. *The Secrets of Biblioland* game has been produced using Adobe Flash and features 2D illustration and animation. The choice of such technologies is related to accessibility and reusability issues and to the limited available budget and time-frame. The game has been developed by a team of academics specialising in digital media: Elena Moschini (team leader), Che Guevara John and Vanda Corrigan from London Metropolitan University and Enrico Benco from Middlesex University. The team has adopted a user-centred approach: the game idea, the interface and game mechanisms and the learning materials have been tested during the production phases

via a series of focus groups with students and academics (Moschini, 2006). *The Secrets of Biblioland* project has been awarded an ESCalate Development Grant and a grant from the Learning et Teaching Projects Fund, The Centre for Academic Professional Development, London Metropolitan University. The game and the accompanying learning materials are accessible on the web at: http://www.biblioland.org.

4. Conclusion

Game-based learning in higher education is moving from the early stages of enthusiastic expectations to an operational implementation phase revealing the need for a systematic approach to the analysis of educational games. This is a relatively new field for both game designers and educationalists and requires attentive choice of production methods, more evaluation projects and further research. *The Secrets of Biblioland* game constitutes an attempt to explore ways to apply game-based learning principles to the acquisition of academic literacy skills and to introduce a new generation of university students to knowledge repositories, authorship, referencing and plagiarism issues and the development of writing and scholarship traditions.

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E-learning by Doing with Computational Logic

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Abstract

E-learning by doing is an important e-learning process, that provides several advantages but that requires a high interactivity degree, not always supported in e-learning contexts. In this paper, we propose to exploit a formal approach (based on Computational Logic) to define, verify and support the e-learning by doing paradigm. To this end, we introduce the SCIFF formal frameworks, its features, and two software components for e-learning of software applications.

Keywords: Logic Programming, E-Learning by doing, Interaction Protocols, Software Application.

1. Introduction

One of the most promising learning paradigms is the *learning by doing*, where the student directly practices a learning topic onto a real system, or a model that simulates the real system. The student is presented with a problem, whose solution requires the use of the acquired knowledge. By directly practising on the real system, the student enforces such knowledge; moreover, if the solution of the problem has not been given before (and it is not a naïve consequence of the knowledge itself), the student is forced to construct its own solution, hence exploiting and practising the acquired competences. The *learning by doing* approach can be applied also to e-learning processes (Baldoni et al., 2003), and in particular to software applications learning. A further advantage of this approach derives from the fact that many software systems allow different solutions for the same problem: in the e-*learning by doing* there is no need to overload the student with such information, but rather she is left the task of "discovering" such possibilities, making the learning process a personal experience.

The advantages of the *learning by doing* are a consequence of the high degree of interactivity that such model envisages. Supporting interactivity then is fundamental, and weaknesses on this aspect deeply hinder the approach. E.g., the student should receive help and feedback whenever it is opportune, hence avoiding the risk of being blocked. To this end, run-time evaluation is fundamental to automatically provide suggestions to the student, while "a posteriori" evaluation is needed to assess the acquired skills. Moreover, the common situation where the same learning goal can be achieved in more than one way requires the tutoring system to be able to evaluate all the options, and in particular to dynamically adapt to the student choices.

In this paper we present our approach, based on computational logic, to the e-learning by doing model for software applications. We draw inspiration from our previous work on software Multi Agent Systems and agent societies. In particular, within the European project

SOCS[1], we developed a comprehensive framework, namely *S*CIFF, containing theories, languages and tools for defining, constraining and evaluating the observed behaviour of agents in a social context (Alberti et al., 2008). Here, we show how the *S*CIFF declarative language can be used to define learning goals and to rule the learning activities. Then, the same tools used for agent verification can be adopted to perform evaluation at run-time/posteriori, and to provide hints. W have focused our attention on office applications, namely the OpenOffice Suite and the MSOffice 2007, and we have developed a software prototype supporting these two frameworks. The software comes as a plug-in that receives as input the high-level description of a learning activity, and the actions performed by the student. Evaluation or suggestions then are given as output, supporting the interaction required by the learning model.

2. The SCIFF approach to Agent Interaction Protocols

The *S*CIFF language (Alberti et al., 2008) was originally introduced for the specification of global interaction protocols in open agent societies. It is focused on the observable events which occur within an interaction among two or more agents, where with the term “agent” we generally mean a software component, as well as a human user or a robot. We assume the reader to be familiar with Computational Logic, and with Logic Programming in particular; the non accustomed reader can find a good introduction in (Lloyd, 1987).

*S*CIFF models the occurrence of an event *Ev* at a certain time *T* with the predicate *H(Ev,T)*, where *Ev* is a logic programming term and *T* is an integer, representing the discrete time point at which the event happened (the *H* stand for ``Happened"). Beside the explicit representation of what has already happened, *S*CIFF introduces the concept of “what” is expected to happen, and “when”. Thanks to the notion of expectation, *S*CIFF allows to specify interaction protocols in terms of rules of the form “if A happened, then B should be expected to happen”. *S*CIFF pays particular attention to the openness of interaction: interacting peers are not completely constrained, but they enjoy some freedom. This means that the prohibition of a certain event should be explicitly expressed in the model: to this end *S*CIFF supports also the concept of negative expectations (i.e. of what is expected not to happen).

Positive expectations about events come with form *E(Ev, T)*, where *Ev* and *T* could be variables, or they could be grounded to a particular (partially specified) term or value respectively. Constraints (à la Constraint Logic Programming, (Jaffar et Maher, 1994.)), like *T>10*, can be specified; attaching this constraint on the above expectation means that the expectation is about an event to happen at a time greater than 10. Conversely, negative expectations about events come with form *EN(Ev, T)*; writing $EN(Ev, T) \wedge T>10$ means that *Ev* is forbidden at any time which is greater than 10. Social Integrity Constraints are forward rules used to link happened events and expectations, to the end of defining allowed interactions by means of declarative rules. They come with the form $body \rightarrow head$, where *body* can contain (a conjunction of) happened events and expectations, and *head* can contain (a disjunction of conjunctions of) positive and negative expectations.

The operational counterpart of the language, namely the *S*CIFF proof procedure, is able to verify conformance of a set of interacting entities w.r.t. the considered protocol by hypothesizing positive (resp. negative) expectations and checking whether a matching happened event actually exists (resp. does not exist).

[1] “SOCS: Societies Of ComputeeS” project, IST-2001-52530, 5th Frame Program.

2.1. Applying the SCIFF framework to the E-learning scenario

We start by considering both the student and the real system (a software) as two distinct agents interacting with each other. Each event corresponds to one observable action that the student performs, i.e. mouse clicks, shortcut key pressions, and similar. The *S*CIFF language then allows defining a possible exercise in terms of a goal and of a set of rules the student must follow. Each rule defines the expected, future behaviour of the student, i.e. which are the actions she is expected to do.

For example, consider the following exercise: "The student should create a new document, insert a title, applying the style Heading1 and finally save such document". The goal of the exercise is given by the conjunction of many sub-goals, each one achievable in many different ways. For example, a *S*CIFF rule for the creation of a new document would be:

$$\begin{aligned} H(\text{start}(\text{exercise}), T_s) \rightarrow\ & E(\text{fileMenu}(\text{createNew}), T_c) \\ & \vee E(\text{keyPression}(\text{ctrlN}, T_p) \\ & \vee E(\text{keyPression}(\text{altFN}, T_a). \end{aligned}$$

The right part of the rule contains, in a disjunction, the alternative actions that satisfy the goal of getting a new document. The rule is satisfied if the student performs at least one of the expected actions.

The *S*CIFF Proof Procedure can be exploited then in two different ways. A posteriori, it can be used to evaluate the sequence of performed actions, and determine a score of how much

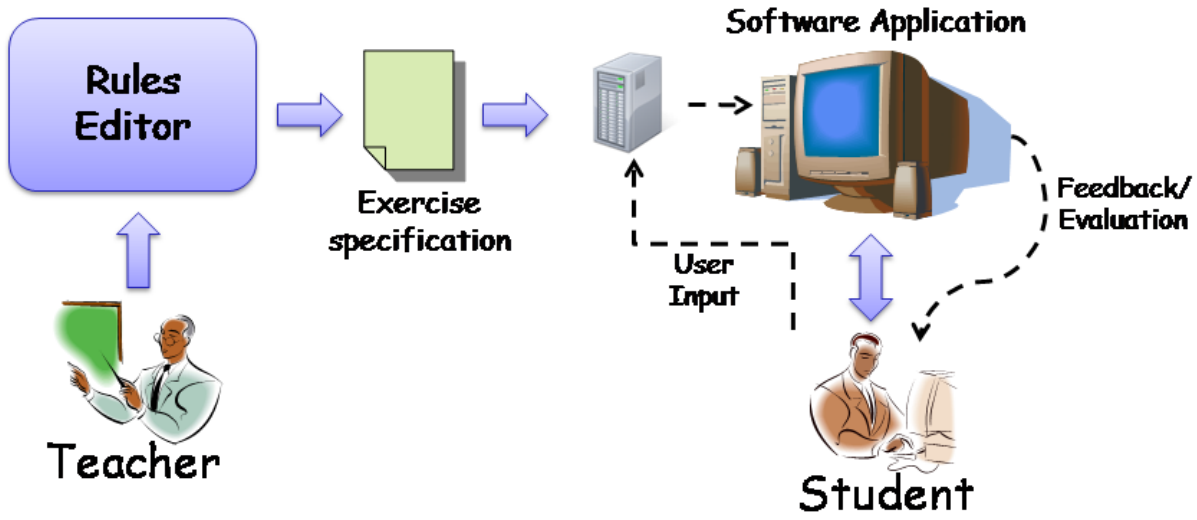

Figure 1: Overall architecture of the SCIFF Verification Plug-in

she has fulfilled the expectations. Such expectations could have been a direct consequence of the exercise goal, as well as they could have been generated by the triggering of some rule.

At run-time, the *S*CIFF proof procedure can be exploited again for evaluation purposes or, more interestingly, to compute, at each moment, which are the expectation about the student behaviour. If needed, the proof procedure can directly provide suggestions. The choice of whether providing a suggestion or not can be defined by the teacher by means of SCIFF rules again.

3. The *S*CIFF Verification plug-in and the Rule Editor

The overall architecture we propose is depicted in Figure 1. The first step consists on defining the exercise, by providing a goal and a set of rules, in terms of the *S*CIFF language. To this end, we developed a visual editor that allows the teacher to abstract from the *S*CIFF syntax (Figure 2). The editor presents to the teacher the list of the available actions the student can perform: the teacher is left only the task of creating a link between a set of actions, and what the student is expected to do if she performs such actions.

The exercise specification in *S*CIFF then is provided as input to the Verification plug-in, whose main task consists on monitoring the student actions, and to provide feedback/evaluation if needed. The Verificaton plug-in then comes with four different components, (1) a toolbar to activate/deactivate and load the exercise; (2) a module (not

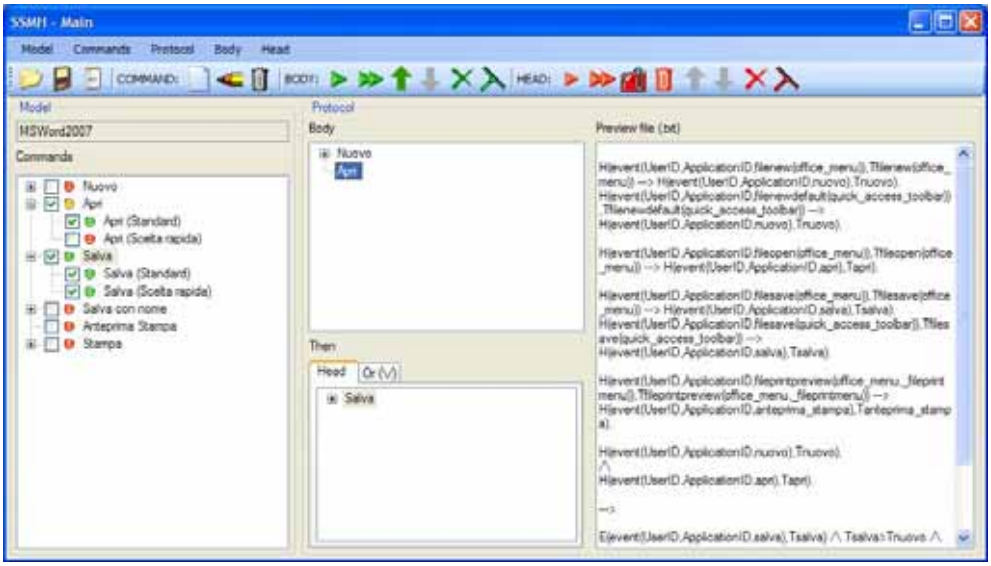

Figure 2: The Rule Editor

visible to the user) to intercepts the student actions and passes them to the *S*CIFF proof procedure; (3) a module encapsulating the proof procedure to evaluate the student behaviour; and (4) a special window where messages can be displayed to the student.

4. Conclusions and Future Works

E-learning by doing is an important learning model that provides several advantages, and in particular the possibility of having students practising learning topics directly on real systems, hence making the learning experience a personalized process. In order to be successful, e-learning by doing model requires a high degree of interactivity; moreover, systems supporting such model must be able to dynamically adapt to a number of different conditions and situations.

Starting from our previous experience on Multi Agent Systems, we exploited the framework *S*CIFF in two ways: as a specification language, to support the definition of exercises in terms of logic programming goals and rules; as a verification tool, to verify if the behaviour of the student respect the constraints given by the exercise. The advantages are manifolds: the use of a declarative language makes easier the specification of an exercise; evaluation can be performed a posteriori, o directly at run-time; moreover, the same tool used can be used to provide feedback, if the student needs it, hence supporting a certain degree of interaction.

The developed software components, i.e., the Rule Editor and the SCIFF Verification Plug-in, are yet in a prototypical stage. We have started some testing with some students, getting some

positive feedbacks but also some remarks about the feasibility of specifying complex exercises. A far deep testing of our approach is needed before we can draw any conclusion. Moreover, the Verification plug-in actually supports only two software applications.

Future works will be devoted to better evaluate the feasibility of our approach, as well as to consolidate and extend the developed software. We also plan to test our tools with a real e-learning by doing case, in order to understand the limits and the real advantages of our approach. In the medium term, we plan to build a repository of possible exercises supporting our approach, to the end of providing a reasonable experimental support for our tools.

Acknowledgements

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Open Education and virtual communities: an experience

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Abstract

In Fall 2007, Utah State University professor David Wiley held a course about Open Education. That time Dr Wiley's course was followed by an unusual group of students. The Fall 2007 edition, in fact, was available to anybody, free of charge, all over the world. The only requisite required was the possession of a blog for the completion of the weekly assignments. The present paper, whose authors attended the course, is an account of their experience. It can be considered an innovating experience from many different viewpoints and an example of how the world of the formal education can meet the demands of the informal one, in the broader landscape of professional training and lifelong learning.

Keywords: OER, Open Education, online community, informal learning

1. The "Introduction to Open Education" course

The "Introduction to Open Education" (OpenEd: INST 7150 Introduction to Open Education, Fall 2007) course is a formal undergraduate course by Utah State University (USA).

The instructor is David Wiley, Associate Professor of Instructional Technology and director of the Center for Open and Sustainable Learning (COSL) at Utah State University (http://cosl.usu.edu/), well known researcher in the area of Learning Objects and Open content.

The novelty in the Fall 2007 edition of the course was the opportunity of attending the course free of charge, offered to anyone in the world. The only requirement was the availability of a blog, to be used to publish weekly posts on the various topics of the course.

The course could be attended in different ways:

- *credit*: students who needed credit had to sign up for an independent study at their university and find a supervisor to whom the instructor should send a grade at the end of the term;
- *non-credit*: students could attend the course without any grading from the instructor. If they completed it they could get a certificate at the end of the course stating its successful conclusion;
- *informal*: fully non-credit attendance of the activities.

The course objectives were:

- to give a firm grounding in the current state of the field of open education, including related topics like copyright, licensing, and sustainability;
- to help locate open education in the context of mainstream instructional technologies like learning objects;
- to get thinking, writing, and dialoguing about current practices and possible alternatives in open education;
- to be able to propose OER projects locally.

2. The course contents

The contents offered by the OpenEd course were focused on Open Educational Resources (OER) starting, however, from a wide perspective about researches onto the respect of human rights in the educational field, reflections about the opportunities and limits concerning the chance to gain free access to educational resources, and considerations about weaknesses and strengths of the OER movement (http://www.opencontent.org/wiki/index.php?title=Intro_Open_Ed_Syllabus). Furthermore, it included examples of good practices in the OER, reflections from the literature on learning objects and hints about its future developments.

3. The Italian group

In January 2007 the Laboratorio di Tecnologie dell'Educazione (LTE) at the University of Florence (http://www.scform.unifi.it/lte) set up a virtual community of students, former students, professionals and teachers whose main objective is supporting informal learning and professional training for those who are interested in educational technology. It has been named LTEver (http://www.lte-unifi.net/elgg) and is based on the Open Source software Elgg, http://elgg.org, (Fini, 2007). Multiple blogs are the main elements in LTEver and it was just from the blog of one of its participants that some LTEver users heard of the OpenEd course and decided to enroll. Meanwhile a dedicated Italian community was activated inside LTEver to attend the OpenEd course and interact inside it.

Based on informal networks of relationships through personal blogs and the LTEver community blog, the people involved in the course have played an active and proactive role contributing efficacious proposals to improve their own training experience, in a balanced union of informality and mutual commitment, typical of the communities of practice (Trentin, 2004). The group experienced what Wenger believes are the three basic principles of an effective community of practice (Wenger, 1998):

- establishment of a 'joint venture', through the formation of a shared vision of problems and shared solutions, the negotiation of priorities among the members and the development of a common awareness;
- mutual commitment on the basis of which the members interact and share the experience that is owned by the individual in order to feed cooperative learning;
- presence of a shared repertoire represented by sets of knowledge, tools, methods and artifacts through which the collective knowledge is being conveyed and the memory of the community is being kept.

4. The collective interaction

As regards the development of the training process, three different phases took place in which the role of the collective interaction became a decisive factor:

- Creation of a starting process: the course teacher traced an outline of the training process to complete by the end of the course indicating its objectives, tools, materials and schedule. The syllabus was published on a wiki that was utterly available and open to the learners, even in its editing options. Therefore, integrations and changes to the structure of the course were allowed, for example some weekly assignments were changed to fit the needs of a group of learners.
- Emergence of the interactions: a group of participants, while completing the weekly assignments on their own blogs, shared their own ideas and experiences about the learning process that had been proposed and produced a wide and structured net of interactions with

constructive functions and cooperative learning purposes. At a first stage, the organizational and didactic structure of the course indicated an individual learning modality for the reading and the working out of the reflections, while the collective interaction among the participants was postponed to a later time, with the stated objective to spur the learners to read the posts in the blogs of their colleagues, getting them to comment on one another. An RSS feed had been arranged, but it turned out to be not very functional to the needs of the participants as the references to the comments were not included while, as many learners pointed out, the discussions that sprang from the comments were even more interesting than the posts themselves.

- Restructuring of the process: the course instructor worked on the net of interactions produced by the group, received their stimuli and restructured the development of the course proposing a final version, modified and broadened on the basis of the learners' observations. At the end of the course, starting from the learning material produced by the participants, the teacher could have the opportunity to extrapolate a new pattern for the course to re-use in the following edition, in a constant process of spiral renewal.

By means of peer interaction, inside a conception of learning traditionally regarded as an individual and passive fruition of contents, as the course seemed to develop in the first phase, we moved on to something else, namely the notion of a learning environment in which the individual who learns changes and creates the learning materials by himself contributing to determine the collective educational experience and making both the traditional learning poles (author-reader) coincide. There was an alternation between moments of individual fruition and moments of collaboration that asked for the reading of the course participants' posts and the comments on the posts that each learner considered relevant. The discussions that sprang from this process turned into such a massive instrument of aggregation that they determined a strong motivation to work out a model of learning based on a constructivist style, which acquires a quite different formative value from a traditional distance course.

We have moved from a conception of knowledge as a typically reticular structure to the development of purely connective organizations and patterns, which establish a tight connection between contents and users, towards a more and more creative and collaborative dimension (Pireddu, 2007).

5. The role of the community

The course was set up with a very open perspective. However, during the first eight weeks activities took place in a rather conventional way. The participants read the assigned materials and blogged their own answers to the assigned questions. Therefore, apart from the delivery method based on blog posts, the course appeared to be a kind of conventional e-learning course, with very little interaction among its participants. Probably, the interaction lacked initially because of the very tight schedule.

This state of affairs caused a lot of discussion in the Italian LTEver community of Open Education classmates, so that one of them wrote a pivoting post, the so called "Week X" post, to point out the weaknesses of the course. A broader discussion spread among the other classmates. The teacher proved to be really open-minded since he took part in the discussion and readjusted the syllabus according to the issues raised by the participants.

The new syllabus let more time for cross-reading and cross-blogging. Even the teacher had more time to comment on the students' posts. The lesson taught by this occurrence is that, even in a markedly informal course, a sensible attitude of the teacher is crucial. The final group of students was smaller than the initial one of about fifty people, but it was still quite heterogeneous, being composed of college students, teachers and researchers. This final group

turned out to be highly motivated since it followed the schedule of assignments regardless of the expectations in terms of final credits.

The Italian subgroup built itself around the Open Education community inside LTEver which turned out to be a very effective place for discussion and problem sharing as well as a good scaffolding tool.

The "wrap up" closing assignment was delivered by the Italian community as a collaborative work by means of the presentation tool available from Google Docs. The initiative was a natural outcome of the previous team work that had influenced all the course life, being appreciated by the teacher as well as by the other foreign course mates.

6. Conclusion

The OpenEd course can be considered a case study for several reasons:

- the nature of the course. It was a formal course, offered by a formal institution (Utah State University), but it was managed and released as an informal learning initiative. This could be a real opportunity for universities. In this way, they might open their courses at a very low cost. While discussions grow on the role of higher education institutions in lifelong learning, this is a real chance to consider;
- the course contents. They were of particular interest in Italy where there are little significant OER initiatives, not comparable to others abroad;
- the carrying out of the course. It offers a working example of a new way for professional development courses and lifelong learning. In this case, the professional community worked at different levels, almost all of them mediated by the technological system that supports the community life: 1) information; it was through the community that participants learnt about the opportunity of attending the course; 2) decision-making; because of emulation and reciprocal encouragement a group of users decided to enroll, creating a specialized sub-community; 3) scaffolding; participants supported one another, both in the cognitive and the emotional aspects, during the course.

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Open Source LMS and Web 2.0 for supplementary teaching: an experience

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Abstract

The aim of the present paper is to discuss the achievements and the drawbacks of the integration of LMS (learning management systems) with the cooperative tools of the Web 2.0 through the account of a supplementary online course that has taken place in an Italian secondary high school. It can be considered an innovating experience from many different viewpoints and can be regarded as an example of how the world of the formal education can meet the demands of the informal one, in the broader landscape of school learning.

Keywords: Open Source, eLearning, LMS, supplementary teaching.

1. The idea

The idea of creating a summer course for High School (Liceo Scientifico) students through the use of the Web (http://www.liceodaprocida.net/users/recuperareconilweb/spazioweb/) was born in June 2007 as a response to the learning needs of some students who had to improve their school results in English as a foreign language by the beginning of the following school year. Article No. 4 in D.M. No. 42 of 22nd May 2007 regarding school credits and debts in Italian High Secondary Education allowed schools to organise summer courses for the students who needed to improve their preparation in curricular subjects, even in an innovative way and cooperating with other schools (MPI, 2007a). It was decided to exploit the availability of an open source LMS from another school (Liceo Scientifico "Da Procida" in Salerno, www.liceodaprocida.net) and the presence of a popular online helpdesk for English as a foreign language carried out on a blog (http://sportelloing.blog.tiscali.it) plus a podcast (www.quadripodcast.it) to ask the students to choose between the supplementary summer learning activities traditionally offered by the POF (Formative Offer Plan) of my school and the participation to an online distance course. The latter alternative was chosen, probably for the presence of their teacher as an e-tutor.

An online supplementary course can thus represent a further opportunity among the traditional ones offered by a school to help students solve their learning problems. However, it should be regarded as integration, not as an alternative, to ordinary teaching practice.

2. Organizational aspects

The project was developed with a pragmatic approach, through the exploitation of the technology and resources already available at school: LAN, Internet connection and open source e-mail programme, with materials and webtools freely available on the Internet and personal materials. Then, a repository of lessons, activities and learning objects was created on the LMS with an individual login for the participants.

After the attendance of a trial lesson where the students were asked to familiarize with the technological tools and resources on the platform, an instructive agreement was signed by the students who accepted to participate to the learning activities responsibly, to interact in group work and to accept that their papers were published on the LMS to be checked and assessed within the project.

The project objectives were essentially linguistic and pedagogical:

- to revise the syllabus and improve the students' competence in English literature;
- to overcome the learning difficulties in some language strategies;
- to recognize the importance of cooperative learning in one's personal growth;
- to acquire new learning tools for writing in a cooperative way;
- to help students become active and co-participative involving them in group work;
- to stimulate peer confrontation and horizontal scaffolding.

From the didactic viewpoint, the integration of formal education as it is provided by LMS and informal learning as it can be found in the cooperative Web 2.0 embraces the principles of Constructivism and Socio-constructivism with its theory of cooperative learning viewed as an interactive process through forms of social interaction and negotiation where people learn from one another.

Moreover, after the success of the so called Web 2.0 which is characterised by a more and more active role of the users in the production of contents, some authors have started to criticize the distance learning approach based on the exclusive use of LMS and foster new types of approach (Cross, 2006). The objective to attain for an effective e-learning is the integration of different kinds of knowledge acquisition, from formal to informal, as it happens in traditional learning. So, it was chosen to integrate the experience of the online knowledge management and formal e-learning activities with others deriving from informal e-learning because of the strong motivation that drives towards what has come to be called "e-learning 2.0" (Downes, 2005). E-learning 2.0 requires a new way of considering e-learning. It is not a technical question but a methodological issue, in other words it deals with the opportunity of becoming authors in the web as well as readers by means of the creation of blogs and podcasts, photo and document sharing and so on through any kind of social interaction (Fini, 2007).

Thanks to the tools of the Web 2.0, the traditional distance practice based on the transmission of contents is turned into a more stimulating, appealing interactive process, an aspect of great importance in one's motivation towards learning.

For all these reasons it was decided to prepare only a small number of modules and activities focusing the attention on the needs and difficulties on which the students were most in trouble during their learning process, even on the basis of the specialist literature on the topic (Calvani et Rotta, 1999). This choice proved to be appropriate, and in fact it was appreciated in the feedback about the project.

3. The learning environment

The notion of learning environment changes considerably from the traditional learning situation where there is a strong vertical interaction between teacher and learner.

The teacher is seen as a facilitator, an assistant on demand who does not intervene in his/her students' choices but is always available and sensitive to their needs, who is learning to use the technological resources available on the web in a parallel process together with his/her students. Learning languages in the Web 2.0 implies a different attitude by teachers. "The task of teachers is to create a multimedia learning environment which means to structure and to organize the learning process." (Donath, 2008).

Horde (http://www.horde.org) the open source LMS from which the online supplementary course has been implemented, is a piece of software and a project that comprises a set of

Web-based productivity, messaging and project-management applications, each of which allows communication, interaction at different levels and in different ways, cooperative work and learning, document sharing and much more. One of its best achievements is its ergonomics, as its use is very simple and intuitive.

The figures provided by the platform are the administrator, the user, the forum moderator. A particular importance is devoted to group work with the provision of a "work area", a forum, a wiki, a web public area besides a personal one.

In other words, Horde is a learner-centered but substantially formal learning environment. The use of a blog, instead, meets the demands of an informal learning environment where further peer interaction and the sharing of experiences, problems, learning achievements are allowed, something that is particularly appealing and motivating for teenagers, many of whom are passionate and experienced bloggers. By the use of both technologies, the condition for effective e-learning through the integration of the formal and the informal dimension is fulfilled.

The learners' position changes as well. While in a traditional classroom activity students learn passively from texts, in this learning context they use an environment that is congenial to them and contribute actively to it on the basis of their different technological and linguistic competencies. Students can organize their own learning times, spaces, modalities with great flexibility, integrating formal and informal learning occasions. If they are shy in a traditional learning environment, the mediation of a computer and the Web 2.0 help them have fewer inhibitions and decrease the factors that create psychological barriers. Horizontal scaffolding can be a major advantage for learners because it cuts down anxiety and helps develop self-confidence.

4. Results and evaluation

The results of the experience were assessed through a traditional written and oral test carried out at school together with other students who had to take an extra exam before the attendance of the following school year. Four out of five students got positive results and did not show any particular foreign language problems in the following school year. However, this experience has given the opportunity of assessing not only the students' final preparation after the course, but also their learning process through the monitoring of their activities on the platform.

For the assessment of the project an online questionnaire was provided (http://www.farnt.unito.it/trinchero/qgen/richiama.asp?codice=elspad_rec), using an online questionnaire generator implemented by prof. Roberto Trinchero at the FAR (Formazione Aperta in Rete), Turin University. The evaluation of the project has been positive. Besides the recognition of the validity of such a kind of learning experience as an effective alternative to traditional teaching practice, it was suggested to extend the experience to the rest of the class during the following school year as a form of integration of traditional teaching activity and revision for the final diploma examination. Only one student did not see any utility in such a project and another did not consider the quality of the expression clear enough.

The new project has involved the whole class and other two classes from other two licei in other parts of Italy (http://www.liceodaprocida.net/users/cooperareconilweb/spazioweb/#inizio) and has also received a good feedback from the students in the final evaluation questionnaire (http://www.farnt.unito.it/trinchero/qgen/richiama.asp?codice=elspad_coop), whose results are shown in figure 1.

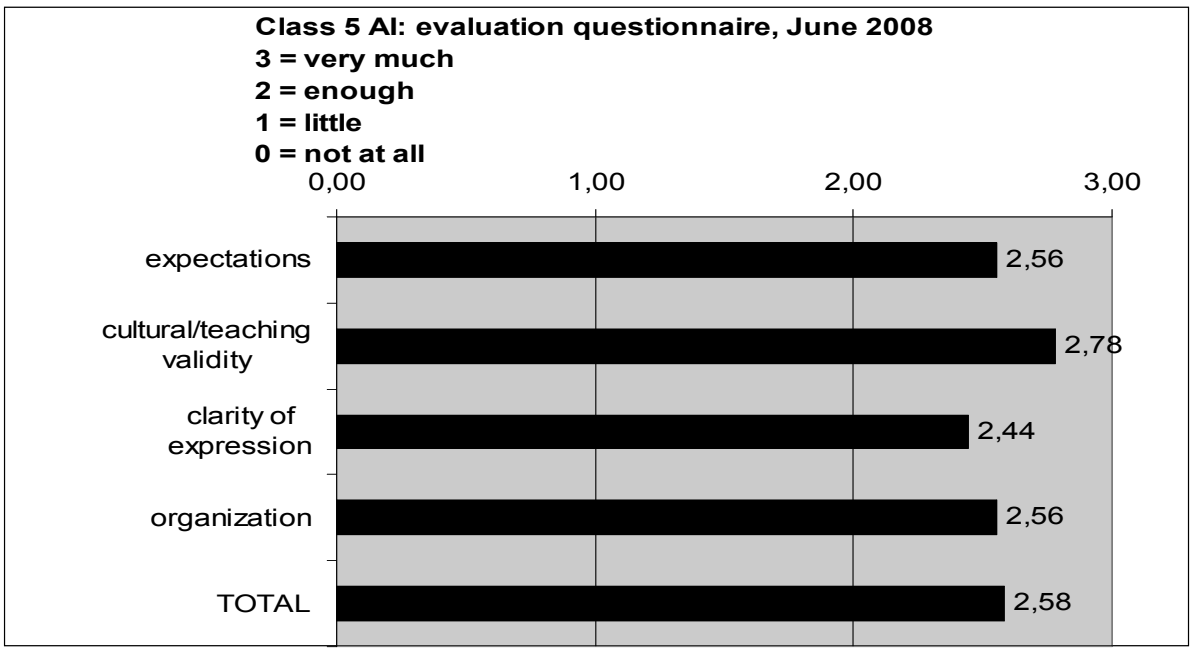

Figure 1

The positive aspects of the experience have been the enlargement of the learning offer; more interest in the integration of the studying of literature; more efficacy of the retrieval and strengthening process; a higher degree of autonomy in the learning method; the improvement of some linguistic skills; increased motivation in the approach to the foreign language and/or the use of modern technologies for educational purposes.

The negative aspects have been the students' laziness who prefer to talk to the teacher directly without the intermediation of an e-mail; the necessity of a constant production of learning materials; a great organizational effort compensated for by a very modest budget, as the 'Decreto Fioroni' does not recognize online supplementary activities explicitly; difficulty of humanising the virtual relationship between students and teacher; the risk of silence; disrespect for times and difficulty in meeting the deadlines; the e-tutor's loneliness in assuming his/her teaching responsibilities and making his/her educational choices.

5. Conclusion

Without pretending to offer a universally valid answer to the problem of the effectiveness of the use of LMS and the Web 2.0 in teaching practice, the experience described in this paper points out that their progressive introduction can represent a further learning opportunity in both teaching and learning. This does not imply that being able to use the new technologies leads automatically to the acquisition of an effective technological competence as the one required in the current guidelines for compulsory education in Italian schools (MPI, 2007b), but the use of ICT can offer some opportunities that can be seized in the same way as a rich semantic-lexical competence can favour deeper thinking abilities. The challenge is now to keep the students' interest towards this learning experience alive, perpetuating it in time and adapting it to their educational needs.

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A PROBLEMATIC TEACHING MODEL FOR THE IMPLEMENTATION OF E-LEARNING FORMATIVE PATHWAYS

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1. Current situation: between theory and operative implementations

The contemporary e-learning scenario is marked by a strong contradiction between Italian and international technical and pedagogical literature on one hand and the reality of the experiences carried out to date on the other.
From a pedagogical perspective, analysis of the literature reveals four strong points in e-learning, corresponding to as many methodological-didactic categories characterizing contemporary innovative didactic practices. In brief, these categories relate to the concepts of individualization, personalization, constructive/socio-constructive approach, student/students and students/teachers educational interaction. Since we are dealing with complex categories, it is worth briefly analyzing their internal problems and the gap between theory and practice in e-learning settings. In any case, their usage must include structural integration and cannot stick to single educational experiences of the additive-linear kind.

1.1. Individualization

The formative category of individualization seeks equal formative opportunities for the learners and deals with the need to use differentiated didactic strategies in order to allow all the students to achieve the same goal. The didactic concept which supports this category envisages the very same formative objective (knowledge or competence) for all the students, but differentiated didactic procedures (timing, materials, spaces, exercises…), reflecting student individuality. This allows everybody to reach the same objective.
In theory, e-learning grants maximum individualization, since it can offer many didactic paths simultaneously, all aiming to achieve the same goal.
In actual fact, this possibility is almost never exploited or is trivialized in a limited choice of alternatives which hardly exploit effective reading tools of entrance levels for single students, offer scanty formative evaluation feed-back and remedial sequences and strategies.

1.2. Personalization

The formative category of personalization deals with allowing the students an opportunity to pursue different formative goals according to identical or different didactic strategies. This category supports the didactic notion that the student can bear out the subjective peculiarity of her/his motivations, aspirations and resources in the choice of formative goals s/he needs to pursue and in adjusting the didactic strategies required to reach them. Personalization strategies aim to give the utmost value to individual diversity and structurally cater for the possibility of choosing parallel paths and directions and concentrating on personal interests.

In theory, offering a very rich number of options, e-learning environments permits the highest degree of personalization.
In actual fact, the presence of didactic material and pathways left to the student's individual free choice is hardly noticeable: this seems to reflect an unplanned didactic redundancy rather than a programmatic choice to provide the student with an effective opportunity of taking part in the definition of formative goals and didactic strategies stemming from personal expectations and motivations. Orientation tools to guide the student in the personal shaping of learning paths are lacking, as are comparative evaluation models of the competences acquired through the fruition of different paths.

1.3. Constructive/Socio-constructivist approach

The constructivist approach overturns the logic of the traditional top-down curriculum (which moves from the syllabus to the pupil, requiring mainly informative skills from the teacher and mainly reproductive diligence from the learner). At the centre of the learning path is the student's active role (possibly in a socio-collaborative context) in the construction of her/his own knowledge. This role can be spelled out when the learning path stresses the learning process rather than its product and when the student's personal experience, her/his research activity and reflection are constantly emphasized.
The pedagogical theory of e-learning asserts its enormous potential in a constructivist and socio-constructivist direction. Nowadays theories of learning and practice communities can be implemented in a rich frame of applications which overcome the old dimension of forums and open up effective collaborations.
In the most common e-learning practice, apart from isolated cases of advanced University and extra-University hyper-experimentations, the constructivist dimension turns out to be substantially absent. Most didactic pathways tend to be merely reproductive; in addition, they are contextualised in a vaguely "active" behaviouristic model rather than focusing on the student's participation (as an individual or in group) in the construction of knowledge. In most cases, we find applicational exercises limited to the control and/or reinforcement of the reproduction of notional knowledge or of guided itineraries towards unquestionable knowledge. These seldom involve reflection activities or procedures of a metacognitive kind, aiming to make the student aware of the competences s/he has reached and the path s/he has carried out to reach the scheduled tasks.

1.4. Formative interaction student/students and students/teachers

In conventional secondary education settings, the interaction between the student and the teacher is mainly limited to face-to-face communication and to testing/assessment of acquired competence. Student/teacher encounters supporting learning and remedial tasks are always erratic and difficult to organise on a technical level.
The scientific literature agrees on defining the possibility of granting structurally continuative forms for the student/teacher relationship. This requires the presence of differentiated teaching/assistant roles: the tutor, the mentor, the coach. Moreover, the planning of a didactic high-quality e-learning environment today can include the conduction of adequate collaboration bordering onto cooperative learning (from collaborative study to the experimentation of differentiated roles in the students' group, to the sharing of common researches, etc.).
In actual fact, in the contemporary e-learning practice we can note the presence of some integrated help for students through accurate and timely technical-administrative answers, the presence of FAQs (Frequently Asked Questions) and definitions of specific learning support roles, such as: tutor, disciplinary expert (less frequently mentor and coach). These educators seem to pertain more exclusively to the domain of support and reproduction facilitation. As for the students, interaction

possibilities are mainly supplementary and independent from the algorithm of LOs which constitute the lesson.

2. A problematic didactic model for the realization of e-learning formative paths

2.1. Guidelines for a model for the realization of e-learning formative paths

The idea of using a problematic didactic model in e-learning formative paths again echoes pedagogical problematicism topics and defines a complex hypothesis which can emphasize the integrated coexistence of different didactic strategies referring back to a problematicist matrix. The theoretical foundation of the model explicitly recalls the main didactic categories mentioned above and their critical interaction.
The starting point of the model described here is the possibility defining three main Learning Objects typologies, focusing respectively on the object, the process and the subject of learning.

LO typology centred on the object of the learning is a part of the so called "top-down curriculum". Its organization stems from the specific subject contents taught. Its formative goal is based on information/reproduction since it is meant to provide the student with learning units which have to be reproduced in a precise way. It can deal with basic or complex alphabets, specific notions, competence or professional skills. The reference model of this didactic strategy, in a conventional formative setting, is the Teaching Unit in its different implementations. Among these, the most rigorous is the so-called "Mastery Learning", which ensures the highest individualization level.

The LO focused on the learning process is a "bottom-up curriculum" application. It moves in a constructive perspective, which is based on the so-called "scientific thought". By "scientific thought" we mean a knowledge construction modality which uses specific research methodologies compatible with the specific subject contents. In other words, it encourages the use of direct investigation tools which allow knowledge conceptualization, generalization and portability.

The Learning Object based on the motivations and "emotions" of the learner deals with motivational and emotional features in evaluating the efficacy of the learning process. This problem has traditionally been considered central in educational research. This kind of LO pursues activation of competences which are not easily measurable because of their close connection with the individual. The main didactic activities are represented by cultural awareness activities, i.e. stimulation strategies to touch the learner's personal sphere.

As we have stated so far, the three LO typologies rise from different learning interpretations and thus imply different formative goals. In a problematic didactic model the main issue, rather than deciding which is the best LO typology, is to define the specificity of the single typology in order to schedule lessons which can include the three LO typologies described, according to the following criteria:

- disciplinary specificity of the object of the learning;
- explicit goals of the course;
- learners' age and initial competences;
- main features of the context.

The main idea of the problematic model is that one cannot acknowledge a high formative quality to coursework which does not offer any of the three LOs described above.

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A web-based learning tool for applied mathematics disciplines

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Abstract

Recently, many efforts have been devoted to the implementation of web based learning tools, that have found widespread diffusion in high schools, graduate and undergraduate universities classes. They enable the fruition of educational materials through a web used user interface and they often implement the same cognitive model that is beyond a traditional course. The aim of this work is to present SIRMM (Searchable Information Repository of Mathematical Models), an interactive environment for mathematical teaching and learning within scientific disciplines.

Keywords: Learning Environments; architectures for educational technology systems; teaching/learning strategies; improving classroom teaching.

1. Introduction

A large amount of projects and material is nowadays accessible online aimed to redesign the educational process throughout the integration of computer and communications technologies (Avgeriou et al., 2001a, b). Nevertheless, the heterogeneity of the different projects around and the lack of portability and adaptability of the developed systems to different educational scenarios are serious drawbacks to achievement of such ambitious goal.

The aim of this work is to present SIRMM (a Searchable Information Repository of Mathematical Models), a new interactive environment for mathematical teaching and learning within scientific disciplines. The goal of the SIRMM project is to provide a mathematical common and unifying framework to teach scientific and technical disciplines such as physics, engineering, biology and finance, in which mathematical modeling and data analysis play a major role. On the other way around, SIRMM might be used in teaching and learning mathematics through real world applications (Greer, 1993; Greer, 1997). SIRMM is not supposed to be a simple collection of problems, rather it is an adaptable Learning Environment (LE) to be used in a wide range of courses.

2. SIRMM conceptual architecture

SIRMM proposes a conceptual framework (Giannino et al., 2004) for the development of a problem solving-oriented learning system for applied science disciplines, in which the main mathematical concepts involved in real word applications are supplied in a unified, flexible and collaborative framework.

SIRMM database contains objects of different types usable in frontal and distance learning processes within standard learning paths. SIRMM has the ambitious goal to support different learning paths for different types of students and subjects field. It implements a learn-by-doing approach, thus yielding the greatest educational benefit. In contrast to traditional science, students are presented with a LE in which they have the option to dynamically create their own study path. Furthermore, students have also the chance of accessing additional information and tools as need arises, stimulating a flow of knowledge.

SIRMM let people solve problems step by step from the easiest level to the most difficult one and provides the possibility of building various modules of information related to every specific issue, and different educational paths; Figure 1 presents two alternative paths. The first one focuses on mathematical issues (calculus and numerical analysis and computational techniques), by integrating application problems in the learning path, whilst in the second one the mathematical concepts support the formalization and the problem solving stage in a technical discipline.

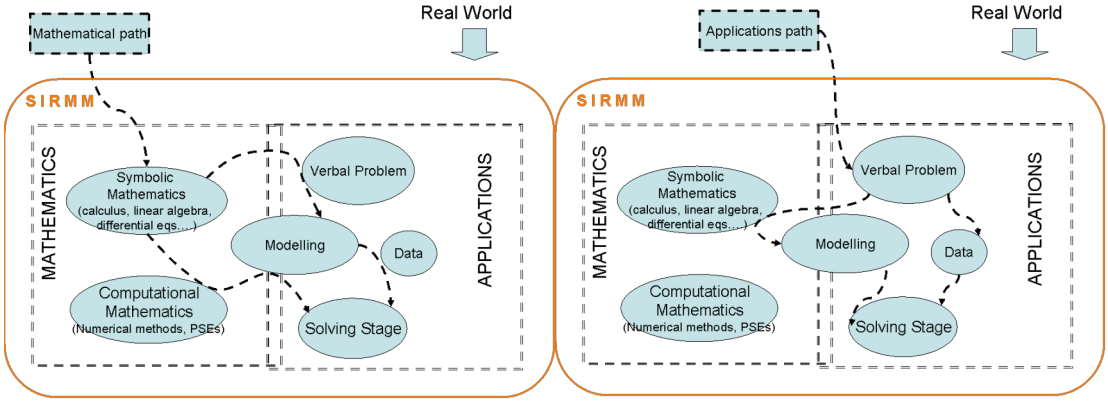

Figure 1. Example of learning paths supported by SIRMM.

The information granularity behind SIRMM substitutes the traditional structure of knowledge arranged in a rigid form, overcoming knowledge separation and obstacles in multidisciplinary approaches. Users identify and browse the Learning Objects (LO) that characterize the steps of a specific learning path as components which may be reused in the comprehension of other problems. Fine-grained modules are reusable for different courses and disciplines, facing the needs of an educator to teach the desired course and convert a module already developed into another one. SIRMM is flexible enough to address changing user requirements and knowledge, and is usable in a variety of contexts.

2.1. SIRMM platform

SIRMM platform is accessible through a web browser (http://www.sirmm.unina.it) that integrates different scientific applied problems. It provides, for each problem:

1. a clear description of the phenomena,
2. a model definition (data, relations, parameters) with the analysis of the mathematical issues,
3. a numerical-computational approach,
4. case studies with analysis and interpretation of the results,
5. links to additional source of information.

2.2. Model database

SIRMM is composed of a set of entities interacting at different levels. In this section a model for those entities and their relationships is given. The design of the learning management system will be derived from this analysis.

Figure 2 provides an Entity-Relationship model. The entity DISCIPLINE describes the scientific area of interest, that is the fields in which the contents of SIRMM are catalogued. Each discipline includes several PROBLEMs, that are identified by a name and a short description. A problem is formulated as a MODEL (possibly more than one), composed, according to Von Neumann, of equations and a description in natural language of what it represents in that context. Each MODEL is identified by its name, and it can be related to different PROBLEMs. The following step concerns the computational solving stage, which involves a SOFTWARE which implements a suitable

solving method for the MODEL, and input DATA. Each SOFTWARE can be either a code (specifically created for SIRMM) or a link to some external PSE or library. Input DATA are given in a format(s) suitable for related SOFTWARE. A specific instance of a problem can be described in natural language and becomes a CASE STUDY. Finally, each of those entities is related to one or more RESOURCEs (i.e. book, article, …), to provide further reading on the topic.

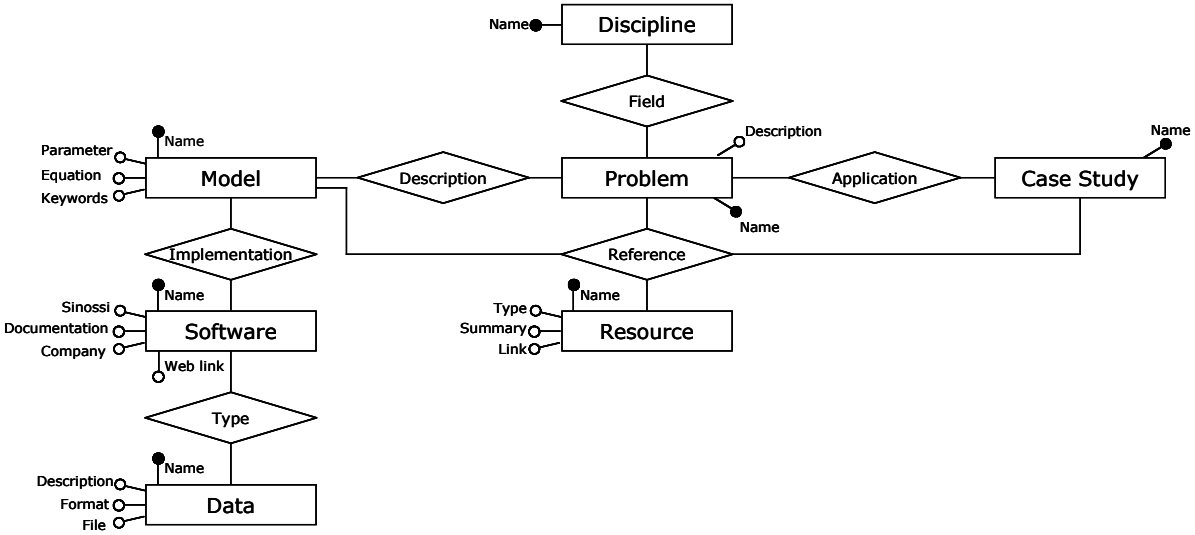

Figure 2. Entity-Relationship diagram.

The logical model of entities and relations induces a model in the navigation of the information stored in the system. Since each entity is in relation with one or more entities, it is possible to start the navigation from each of them. For example, a student can have some data, and he might want to discover which are the software that can accept them as input. As another example, one could start from a particular problem, then studying the available models. For one model one can be interested in a software that implements an algorithm that can solve the model for given data. For each model auxiliary information can be accessed, such as references, slides, books, for a better understanding of the topic.

3. Using the system

SIRMM includes three types of users, with different roles, and therefore authorization levels: *consumer/student*, *producer/teacher* and *administrator*. The *consumer* is a user that navigates the system, he can read all records/forms of the database, search information and download files; he is in general a student that uses SIRMM as an interactive learning system, and he does not necessarily need to be authenticated by system. The *producer* is a user that can add information and data in the SIRMM database; usually he is a teacher who wants to insert and share (LO) and therefore needs to be authenticated from the system. Obviously a producer can modify only the LO that he has previously inserted. In addition, using the data of SIRMM the producer can build his own e-learning course. Finally, the *administrator* is in charge of all system management tasks, such as the authentication requests.

This structure has be implemented into SIRMM through three main sections: *Navigate*, *Contribute* and *Course*; any LO in SIRMM system can be accessed by the consumer (*Navigate* section), inserted and modified by the producer (*Contribute* Section). The producer can also produce an e-learning course, through a logical path which includes LO belonging either to SIRMM or to the external world (*Course* section). Figure 3 shows the flow of information and activities into SIRMM, with the roles of the different kind of users.

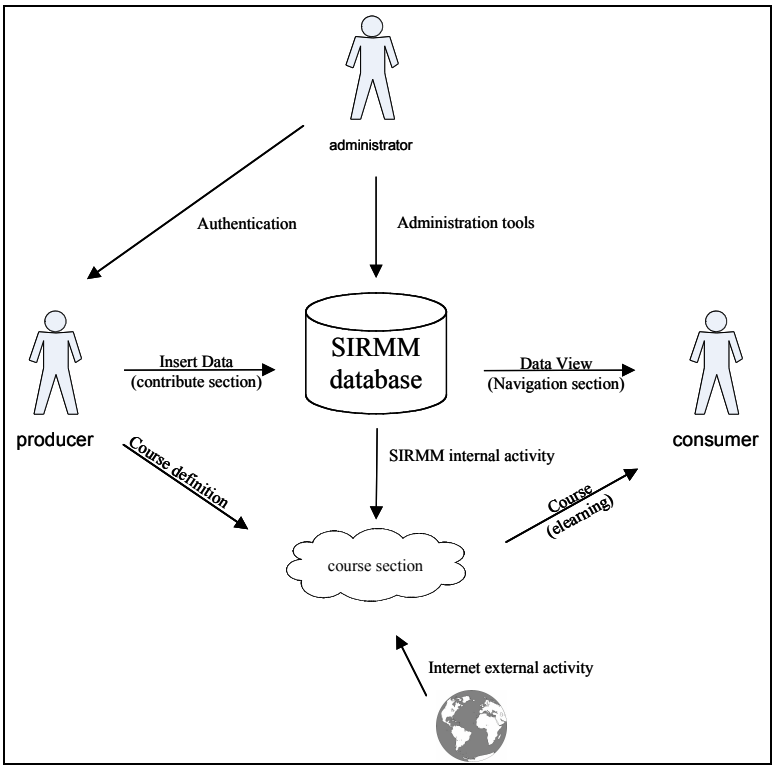

Figure 3. SIRMM using interfacing structure.

The web interfaces provided by SIRMM have a rather simple full-screen menu structure (Figure 4), that includes:

- The *Horizontal menu* at the top of the screen which offers access to the functions that allow to use the system: starting from here, the user can either *Browse* through the system by accessing to information repository, or to *Contribute* with a new record or new *Courses*. In addition, the *Download* of external resources is allowed.
- The *Side menu* enhances the system navigation. It works dynamically and, at each moment shows only the entities that are related to the record of database that is currently displayed. For instance, if the user is accessing the information about a specific *Model*, then only *Problem*s, *Resource*s and *Software* links.
- The *Page content,* i.e. the area of the graphical user interface in which records are displayed.
- *Bottom bar* contains links to the Site Map and to the Contact us section. If the user has logged in as an authorized producer, it will display links to change user settings and to logout.

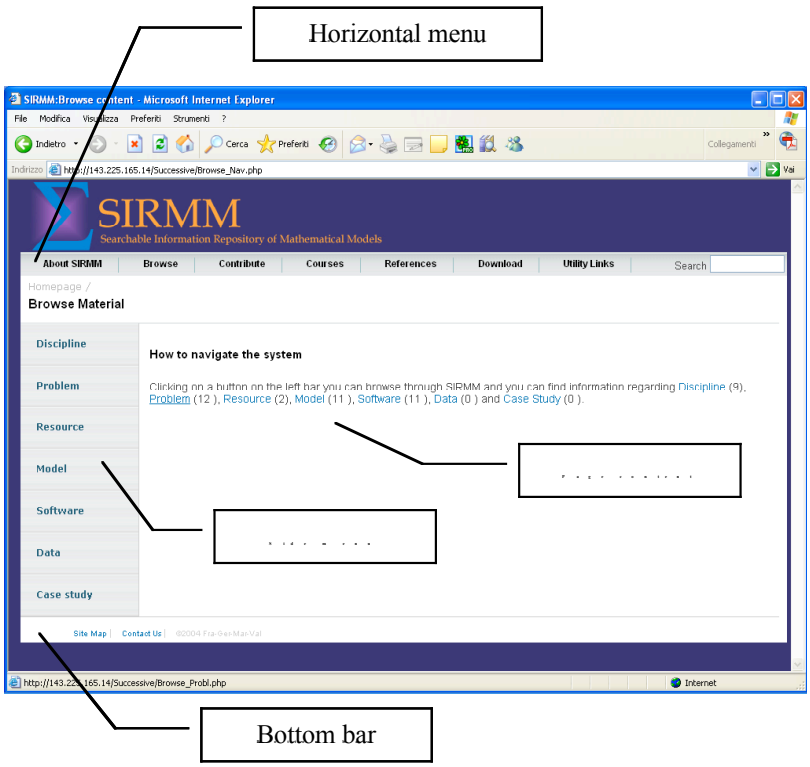

Figure 4. SIRMM user interface.

3.1 Navigate Section

The navigate section allows to browse all elements of the SIRMM data base. It is possible to navigate the system using the side menu (discipline, problem, resource, model, software, data, case study). When a specific instance is chosen the names of all related instances are shown, and the user can access their information. Figure 5 shows a software instance (SIMILE, for system dynamics problems), in which it is possible to see the hypermedia web page with text, images and mathematical formulas. Moreover the side menu links directly to LO related to such instance, so to enhance possible interactive educational paths to the users.

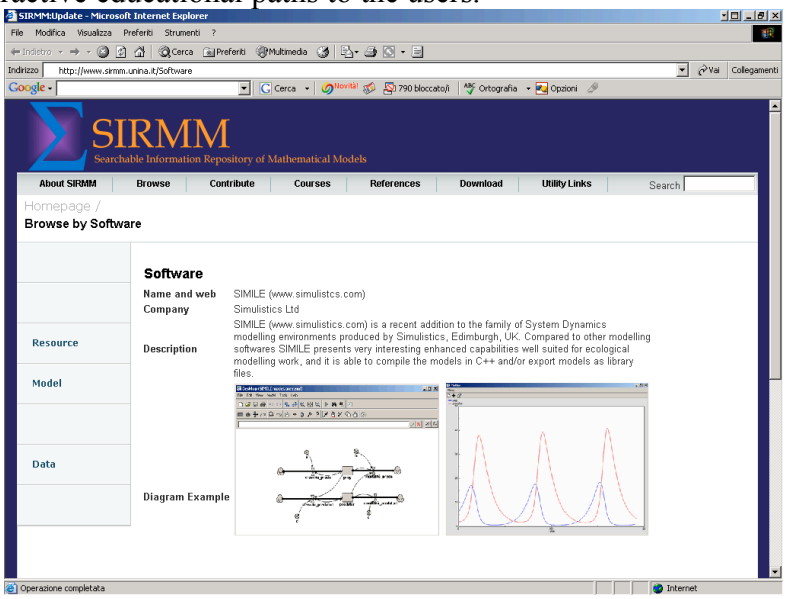

Figure 5. SIRMM software instance.

3.2 Contribute section

The Contribute section of the system provides forms to insert or update elements in the system database. Once the user has been authenticated, he can add records to any entity in the database. He can use an improved version of the rich text format editor of the Wikipedia project (http://www.wikipedia.org/) to edit text, images and formulas. Formulas are inserted in the Latex mathematical environment syntax. They are then stored in the database and displayed either as gif images, or as MathML formulas, depending on the browser functionality. Moreover it is also implemented a *formula preview* window (Figure 6).

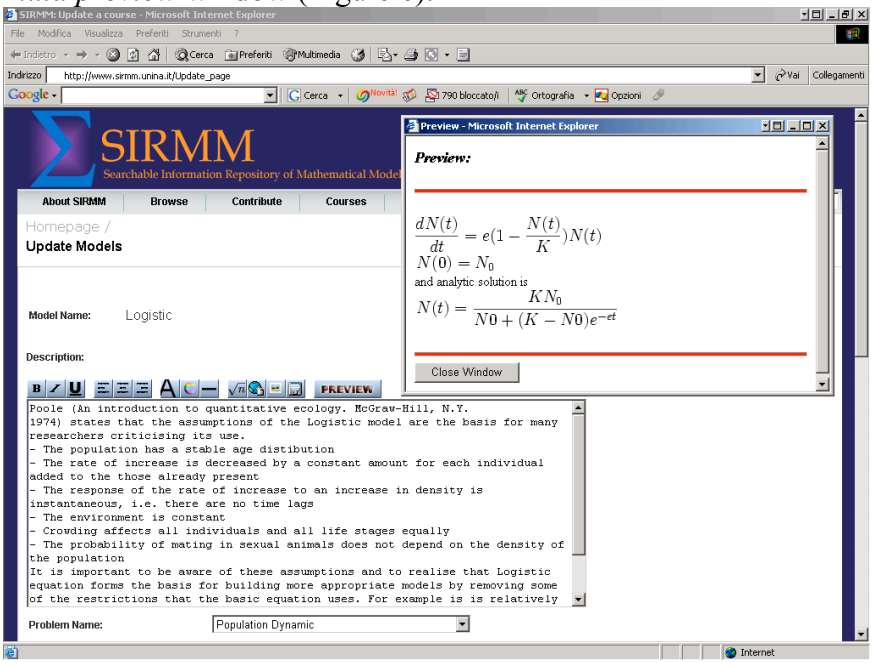

Figure 6. Update page of Contribute section.

3.3 Course section

The *Course section* allows the consumer to access a course which has been already implemented in the SIRMM framework, while the producer can either modify his own course, or build a new course, possibly a modification of an already existing e-learning course. A SIRMM course is composed of two parts: a web page of information (name, teacher, schedule, credits, faculty, …) and a list of activities. Any activity is a link to a web page: an internal link to LO of the SIRMM database or an external link to other www pages.

4. Conclusions and future work

Making easy a mathematical modeling approach to scientific disciplines at every educational level is a goal to be pursued in a modern scientific and technological education process, in which students are required to incorporate applied mathematics and computational tools in their learning process. In this paper we presented the main ideas behind the SIRMM project, aimed to supply a mathematical modeling framework for teaching technical disciplines. SIRMM is still at a prototype stage, and there is still much work to be done, both in terms of system development and database feeding, in order to improve user interface, level of functionality and possibility to implement real courses. However we strongly believe that the project is worth to be carried on, in order to match the needs of the technologically advanced world demands people able to use technological and computational tools, to correctly analyze data, to efficiently support sustainable decisions, to test conjectures, and to develop scenarios of complex systems through a process of modeling and synthesis of the real world.

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OVIDE-project
Methods of using online video in teacher education

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Abstract

In the Ovide project, a Socrates/Minerva project granted by the European Union, ten universities from eight European countries work together to examine current pedagogy of online video use in teacher education. Within the OVIDE project the members have created some 20 case studies which all exemplify different approaches to the use of online videos. Each case study provides information for teacher educators about the methods of use (pedagogical approach(es)) in question and an evaluation by the users.

Keywords: Online video, teacher education, method of video use

1. Introduction

Since many decades video has been used for supporting initial and in-service teacher education. The use of video is virtually the only way for large groups of observers to visit a classroom without disturbing the pupils. Techniques using traditional analogue video have well been tried and tested, but were difficult to edit, difficult to distribute and time consuming to manage. In recent years, advances in computer technology have enabled digital video to be both affordable and relatively accessible and user-friendly. When digital video is utilised with computers and online intranet or internet technologies, it becomes a powerful tool for teacher educators. However, whilst digital video offers many new opportunities for learning and teaching it also produces different technical and pedagogical challenges.

2. Objectives of the Ovide-project

The Ovide project has been designed to examine current practice, to evaluate new ideas and to identify issues concerned with the deployment of digital video. More into detail, the project sought to:

- Provide an overview of current practice through a study of existing international literature and country specify information.
- Produce a collection of case studies of the use digital video in teacher education in all the main areas of its potential use.
- Establish some generic principles of operation and methods of use.
- Identify the practical and technical issues pertaining to the use of digital video

3. Literature search

In the course of the Ovide project an extensive search through international literature on the use of digital video in teacher education has been carried out. There is a lot of consensus about advantages such as the possibility of classroom observation, with no disturbance of lessons, to be viewed by a large audience, with the potential of repeated observation of the same situation. In addition to that and still more emphasized, digital video is regarded to be much more flexible than its analogue precursor, because it has the potential to combine images, audio and texts. And finally of course there is the big advantage of time and place independent learning.

Our study made clear, however, that the digital revolution alone does not fully account for the increased interest in video in the past decade. It is also important that the emergence of digital video coincided with the upcoming of competency based teacher education and cooperative learning, both clearly facilitated by the new technological possibilities.

In particular the use of video in a hypermedia environment attracted a lot of interest, with a focus maybe on the question how (prospective) teachers can best learn from reflecting on video recordings of their own teaching or that of co-trainees and more experienced colleagues.

Because of its volume, the bibliography of our literature study has not been added to this paper, but it can be found, together with a selection of abstracts, on the Ovide website. The literature survey will be reported upon into more depth in a separate paper, but below we present a first summary of the findings.

One major outcome from the literature study is the emergence of six basic ‘methods of using video’ in teacher education. Because this has offered an organiser for the Ovide case studies to be reported in this paper, these methods of use - or if one so wishes ‘pedagogical approaches’ - will be presented in a separate paragraph (see below).

A survey of further findings:

- It is obvious that students do not learn from multimedia material simply from themselves. It is mentioned on several occasions that they tend to display ‘zap behaviour’, with rather superficial processing of the material. The response from teacher educators has been to include study tasks into the material and research has made clear that this substantially improves the learning outcomes.
- Teacher trainees appreciate multimedia learning as one of the ways to become more proficient in using ICT for educational purposes.
- The most mentioned function of video is ‘showing good practice’, without presenting the examples as the way how it should be done, but rather as how it could be done.
- It is desirable when showing video of schools and classrooms to add context information, e.g. demographic information on the school population, academic level of the students being observed, year group, etc.
- It is advisable to keep video fragment short and relatively simple and ‘empty’.
- The importance of good microphones has been emphasized by many authors: the audio quality is more important than the imagery.
- It takes a lot of time and effort to produce good multimedia material. Collaborative work and funding by various stakeholders add to the quality of the material.

- Stand-alone use of multimedia suffers from the lack of face-to-face contact. If possible, at least blended learning arrangements should be used.
- Privacy issues tend to throw up barriers. The way in which this is being addressed varies form country to country.
- A set of rules should be agreed upon as to decent behaviour in digital environments ('nettiquette').
- The introduction of multimedia cases in teacher education requires further professional development of teacher educators, because it implies a twofold change: firstly case based teacher education means putting practice more in the centre of the curriculum, secondly it means extension of the use of ICT in the programmes.
- Educators should acquire more knowledge and skills in the field of e-didactics.

4. Methods of using online video

As already mentioned above, six basic methods of using video in teacher education seem to emerged:

1. *Demonstration of teaching behaviour*
   the teacher educator uses video to support the learning of various competencies by the teacher trainees; teacher trainees can analyse teacher behaviour, reflect op their own ideas on good and bad practice, etc.
   (there might be an overlap with 2)
2. *Demonstration of characteristic professional situations*
   these videos often contain dilemmas that trigger reflection and discussion, e.g. in the framework of collaborative learning; the teacher educator uses video to stimulate teacher trainees to be aware of potential choices to be made
3. *Demonstration of 'own' teaching behaviour*
   these videos help teacher trainees to build a realistic picture of their own performance and they are very helpful for underpinning reflection and receiving feedback from peers and teacher trainers; they can be part of a development oriented e-portfolio
4. *Demonstration of professional situations for assessing competencies*
   here the videos are being used in the framework of assessment (entry, formative, summative); they can be part of a show case oriented e-portfolio (in the case of formative assessment there is a strong overlap with 3)
5. *Demonstration of context and subject matter to the teacher educators*
   here the teacher educators are the primary learners, on specific theory or subject methodology or materials, etc.
6. *Demonstration of context and subject matter to the teacher trainees*
   here the teacher trainees are the primary learners, on how pupils act or learn in specific situations, how they can use technology, etc.

The case studies which have been carried out cover as many as possible of these potential uses.

5. Project partners and case studies

The following case studies have been carried out:

Centre for Academic Teaching and Learning (UOCG), University of Groningen
- Teacher trainees develop instructional IPOD clips
- Using video cases to learn about classroom management
- Using Dividu as tool for reflection on own practice

Institut Universitaire de formation des maitres Midi-Pyrenees, **University of Toulouse**
- Using video for teacher training in micro-teaching situations
- Using video to jump from reflective analysis to heteroscopy.
- Autoscopy and heteroscopy: two complementary ways of using video to compose a portfolio

Faculty of Psychology and Educational Sciences, University of Leuven
- Familiarising students with the 'cycle of teaching': preparation, teaching, reflection
- Training mentors in supervising student teachers
- Imparting micro-political literacy to student teachers

Faculty of Education, University of Joensuu
- Language student teachers learn how to teach oral language skills in a large group in secondary level
- Ethnic minorities and education
- Modelling graphically different kinds of motions in the physics course at upper secondary school

Teacher Training School, University of Turku
- Teacher trainees planning and delivering a language class focusing on activities that are socio-constructivist by nature
- Teacher educator using new technology (whiteboard) to teach multiplication
- Demonstration and modelling in physics
- Representative teaching in high school physics

Ruud de Moor Centrum, Open University The Netherlands
- Exploring the use of PALET: Digital representation of practice knowledge of teachers, using online video
- Teacher responding to critical situations: a self-assessment tool
- Peer coaching: teachers/colleagues helping each other to improve their teaching behaviour in the classroom

ICLON, Graduate School of teaching, University of Leiden
- Electronic collegial consultation using online video
- Online video in a student's electronic portfolio
- Video to support teaching and learning pedagogical content knowledge

Faculty of Mathematics and Physics, Charles University of Prague

- Digital video for multi-perspective reflections and analysis of learning experience in teaching of gifted children

Faculty of Education, Autonomous University of Barcelona
- Planning Projects in language education
- Elicitation as a discourse technique to build up construct knowledge in a CLIL classroom at secondary level
- Using a video-project to introduce project-based learning in teacher training.

6. Legal and ethical issues

When using video in teacher education, several legal and ethical issues are at stake. As far as legal issues are concerned the following can be mentioned:

- the maker/author of the video has certain rights
- the real owner of the video can have rights
- the people that are in the recording have certain rights according to 'Portrait right' and 'Privacy right'
- creative or artistic work, for example music, paintings, poetry, etc. that has been recorded on video, is protected by 'Copyright'.

Laws and regulations with regard to these rights differ from country to country. In any case, if one intends to make a video recording in teacher education, one should always be aware of possible restrictions due to the above issues and therefore pertaining national laws and regulations should be carefully explored.

The *maker/author* is the person who produces the video (makes the video recording). In copyright law this is the person who owns the content of the video. Content of the video may not be changed, copied or published, without permission of the author. In teacher education we often ask student teachers to make recordings of their practice. In this situation the student teachers are the authors of their videos and own the copyright. When we want to use their recordings in both open and closed settings, in peer coaching sessions or at research seminars and conferences, we should always ask students for permission to do so.

The *real owner* can be the author, but also someone else, for example when the video has been made within a context of a job or when it is produced as an assignment for an organisation. The owner rights fall to the employer when the recording has been made within a contract of employment, unless another agreement has been made between employer and author (employee).

The people in a video recording do not own the recording, but they are protected against misuse by '*Portrait rights*' and '*Privacy rights*', i.e. the author/owner of the video has to take into account the interest of the people in the recording. Generally the author is required to get written permission from the portrayed person when publishing a video. When making a recording in a classroom it is important to obtain written portrait-use permission from the students, pupils, their families, and school-related persons appearing in the video. Still retrospectively everyone in the recording can make objections to publication when they feel their interest is being violated. They can then appeal to 'reasonable personal interest', for example when someone thinks he/she is made a fool of.
Privacy right is the right and ability of an individual or group to seclude themselves or information about themselves and thereby reveal themselves selectively. According to this 'right' a person has the possibility to make a complaint if he or she thinks his or her personal information has been mishandled.

Copyright protects creative or artistic works. One can only copy or use a copyrighted work with the copyright owner's permission. This means that even in non-commercial education you should not reproduce or (re)publish copyright protected work without mentioning title and name of the author. This includes publishing videos and photographs on the internet, making a sound recording of a book, and so on.

Even if all legal restrictions have been taken into account, there might be circumstances in which you could decide not to use or publish a video recording for *ethical reasons*, however

useful it might seem for an audience. Crucial questions are: what can be the consequences of publishing/showing the recording? Is any one's interest violated in the recording? Is the material limited or publicly accessible?

7. Lessons learned

The evaluation of the various case studies leads to the following summative conclusions:

- In line with literature findings, video is felt to be very important, as it has always been, as a means to observe a large variety of authentic situations in various kinds of contexts. This applies in particular to online video, because it adds the dimensions of time and place independency and the possibility of flexible combination with other media.

- As has also already been repeatedly reported in literature, the mere supply of video examples of good practice (such as with methods 1 and 2) does not always motivate teacher trainees to better learning. It seems to be much more efficient if multimedia material is built into a didactical framework, an environment with questions and assignments etc. to focus attention of the learners on specific aspects of the material.

- As long as the use of video does not call too much on their ICT-skills, the various target groups seem to appreciate the added value of online video: flexibility of use is mentioned, levels of student activity are reported to be high, re-usability and adaptability are said to be important. In terms of our methods of video use, methods 1, 2, 4 (partially), 5 and 6 meet this requirement.

- A substantial amount of users feels that too much is being asked of ICT-skills in the case of methods 3 and 4 (partially). For many teacher trainees and teacher educators the whole process of video recording, capturing fragments, producing clips, etc. seems to be too time consuming in relation to the added value offered.

- Technical support adds greatly to the willingness of the target groups to use the opportunities offered by online video. Making it compulsory does not seem to be a desirable strategy, although in the near future ICT skills will be an important aspect of teacher competence.

- Legislation and privacy issues are a big problem and not supportive of teacher quality.

8. Literature

An extensive biblography is to be found on the website of the Ovide-project:

http://noah.sitc.co.uk/~noahbree/ovide/index.php

Improving the quality of education in Palestine through e-learning and ICT: the bottom-up approach for a sustainable pedagogy

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Abstract

SPEP (Support to Palestinian Education Programme) is a project funded by the Italian Cooperation, managed by UNDP "United Nations Development Programme- and involving the Palestinian Ministry of Education and Higher Education (MoEHE), 24 public schools with different grades, 4 local Universities (3 in West Bank and 1 in Gaza Strip) and relative Districts and the University of Bologna. Its aim is to support the capacity of the school for self-improvement developing a process where the school becomes able to self-evaluate itself in terms of quality of education (learning and teaching), management and leadership, environment, networking, relation with parents and community, continuing professional development of teachers and principals. Each schools develops its improvement plan with specific action plans, target and tasks, each with clearly identified success criteria in order to evaluate results. Local Universities, coordinating with the MoEHE, work each with 6 schools visiting them regularly, helping in identifying standards and targets for the quality of education and in planning the improvement, training teachers in different areas, monitoring, advising and reviewing. The main concept for the SPEP intervention is that of a comprehensive developmental process focusing the school itself and leading to school growth and improvement. The University of Bologna, Department of Education, has a technical advisory role in the ICT component supporting and working together with Palestinian Universities and schools and coordinating with UNDP and MoEHE. The University of Bologna's role is to implement the ICT knowledge and a critical practice in the schools providing relevant pedagogical models of the use of ICT, tools (software, videogames, learning objects) and methodologies, orientation, material, best practices, and is monitoring the pedagogical experimentation of the use of ICT in the daily didactic (in classroom) with a bottom-up approach respecting schools, teachers and students within the Palestinian context, using technologies and pedagogical-didactical models sustainable: stressing therefore the use of technologies with a low economical impact and open to a variety of cultural interpretation. The bottom up approach aims to innovate the pedagogy in the classroom, via the integration of ICT in the teacher's practice using both our general pedagogical models and models locally experimented in a critical and original way (compared to the traditional know-how): in this approach it is important to help teachers to reflect and elaborate on their own performances and produce as a result learning material to be newly utilized in their contexts.

Keywords: ICT, bottom-up approach, improvement, Palestinian schools, sustainable education

1. Introduction

The Support to the Palestinian Education Programme (SPEP) is an ongoing UNDP's activity (United Nations Development Programme) that has being funded by several donor countries[1]: it aims to increase the enrolment capacity of the Ministry of Education and Higher Education (MoEHE) through the construction of 4 new schools as well as the renovation and extension of 10 existing schools. The project furthermore provides educational materials and equipments to 190 existing schools all over the West Bank and Gaza Strip. It must be emphasized that there are a number of significant events involving the MOEHE, as the education sector review and the implementation of the five years plan 2005-2010 and a large number of educational projects in different subjects and areas.

The Italian Government is also funding this project since 2005 with the management of UNDP and involving MoEHE, 24 public schools with different grades (a total of nearly 14.000 students and 565 teachers), 4 local Universities (Bethlehem University, Birzeit

University and An Najah University in West Bank; Al Azhar University in Gaza Strip) each working with its 6 schools, 4 Districts Educational Offices and the University of Bologna. Each university has a 6 members team from the Faculty/Department of Education plus one ICT focal point; each school has a team of 3-4 teachers, the principal and 2 ICT focal points (generally the IT teacher and another teacher with some computer skills).

The project has effectively started in May 2006 and it was supposed to end in October 2008 but due to several reasons it has been postponed until May 2009.

2. The educational context in Palestine

The state of Palestine, regardless of what its final borders are/will be, is small and limited in natural assets. Its people are its primary resource: population has increased in the past 10 years and due to high fertility rates and the continuing migration of young adults in search of employment the percentage of young people is very high. More than 30% of the Palestinian population are full-time students enrolled in school or university (more than one million students) so education in Palestine[2] has become a community investment in human resources whose benefits are not only economic, but also cultural and social.

Palestinian schools are categorized (according to the supervising body) as governmental (public), private, or UNRWA (United Nation Relief and Works Agency)[3]. There are boys' schools, girls' schools, and co-ed schools. SPEP works only with public boys or girls' schools.

The high demand of education has some negative effects: schools are overcrowded, some schools have a two-shift system and others are housed in unsuitable buildings. The ratio of students to teachers is most of the time very high especially in Gaza Strip (up to 40). The quality of education is low due to the absence of sufficiently qualified teachers (50% of them are undergraduate), the absence of modern schools facilities (space, library books, maps, models, reference materials, science tools, etc.) as well as of modern teaching and learning aids, an inadequate system to evaluate student achievement, the absence of extra curricular activities (especially in villages). Teachers' training activities are provided by the MoEHE but are very theoretical and focused on improving teaching with old methodologies. Teachers' motivation is very low due to low salary, the absence of incentives, the burden of administrative and bureaucratic work without adequate preparation.

Above all, the occupation and the unstable conditions are affecting the entire society.

2.1. ICT in Palestine

Although ICT in Palestine is seen as an important key to combating unemployment, sharing knowledge, overcoming restrictions on movement, ICT diffusion in the Palestinian education system is still faraway from being realized. "According to the MOE reports, 40 percent of the schools (2109) house computers labs (13 computers in each lab), while a small percentage of these labs are connected to the Internet" (Wahbeh, 2006). Many computers are very old and labs are used only during the technology class (45 minutes/week); the MoEHE does not allow schools to use their budget to connect to Internet[4]; most of teachers do not use computers even when they had training courses in ICT because of lack of practice. Computers and Internet are more diffused at teachers and students' homes but it depends on how teachers and parents perceive ICT.

3. The SPEP Project

3.1. Objectives

The main concept for the SPEP intervention is that of a comprehensive developmental process focusing the school itself and leading to school growth and improvement of the quality of education in the Palestinian Territories.

SPEP aims to strength the capacity of the school for self-improvement supporting, through a partnership between schools and universities, the develop of a process where the school becomes able to self-evaluate in the field of effectiveness of learning and teaching, students participation, management, ICT skills, teachers relationship and satisfaction, leadership, environment, networking, relation and involvement of parents and community, continuing professional development of teachers and principals. Collaboration between the schools involved in the SPEP should create a supportive environment that encourages the adoption of change and increases the sustainability sharing of good practices, expertise, resources. Each school develops its improvement plan with specific action plans, target and tasks, each with clearly identified success criteria in order to evaluate results: microgrants are available to develop specific project related to the school's needs. Local Universities, coordinating with the MoEHE, work each with 6 schools visiting them regularly, helping in identifying standards and targets for the quality of education and in planning the improvement, training teachers in different areas, monitoring, advising and reviewing.

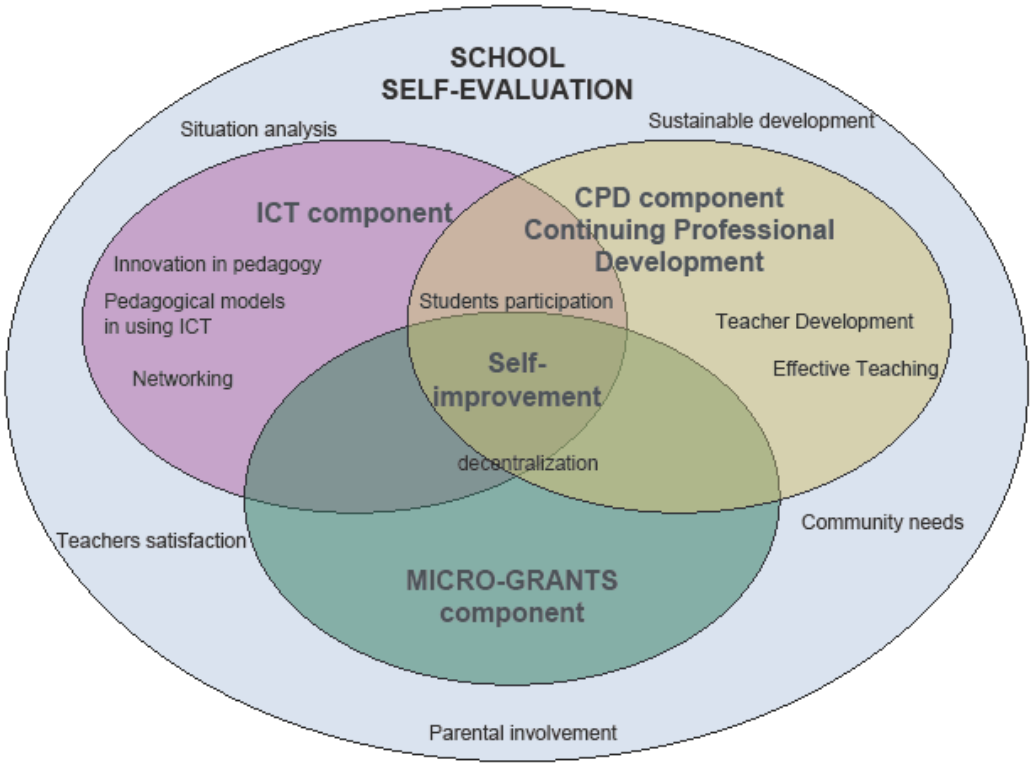

Figure 1: The comprehensive SPEP programme

3.2. Phases in the Project

The project officially started at the end of 2005 but there were some delays in the different contracts that UNDP signed with Universities and MoEHE.

The following phases are identified in the project.

3.2.1. Activation of the process (May 2006-August 2007)

This phase aimed to collect data for the situation analysis of schools, to self-evaluate and to select targets for quality education, to develop the schools' improvement plans, to select project for microgrants.

But we have to underline that after Hamas victory in elections (January 2006), due to the economic blockade of the Quartet (UN, UE, USA, Russia), the public sector suffered a lack of funds which led to cut salaries. This situation brought to a proclamation of a general strike of public employees including teachers and administrative personnel of public schools from September till November 2006. As a result, it was impossible for a long time to make projects on activities with schools or proposals on action plans including school oriented activities and this phase was postponed for several months.

3.2.2. Implementation of the intervention (September 2007-December 2008)

This phase aims to start all activities for coaching, monitoring, developing courses and materials, tutoring, providing certified Continuing Professional Development to teachers and principals in schools according to school's needs, improvement plans and microgrants.

3.2.3. Evaluation, dissemination and generalization (January-May 2009)

This phase aims to evaluate schools' achievements, to adapt and finalize the different products and material resulting from the implementation phase in guidelines and prototypes that can be transferred in other learning context in Palestine, disseminating and involving up other 36 schools in the Project.

4. The ICT component and the role of University of Bologna

The University of Bologna, Department of Education, has a technical advisory role consisting of supporting and working together with the Palestinian universities involved in the SPEP and with MoEHE in the ICT component of the project. This means working primarily with the ICT focal points of Universities, MoEHE, Districts, schools for the benefit of all actors involved. The project includes actions of training the teachers complemented by purposefully conceived action researches that while aiming to innovate the pedagogy in the classroom, via the integration of ICT, provides also, through the process itself, a context for the practical training and the elements for the finalization (either as integration or new development) of the theoretical component of training.

4.1. The bottom-up approach

"ICT can empower the Palestinian education system if students' and teachers' roles are reconceptualised to make them active agents participating in meaningful learning. Literacy in this model includes more than just general and technical skills." (Wahbeh, 2006, p.45-46).

Making ICT available in schools is not necessary to make teachers and students using it and producing new knowledge. The approach of University of Bologna aims to implement the ICT knowledge and a critical practice in the schools providing relevant pedagogical models of the use of ICT, of different tools (software, videogames, learning objects) and methodologies, giving orientation, material, best practices, monitoring the pedagogical experimentation of the use of ICT in the daily didactic (in classroom). This approach can only be bottom-up in order to respect schools, teachers and students within the Palestinian context: it is possible to innovate the pedagogy in the classroom integrating ICT in the teacher's practice not only using our general pedagogical models but also models locally experimented in a critical and original way (compared to the traditional know-how). It is important to help teachers to reflect and elaborate on their own performances and produce as a result learning material to be newly utilized in their contexts.

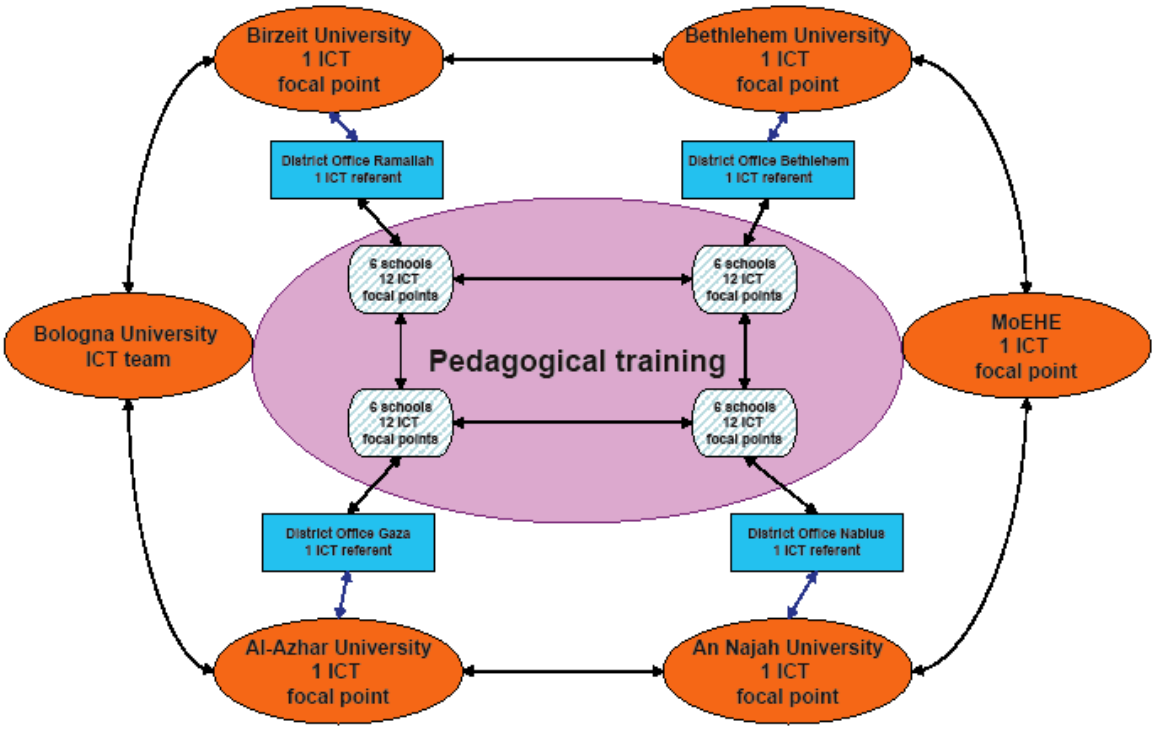

Figure 2: the ICT component

After the situation analysis, a first step was organizing a 2 weeks residential workshop in Italy in September 2007 where the ICT focal points from Universities and MoEHE could visits Italian schools and see different experiences in the use of ICT and meet experts. From this workshop, it was planned to train all teachers in the basic use of ICT and train the ICT focal points in the schools (they will then train their colleagues) with a pedagogical training on ICT where input of training are immediately followed by experimentation in schools. A website is also supporting activities with function of information, research, sharing material, presentation of best practices.

4.2. For a sustainable pedagogy

The model of intervention is based on the idea to develop competences at the local level (Universities, MoEHE, schools) and to create stable links between Universities and teachers for a better sustainability. It is important therefore to stress an use of technologies with a low economical impact and open to a variety of cultural interpretations. In this way it is not important what kind of technology we will use or the market wants to impose to us but the way we use technologies.

5. The present situation

The ICT basic skills training was successfully done and teachers are now able to use computers and internet to prepare material, presentations, homework, etc. It is just the first level of use of ICT but as it is related to small projects monitored by universities it is giving good results in changing the attitude of teachers about ICT and they want to learn more.

Due to the particular political situation and to several problem between UNDP and MoEHE, unfortunately UNDP decided to suspend Gaza Strip for the ICT component, the pedagogical training has been postponed and it has just started at the end of August 2008, microgrants will be distributed in September 2008 to implement schools' projects. So the implementation phase has just started and we look forward to see the results.

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[1] Including the Government of Canada, Japan, Luxembourg, as well as the Islamic Development Fund and the Saudi Fund to Aid the Palestinian People.

[2] The Palestinian Ministry of Education was established in 1994, and the first ever Palestinian National curriculum was introduced in September 2000 to replace the Jordanian and Egyptian curricula in Palestinian schools for the previous 33 years of the Israeli occupation (Communications Office of the United Nations Development Programme /Programme of Assistance to the Palestinian People, 2005).

[3] The situation is different in Jerusalem, which has schools officially operated by the Islamic Waqf Directorate, although they are connected with the Palestinian Ministry of Education. Others are operated by the Jerusalem Municipality or the Israeli Education Department.

[4] To connect computer labs to Internet, schools should seek donations from the local community or parents' associations and the connection should be registered under the funder's name. This has been a very big problem also for SPEP project and until now there are only few schools connected.

Laboratory door opens to non-formal learning communities. Science centres as mediators

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Abstract

The e-KNOWNET is a Lifelong Learning project, which aims to develop an innovative and viable mechanism to facilitate the flow of new scientific knowledge produced in the research laboratory, to larger non-expert segments of society, in forms suitable for non-formal learning, with the use of interactive web-based educational application. This networking and collaboration scheme hopes to provide science centres with learning resources that have been produced based on the latest developments of scientific research, and methodological tools for further production of similar learning materials. These resources will be available on-line and off-line for their visitors.

Keywords: non-formal science learning, science communication and social networks.

1. Rationale and background

In the past 20 years, the rapid evolution of the information and communications technologies (ICT) and the growing public use of the Internet have brought immense changes in the way people communicate, learn, and experience the world. The latest generation of ICT[1] combined with World Wide Web applications create a plethora of new learning environments (web-based collections, on-line exhibitions, simulations, augmented reality applications, wikis, on-line seminars etc), and encourage the emergence of new networks linking physical spaces, users and networked experiences. Boundaries between institutions and disciplines subside, as well as the concept of age-specific learning cohort.

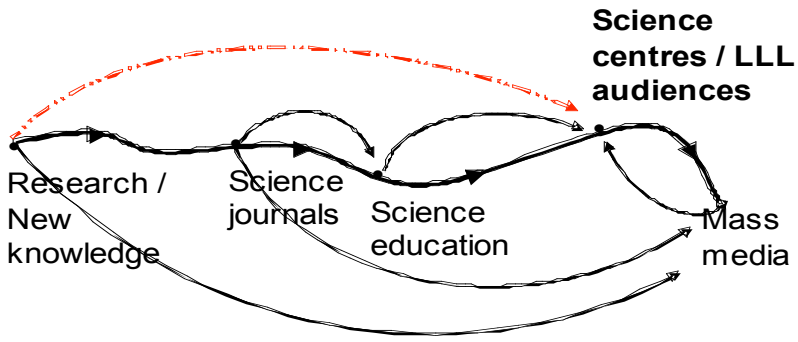
There is no doubt that a certain degree of science literacy is increasingly becoming a necessary condition to function as a citizen, an employer or employee, a participant in social activities, etc. New knowledge produced through research needs to be efficiently disseminated through education and applied through innovation. Information flow from traditional loci of science knowledge production (e.g. research centers, universities, sites of industrial research) to non-expert segments of society can take as long as two decades - about 20 year lagging for nuclear energy issues, 12 to 15 year for informatics, 8 to 10 for biotechnology (Rudig, 1990; Wright, 1986)! In Europe a network of more than 70 EU-funded Innovation Relay Centres, a number of R&D liaison offices[2] and dedicated sites and relevant projects (ISTResults, Technology Market Place cordis.europa.eu/marketplace, EU funded SINAPSE site, DARE programme) circulate information referring to on-going research or research results and encourage relationships between industry and research centres across

[1] A blueprint for a new approach, Science, Technology and Innovation in the Media (STIM), Ministry of Flanders, Science and Innovation Administration, Crete - March 27, 2003.

[2] In Greece there are two main networks: the Innovation Relay Centre and the Innovation Relay Centre Praxis (nonprofit organization under the auspices of Federation of Greek Industries (ΣΕΒ), Federation of Industries of Northern Greece (ΣΒΒΕ) and Foundation for Research and Technology – Hellas (ITE).

member states. This type of network leaves out intermediary organizations such as science centres, which are important players in non-formal science education. As a consequence, science centers have no means to remain informed about state-of-the-art research and technological developments and select their content often most relying on the agenda set by the media which observes the criterion of newsworthiness and public attractiveness and less often that of real scientific value or innovative quality.

In the countries of the e-KNOWNET partners, and according to data referring to Europe, scientists are often reluctant to share with non-expert audiences the product of their work in a comprehensible way, probably in an effort to defend the conventions and principles of the scientific method and the integrity of the scientific results[3]. Restriction of knowledge within isolated "islands" is a hindrance to innovation holding back the potential of societies to advance their learning environments, and improve their information and educational resources and practices. Therefore, there is a need for efficient networking among the major stakeholders of production and dissemination of new scientific knowledge through non-formal education, in order to accelerate the circulation pace of specialized information and minimize the influence of extra-scientific factors upon the development of information and non-formal educational resources which reach the citizen.



The "adventures" of new science knowledge before it reaches the non-expert

2. The Project

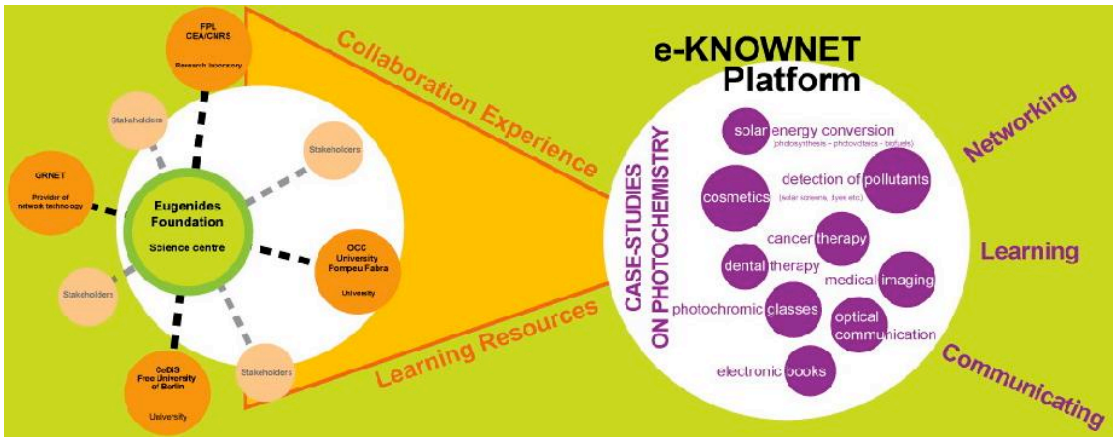
The project promotes networking and cooperation in the field of lifelong learning among complementary knowledge-based organizations such as research institutions, universities, science centres and museums, and also between communities linked to formal and non-formal education, practitioners, as well as experts in learning and communication sciences, technology-enhanced learning etc. The network brings together 5 complementary institutions associated with knowledge and learning (e.g. universities, research laboratory, technology provider to academic and school communities, and a science centre), with diverse experience of ICT-mediated learning, aiming to develop new, demand-driven insights and know-how on ICT-enabled science learning in non-formal environments. The network with the use of ICT enables the direct cooperation between knowledge producers (researchers), transformers of this input (educational experts) and its end-users (learning communities).

[3] CREST Report on Science and Society (CREST 1206/01), "Science, Society and the Citizen in Europe", SEC (2000) 1973.

The partners of the project are: Eugenides Foundation, Athens, Greece (coordinator); Greek Research and Technology Network (GRNET), Athens, Greece; Free University of Berlin – Center for Digital Systems, Competence Center e-Learning/Multimedia, Berlin, Germany; Francis Perrin Laboratory - Commissariat à l'Énergie Atomique / Centre National de la Recherche Scientifique-CNRS, Paris, France; Science Communication Observatory / Universitat Pompeu Fabra, Barcelona, Spain. The Educational Portal of the Hellenic Ministry of Education and Religious Affairs (www.e-yliko.gr) participates as silent partner.

This direct cooperation accelerates the circulation pace of specialized information which reaches the citizen and limits the influence of extra-scientific factors upon the selection of scientific information and transformation into educational resources. A dedicated e-platform will act as the virtual depository for – and as the hub for redistributing - popularized new science knowledge available in resourceful forms beyond the conventional. A series of pilot learning electronic resources and services available through the Internet or locally at science centres (i.e. science web content, e-exhibits) will be accomplished utilizing popular applications (e.g. Video Web casting, Video on Demand, Grid Computing, etc.). Science centres are expected to act as catalysts in this process of knowledge sharing and circulation considering their significant outreach potential and public appeal. There is nowadays an evolving convergence between the traditional learning resources and the new ICT which combined with web application may be a major support in the teaching of science content (e.g. the laws, theories, facts) and scientific processes (e.g. measuring, recording, processing data) through simulations (i.e. models that are created by others) and / or modelling (models created by pupils). Science centres can encourage their visitors to profit from ICT–enabled life long learning activities. ICT has increasingly entered the field of science museums and centres, furthering the attractiveness of the visit for visitors of all ages (web-based collections, on-line exhibitions, simulations, augmented reality applications, wikis, on-line seminars, etc). Simulations and modelling used in science exhibits incorporating ICT offer a wide range of learning opportunities by either describing reality or by simplifying it to aid conceptual interpretation (Boohan, 2002).

The e-KNOWNET will offer pilot learning activities which will be customized along the different pedagogical profile of each learning audience. e.g. Dialogue with users with special and demanding needs, will be established in order to ensure that their requirements are met. Specific actions to achieve this are the following: Technical meetings with representatives of such groups, provision of consultancy in the form of project management assistance and technical advice, to help in establishing particular network configurations. Well tested methods and practices of science education in life-long learning contexts, will be employed in this phase. The piloting activities will focus on fast developing topics of Physical Chemistry and will be adjusted to fit real learning needs of the users. Lastly, e-KNOWNET has a dual concept: a) the human network dimension, meaning the a network of institutions, partners, stakeholders and LL – learners (study visits between partner organizations, peer-training workshops on the production of material suitable for ICT supported life-long learning) and b) the ICT dimension which means as a portal will be the test bed of the knowledge - sharing network.



A graphic representation of the concept of the e-Knownet project

3. Aims and objectives

The project will develop an innovative and viable ICT-enabled mechanism for fast and efficient sharing of new scientific knowledge among larger, non-expert segments of society. The "show case" of the project will be an e-platform focusing on Photochemistry (European Photochemistry Association is a privileged stakeholder of the project which is going to actively contribute offering knowledge input, supporting for awareness-raising purposes, holding a strong participant role etc.) that will function as a virtual depository and as a redistributing hub for the dissemination of popularised new scientific knowledge. The platform will also act as a virtual meeting place for a variety of learning communities. In this distributed learning environment science centres are seen as catalysts that promote the use of ICT for life long learning among the general public.

More specifically, e-KNOWNET main objectives are the following: a) to produce an innovative model of a European knowledge-sharing network enabled by information and communication technologies, b) to use ICT tools to promote knowledge-sharing, collaboration and networking, c) to promote the educational role of ICT in non-formal environments and encourage digital literacy, across the lines of gender mainstreaming, d) to trigger new dynamics in ICT-enabled life-long learning, through linking up fields that traditionally have been working in isolation, i.e. scientific research institutions, communities of pedagogical science experts and science centres, e) to enhance the quality of educational services provided in non-formal environments, such as the science centre/museum, f) to offer new incentives in science learning (on selected topics of Physical Chemistry), g) to expand the human network involved in the e-KNOWNET (exploitation phase), h) to promote and make known the e-KNOWNET to learning communities and stakeholders through awareness raising and dissemination activities (launching and closing conference, two press conference, 5 science cafes, 2 awareness-raising workshop with key stakeholders, Science Cafes, press briefings and press releases) and i) to promote equal opportunities in informal learning for the disadvantaged, offering learning opportunities to remote, isolated or secluded populations, and people with disabilities, through the application of special assistive technology tools.

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iVideo – Interactive Videos as an Instrument for E-Learning and Knowledge Construction

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Abstract

As a multitude of studies has already revealed, illustrations can be profitably used to convey knowledge. While the importance of videos continues to increase on the internet, we notice major changes in usage patterns. In addition to the pure perception of pictographic material, interactivity - especially in e-learning - is considered to become more and more important. Although professional tools for creating interactive videos already exist, they hold serious disadvantages. Besides high licensing fees, it is almost impossible for a non-professional user to handle these tools due to their complexity. Therefore the aim is to develop an open and scalable tool for creating interactive videos, which is easy to use. The user shall be enabled to interact with videos directly and also to produce interactive videos without professional help. Within this paper the idea and realization of a tool for generating interactive videos is presented and discussed.

Keywords: Interactive Video, Hyper-Video, E-Learning

1. Introduction

Images support the construction of mental models and the comprehension of complex relations (e.g., in assembly instructions). Moving images are even better suited for this purpose. They benefit users' information processing by sequencing information and by reducing cognitive load from inferring relations. Moreover, learners might get additional concept formation guidance from slow motion, freeze frames, repetitions and the overlay of letterings. The benefits from visual materials can be maximized by using interactive materials. Interactivity – which is not be confused with random access to information – can increase the efficiency of learning programs and thus support the individual learning process by providing individualized and motivating learning. Especially learners with little prior knowledge and suboptimal learning strategies benefit from a well-structured learning environment, whereas for students with good learning strategies the degrees of freedom are substantial for successful learning. However, many contemporary systems neglect interactivity. Current video applications in e-learning include basic learning support (e.g., recordings of lectures), training support from video analysis (e.g., recordings of training sessions and matches), or depicting complex objects (e.g., in machine design); yet, these formats tend to push learners into a passive role.

2. Learning & interactivity

Ever since the concept of direct manipulation (Shneiderman, 1983), which is used synonymously with the modern human-machine-interface, the terms interaction and interactivity gained great importance in scientific literature. Interaction derives from Latin inter (between) and "agree" (to act) and means mutual influence and interdependence. Interactivity is to be understand as deduced term, which offers the user miscellaneous possibilities to interfere and to control in the context of computer systems (Haack, 1995). There are many attempts to define this term, which often consider vaguely the user's active part as well as the variability in the choice of contents.

The difficulties of drafting a consistent definition result from the fact that interactivity indeed is an attribute but this only can be grasped on a scale. “We must conclude that the point is not: interactivity yes or no. The point is: more or less. All the named characteristics of interactivity gradients” (Jaspers, 1991). It remains to adhere that the term interaction stands for communicative, social actions among each other. The term interactivity on the other hand means the user’s manipulative actions with hard and software – this may include the contents of the depict objects. In the range of e-learning the interactivity of learning objects is focused because herein is seen an especially high importance considering the motivation in the acquirement of knowledge.

Research has revealed “…that interactivity – if it is not understood as random access to information but as possibility to interfere into a didactic offer – can increase the efficiency of learning programs and therewith support the individual learning process” (Schwer, 2002). Moreover the interactivity can be divided into various degrees, as it can be seen in the following chart (Schulmeister, 2003):

level	level of interaction
1	examine the learning object
2	vary the form of represe ntation of the learning object: contemplate different presentation methods
3	modify the content of the learning object: choose or calculate other contents, or
4	combination of criteria 2 and 3: vary the form of presentation and modify the content
5	construct the learning object by yourself: use editors or simulations
6	obtain feedback from the learning object

Figure 1: Interaction levels

This implies that interactivity offers a broad spectrum of possibilities to motivate the student and get him interested in the learning object. Thus, interactivity represents a efficient tool for the creation of learning contents, which should be used.

A study ordered by the Federal Ministry of Economics and Technology e.g. found that: “generally online learning is criticized for not paying enough attention to interactivity […]: The student devotes himself only to pre-programmed learning steps. Just 27% of online education is arranged interactively […]” (c.r.i.s. International, 2001). The study also proves that interactivity provides an individualized as well as motivating learning. The latter shall be understood as the active inclusion of the student into the learning process.

Individualized learning occurs if the interactivity of a learning program offers (range/selection/) a choice and presentation of information which meets the student's interests and needs at a certain point in the learning process. The ATI-research supports this thesis. It revealed that users of multimedia programs differ in their need of support. Research showed that especially learners with less background and suboptimal learning strategies, in a certain domain, benefit from a well-structured learning environment, whereas for

students with good learning acquirements the degree of freedom is substantial for a successful learning process.

3. Case scenarios for the application of interactive videos in e-learning

Following, some scenarios for iVideo-projects shall be presented to illustrate the application fields, the domains and the possible ways of interaction.

Scenario 1: learning support based upon video: In the range of e-learning the application of videos is used more and more. Some basic approaches of e-learning are solely based on videos in order to support learning and transfer learning contents. In most cases, especially in areas close to university, learning videos are not produced professionally but are created out of recordings of lectures and speeches. This form of e-learning pushes the consumer into a very passive role. The user of the iVideo Authoring Software is now able to create interactive learning contents in a simple way, on the basis of the existing "passive" video material. Especially in videos of lectures and speeches you can identify clear thematic blocks, which can be annotated by means of the iVideo software in separate scenes. Diverse descriptions as well as thematic additions can be added to an entire scene as well as to segments or points of time. Based upon this annotation an interactive table of contents can be generated, which provides a good overview about the issues dealt with as well as making it possible to jump immediately to a wanted scene. Based upon the descriptions and key words of the single scenes, a search function can be integrated into the table of contents, which enables the user to find different contents easily. The splitting up into single scenes makes an adaptation of the chronology of scenes to the knowledge of the single viewer possible. An advantageous application would be the arrangement of different sequences for viewers with previous knowledge as well as viewers with basic knowledge and those who are only interested in details. Especially tests on the learning success represent an important possibility for feedback to tutors and students in e-learning.

Scenario 2: description of complex objects based on video: Descriptions of complex objects in conventional training materials often are difficult to understand. This is why nowadays learning contents based on videos are preferred. In short clips e.g. complex machines are intelligibly explained from diverse perspectives. Interactive elements can support the learning process in an appropriate way. By means of the iVideo software you can underline specific sections and enrich them with additional videos, animations or textual information. Thereby you can easily recognize a clear relation between descriptions and the related area or scene in the video. The visualization of the object helps to understand complex relations, while detailed additional descriptions in the video can be reached easily whenever necessary.

Scenario 3: Distributing iVideo production in social networks: As shown by numerous video platforms in internet, the community thinking is our world today is essential. More and more users are ready to actively participate in the production of contents or even to fully produce these. That the qualities of these "community contents" are excellent could already be proved by Wikipedia and other Wiki-applications. A web-based version of iVideo Software should, especially in big iVideo projects, give the possibility to use the potential of the community. Similar to Wikipedia many different authors can work on the production of the interactive contents, not only to keep these updated but also to minimize the individual realization expenditure.The production of larger interactive videos and complex E-learning videos could be made easier through the "community abilities" of the software. Analogue to Wiki-thinking, different authors independent from one from another could devout themselves to one iVideo project. Drafted on the rich supply of videos from diverse portals, this project could be extended indefinitely. In this way, arranging the

linear passive video clips to interactive and multi dimensional videos without having to produce the entire content.

4. The iVideo Tool

Our projected started from the premises that interactive videos would be used more widely if authoring tools became available that are easy to use for learning content authors even without an extensive digital media background. Therefore, we developed the iVideo tool for the production of interactive videos. Based on available standard technology, the tool allows for economic video production and guarantees connectivity by storing projects in an intermediate language; only upon finalisation will media be made available in a specific format. In this way, iVideo projects stay independent from propriety format and are fully convertible into different formats. iVideo offers full Flash support and thus ensures wide public accessibility with minimal hardware and software requirements.

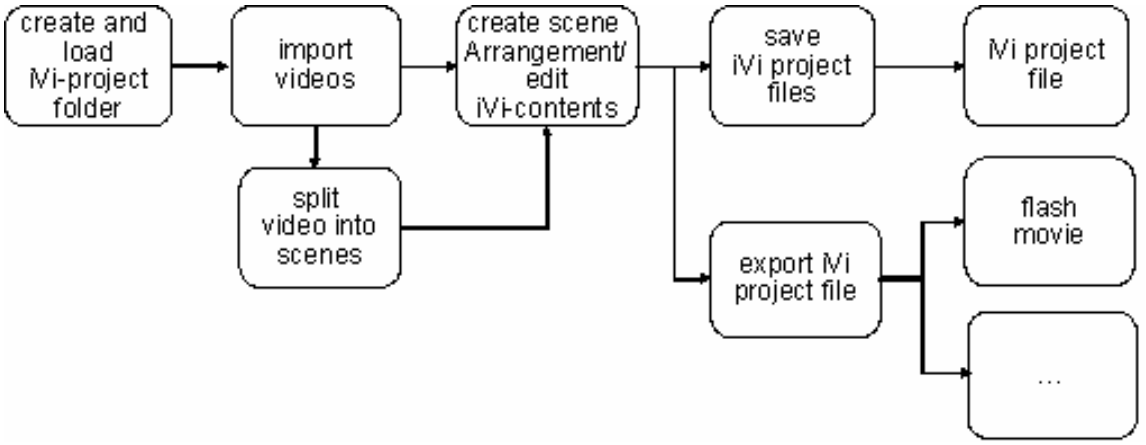

Figure 2: Production of interactive Videos through iVideo

Core functionality includes Video Import, Scene Creation, and Scene Sequencing (cf. Figure 2). This latter feature allows for connecting scenes into optional sequences through user interaction branching. Authors may use a variety of functions to enrich videos with interactivity. Scenes can be annotated at different points in time and in different areas. Possibilities range from simple additions (e.g., texts, diagrams) to rich media contents. Buttons may be superimposed in video clips to get users' attention. Through the same mechanism menus can be realized for branched-out action sequences or tables of contents.

Figure 2 gives an overview of the iVideo System. Users of the iVideo Authoring software may create interactive learning content in a simple way on the basis of the existing non-interactive video material. Especially in videos of lectures and speeches thematic sections may be marked and then annotated by iVideo in separate scenes. Descriptions as well as thematic additions can be added to an entire scene as well as to segments or points of time. Based upon this annotation an interactive table of contents can be generated, which provides a good overview about the issues dealt with as well as making it possible to jump immediately to a selected scene. Based upon the descriptions and key words of the single scenes, a search function can be integrated into the table of contents, which enables the user to find different contents easily. The splitting up into single scenes allows for an adaptation of the scene chronology to the user's prior knowledge. Scene sequences may be arranged according to learning needs (e.g., different levels of prior knowledge, interest in details vs. overview).

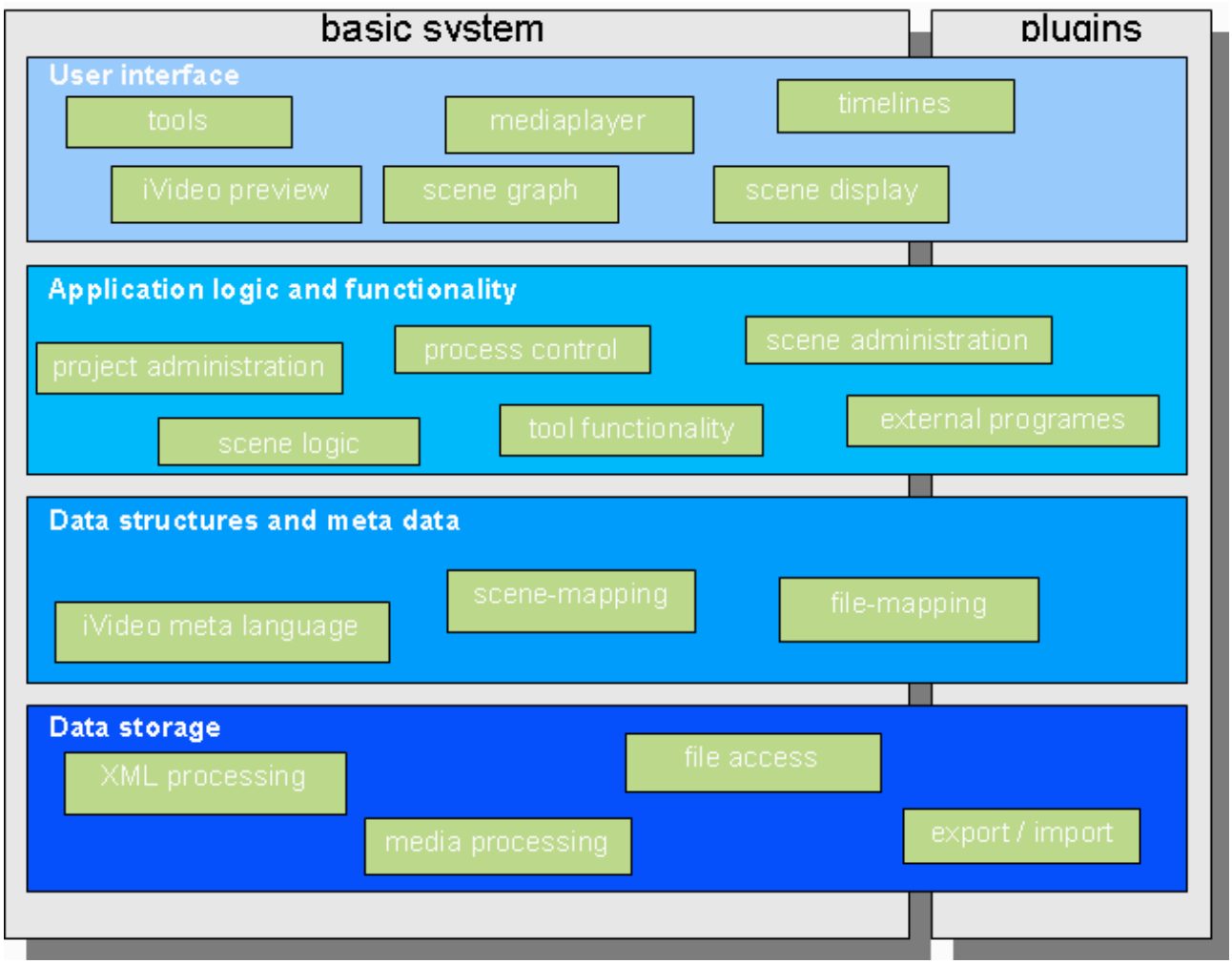

Figure 3: Architectural model iVideo-Tool

5. Conclusion & Perspectives

Interactivity as described above will achieve an ever greater importance for e-Learning. The easy usability of iVideo will enable virtually every content author to produce interactive videos. Outsourcing production to media experts will not always be necessary; learners themselves may even develop their own content. The expandability of the system makes it possible to compile interactive forms independently. Through this flexibility, future connectivity of the tools is guaranteed. New areas of application will become accessible through the plug-in concept.

Currently ongoing experimental assessments of learning success as a function of video interactivity provide valuable insights into ways of giving useful feedback to tutors and students in e-learning.

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Virtual teams and preferential attachment for intrinsic motivation

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Abstract

In recent years, increasing attention has been devoted to virtual learning. In the last decade, a large number of studies in Computer Supported Collaborative Learning (CSCL) have assessed how social interaction, learning processes and outcomes in virtual settings are intertwined. Although recent research findings indicate that learners differ with respect to the amount and type of discourse contributed in virtual settings, little is known about the causes and consequences of these differences. The research presented here investigates how the motivational orientation (intrinsic/extrinsic) of a learner influences the interaction patterns with other learners.

This study of 100 participants who collaborated together in a virtual setting to remediate deficiencies in economics indicates that sub-groups were formed within virtual teams. These sub-groups are based on motivation profiles and differ with respect to the amount and the direction of discourse activity. The research results reveal that the motivation profile influences with whom a learner is interacting. Extrinsically motivated learners have a preferential attachment to connect to highly intrinsically motivated learners. However, intrinsically motivated learners prefer to discuss mainly among themselves, implying that extrinsically motivated learners will receive less feedback and discourse possibilities from other members within the virtual team. Our findings might explain why in distance learning large differences in participation are found and why certain learners are more inclined to drop-out in class.

Keywords: K-means cluster analysis, academic motivation, Social Network Analysis, Computer Supported Collaborative Learning.

1. Introduction

The attention for virtual collaborative learning in recent years is fuelled by two separate yet mutually enforcing developments: The increasing possibilities of Information Communication Technologies (ICT) to support collaboration (Bromme, Hesse, & Spada, 2005; Resta & Laferrière, 2007; Schellens & Valcke, 2005) and the evidence that collaboration can enrich student learning through interaction (Jonassen & Kwon, 2001; Lindblom-Ylänne, Pihlajamäki, & Kotkas, 2003; Van den Bossche, Gijselaers, Segers, & Kirschner, 2006). A common assumption is that ICT has the power to provide a rich learning experience by using a variety of learning methods. ICT-tools like discussion forums and chat "afford" learners to learn in a challenging and interactive manner (Jonassen & Kwon, 2001; Kirschner, Strijbos, Kreijns, & Beers, 2004; Resta & Laferrière, 2007; Yang, Tsai, Kim, Cho, & Laffey, 2006).

Despite the possibilities or affordances of ICT-tools, recent findings in Computer Supported Collaborative Learning (CSCL) indicate that learners who are similar with respect to educational background and prior knowledge nevertheless contribute differently to discourse (Caspi, Chajut, Saporta, & Beyth-Marom, 2006; De Laat & Lally, 2003; Nussbaum & Bendixen, 2003). For example, Caspi, Gosky and Chajut (2003) analysed a total of 7706 messages of 47 courses at various faculties of the Open University in Israel and found that the majority (80%) of students contributed only a small amount of messages. A small minority contributed the bulk of the messages. Thus, these distance learning courses are characterised by largely unequal participation among students. But not only differences in contributions by students have been found. For example, De Laat and Lally (2003) and Schellens and Valcke (2005) showed that students also differed with respect to the type (cognitive, affective, metacognitive) of contributions. In general, it seems there is mounting evidence showing that learners in virtual settings contribute substantially different in terms of amount of messages as well as type of discourse.

Although recent research findings indicate that learners differ with respect to the amount and type of discourse contributed, little is known about what the causes and consequences of these differences are. Previous research has shown that the type of motivation has a strong influence on the amount and type of discourse when looking at bachelor students economics who worked together in virtual teams. In addition, intrinsically motivated students were found to be more central in the social network than extrinsically motivated students (Rienties, Tempelaar, Van den Bossche, Gijselaers, & Segers, Submitted). Motivation plays such an important role as the nature of distance learning and the limited role of the teacher in a collaborative learning constellation (Kirschner et al., 2004; Vonderwell, 2003) refrains the teacher to interact in a similar manner as in a face-to-face setting. In addition, learners are given a large autonomous freedom to decide their own learning path in virtual settings, which is beneficial for learners with intrinsic motivation. Hence, the nature of distance learning suggests a dominant role for intrinsic motivation (Ryan & Deci, 2000a), relative to extrinsic motivation.

In this follow-up study, we investigate whether the motivational orientation has an influence on whom a learner is interacting with. As we previously found a large difference in discourse due to differences in the motivational orientation of learners (Rienties et al., Submitted), in this paper we will explore whether learners perceive and act upon these differences in motivation. One method to draw inferences from interaction patterns among individuals is Social Network Analysis (Wassermann & Faust, 1994). Within educational psychology, a limited amount of research is conducted on how learners are connecting to other learners within in groups using Social Network Analysis (Otte & Rousseau, 2002). In contrast, in disciplines like economics and sociology Social Network Analysis techniques are used more often (Cowan & Jonard, 1998; Otte & Rousseau, 2002). Within these fields, developments of linkages between individuals in networks can be described based on random graph theory or by networks having preferential attachment (Barabasi, 2002). In networks that develop according to random graph theory (Barabasi, 2002; Cowan & Jonard, 1998), learners connect to other learners on an equal basis, irrespective of personality traits like motivational orientation. In contrast, in networks with preferential attachment (Barabasi, 2002), learners are mainly connecting to other learners with some perceived “positive” trait (e.g. large knowledge-base, large network of peers).

For example, a student who is highly intrinsically motivated to learn a particular subject might develop a deeper insight into this subject than an extrinsically motivated learner (Ryan & Deci, 2000b). Hence, the intrinsically motivated learner might be perceived by others to be an attractive learner to connect to in collaborative learning settings in order to exchange knowledge and feedback.

If virtual teams develop like networks with preferential attachment, this will imply that the existence of variation in motivational orientation of the members of a virtual team can have an impact on the interaction patterns of learners. To verify which network is more likely to develop, we will use a cluster analysis of motivational variables in combination with Social Network Analysis to assess how the profiles of motivation influence to whom an individual learner is connected to. Based upon the results of our first study, that demonstrated that intrinsically motivated learners distinguish themselves from extrinsically motivated learners with respect to the number of higher cognitive contributions to the discourse, we expect that all learners have a preference to connect to intrinsically motivated learners. Furthermore, we expect that intrinsically motivated learners are mainly connecting amongst themselves in order to elaborate their insights into a particular subject.

2. Preferential attachment to intrinsically motivated learners

In order to assess whether learners are interacting differently based on their motivational orientation, we first elaborate on the concept of motivation. Afterwards, we analyse whether certain profiles of motivation are more favourable in distance learning settings than others in order to assess whether learners have a preference to attach to particular profiles of motivation. According to Ryan and Deci (2000a; 2000b), most theories of motivation regard motivation as a unitary phenomenon, implying that a learner has either a lot or little motivation, also referred to as states of motivation versus amotivation. To be motivated means to be moved to do something, while amotivation is a state of lacking any intention to act (Ryan & Deci, 2000a). However, focusing only on the level of motivation ignores the underlying attitudes and goals the learner has in order to pursue an action or goal (Deci & Ryan, 1985). In Self-Determination Theory (SDT), Ryan and Deci (2000a; 2000b) distinguish between intrinsic motivation, extrinsic motivation and amotivation.

In intrinsically motivated learning, the drive to learn is derived from the satisfaction and pleasure of the activity of learning itself; no external rewards come in play. Externally motivated learning refers to learning that is a means to an end, and not engaged for its own sake. In contrast to classical theories of motivation that regard extrinsic motivation as a single construct, SDT proposes that extrinsic motivation is a construct with different facets that vary greatly with the degree to which the learner is autonomous (Deci & Ryan, 1985; Ryan & Deci, 2000a). SDT distinguishes four different forms of extrinsic motivation that constitute a motivational continuum reflecting the degree of self-determined behaviour, namely external regulation, introjection, identification and integration. External regulation depicts behaviour that is performed to satisfy external demand without that it is integrated into the self. For example, homework provided by the teacher is made by the learner without that the learner integrates the activity into the self. Introjected motivation represents a form of regulation by contingent self-esteem, which implies that although the regulation is internal to the learner, the behaviour is not fully part of the self (Ryan & Deci, 2000a).

For example, when parents indicate that making homework is important, the learner will integrate (parts of) the regulation when making homework in order to prevent guilt. In identification, the learner has identified the importance of a behaviour and has accepted its regulation as his or her own. For example, making mathematics homework will enable the learner to be mathematically skilled, which will increase his career chances in the future and hence the learner will consciously value this regulation (Ryan & Deci, 2000b). Finally, the most autonomous form of extrinsic motivation is integrated regulation, where a learner fully values the activity and integrates the regulation into the self.

Given the complex nature of distance learning, learners will have to base their perceptions of others exclusively on the quantity and quality of discourse activity (Bromme et al., 2005; De Laat, Lally, Lipponen, & Simons, 2007). As intrinsically motivated learners are more inclined to contribute to discourse than extrinsically motivated learners, in particular with regard to higher cognitive discourse (Rienties et al., Submitted), they possess crucial characteristics for distance learning. Superior contributions to discourse at higher cognitive level might bring them a positive (expert) reputation in the virtual team. Other learners might be more willing to contribute to a learner who is perceived to be motivated and has some expert knowledge. In addition, as extrinsically motivated learners will perceive a lack of external regulation in distance learning, they might direct their attention more towards intrinsically motivated learners, who lead the discourse development within the virtual team, thereby providing the desired external regulation to extrinsically motivated learners. As a result, we expect that extrinsically motivated learners will have a preferential attachment to intrinsically motivated learners. At the same time, given the attractiveness to establish discourse with intrinsically motivated learners, intrinsically motivated learners are expected to establish connections primarily within their own sub-group.

In conclusion, the complex nature of social interaction in distance learning suggests a dominant role for intrinsic motivation, relative to extrinsic motivation. Hence, we expect that learners will have preferential attachments to learners with high intrinsic motivation as they can gain more knowledge, feedback and learning regulation. This then will imply our hypothesis that low extrinsically motivated learners send more (external) messages to high intrinsically motivated learners, while intrinsically motivated learners will send more (internal) messages to high intrinsically motivated learners.

3. Method

3.1. Setting

This study is part of a large European research programme on the effectiveness of virtual team learning in remedial education[i]. The present study took place in an online summer course for prospective bachelor students of an International Business degree programme in the Netherlands. The aim of this course was to bridge the gap in economics prior knowledge for students starting a bachelor (Rienties, Tempelaar, Waterval, Rehm, & Gijselaers, 2006). The online course was given over a period of six weeks in which students were assumed to work for 10-15 hours per week. The

participants never met face-to-face before or during the course and had to learn using the virtual learning environment "on-the-fly". The course used principles of Problem-based learning (PBL), which is a typical application that fosters socio-constructivist learning. PBL focuses student learning on complex situations and on a variety of realistic information (Dochy, Segers, Van den Bossche, & Gijbels, 2003; Van den Bossche et al., 2006). One of the key issues in PBL is that students are actively constructing knowledge together in collaborative groups (Hmelo-Silver, 2004). Students participated in groups within a collaborative learning environment using discussion forums and announcement boards. Within six weeks, students had to collaborate together on solving six tasks through a problem-based learning method. The group, together with the tutor, could decide upon the pace in which content and context were dealt with. No obligatory meetings were scheduled. At the end of each week, the tutor made a suggestion on how to proceed with the next task, thereby focusing on process rather than on content. The results of three interim-tests and a final summative test combined with graded participation in the discussion forums were used to make a pass-fail decision. A non-recognised certificate and a drink at a graduation ceremony were the only external rewards. Hence, this setting provides a unique opportunity to assess the role of motivation on behaviour of learners in virtual settings as the learners never met each other before and collaborated exclusively in the virtual learning environment.

3.2. Subjects

In total 100 participants were randomly assigned into six groups. Data were analysed for those individuals who actually posted at least once a reaction in the discussion forum. This resulted in a total of 82 participants that were selected for analysis. The six groups had an average of 13.66 members (SD= 2.16, range = 11-17) per team. The average age was 19 years and 45% of the learners were female.

3.3. Academic Motivation Scale (AMS)

Individual motivation was measured by the Academic Motivation Scale (AMS), which was developed by Vallerand et al. (1992) for college/university students and measures the contextual motivation for education. Vallerand and colleagues have added further theoretical concepts to the model of Deci and Ryan (1985) as well as adjusting the model for different contexts as the model of Deci and Ryan (1985) was primarily developed to measure motivation among children. Vallerand et al. (1992) acknowledge that the attitudes, values and goals that trigger a learner to become intrinsically motivated can differ. For example, when a learner enters into college or university and voluntarily chooses a study, distinguishing the different intrinsic motives might be important.

The instrument consists of 28 items, to which students respond to the question stem "Why are you going to college?". There are seven subscales on the AMS, of which three belong to the intrinsic motivation scale, three to the extrinsic motivation scale and one for amotivation. Intrinsic motivation subscales are intrinsic motivation to know (IMTK): learning for the satisfaction and pleasure to understand something new; intrinsic motivation to accomplish (IMTA): learning for experiencing satisfaction and pleasure to accomplish something; and intrinsic motivation to experience stimulation (IMES): learning to experience stimulating sensations. The

three extrinsic motivation subscales are identified regulation (EMID), introjected regulation (EMIN), and external regulation (EMER). The three constitute a motivational continuum reflecting the degree of self-determined behaviour, ranging from identified regulation as the component most adjacent to intrinsic motivation, to externally regulated learning, where learning is steered through external means, such as rewards. The last scale, amotivation (AMOT), constitutes the very extreme of the continuum: the absence of regulation, either externally directed or internally. The reliability and validity of the AMS scale has been established in a variety of studies (Cokley, Bernard, Cunningham, & Motoike, 2001; Fairchild, Jeanne Horst, Finney, & Barron, 2005; Vallerand & Bissonnette, 1992; Vallerand & Pelletier, 1993; Vallerand et al., 1992). In total 1445 freshmen filled in the questionnaire during the first course of the semester. The response-rate on AMS-questionnaire was 93% and the Cronbach alpha for the seven items ranged from .760 to .856, which is in line with previous studies (Fairchild et al., 2005; Legault, Green-Demers, & Pelletier, 2006; Vallerand et al., 1992). As the subjects of the summer course were foreign students, the Dutch students were removed from the database, leading to 765 students on which a k-means cluster analysis was conducted.

3.4. Statistical analyses

3.4.1. Cluster analysis

As the first step in the statistical analysis, subscale scores for all seven intrinsic motivation, extrinsic motivation, and amotivation variables were calculated for all 765 non-Dutch freshmen. Next, K-means cluster analysis was applied to these subscale scores. It was found that a three cluster solution provides an adequate description of different motivation profiles present in these freshmen. Afterwards, data on cluster membership of all participants of the virtual teams were combined with individual data resulting from the social network analysis. The interrelationships between all measures were assessed through standard T-tests analyses using SPSS 15.0.1.

3.4.2. Positioning of individuals within social network using Social Network Analysis

According to Aviv, Erlich, Ravid and Geva (2003), a social network is defined as a group of collaborating (and/or competing) entities that are related to each other. Social Network Analysis (SNA) can be considered as a wide-ranging strategy to explore social structures to uncover the existence of social positions of individuals within the network (Aviv, Erlich, Ravid, & Geva, 2003). According to Russo and Koesten (2005), SNA can provide a better understanding of patterns of interaction of individuals in virtual settings. Main indicator for this study is the relative position of each learner within the social network, derived by UCINET version 6.158. In order to assess whether learners with different motivational orientations connect equally to each of the clusters, we will use the (absolute/relative) number of send and received messages per learner to members in each of the (internal/external) clusters as a measurement for equality of interaction between clusters.

4. Results

4.1. Clustering students on Academic Motivation

In order to investigate whether the motivation profile of a learner has an influence on the position within the social network and the neighborhood of a learner, a K-means cluster algorithm was applied to obtain three different profiles for motivation, which were further labeled according to the final cluster center position (See Table 1). As can be seen from Figure 1, the three motivation profiles are: (1) cluster one: low intrinsic motivation, high extrinsic motivation; (2) cluster two: medium intrinsic motivation, low to medium extrinsic motivation; (3) cluster three: high intrinsic motivation, high extrinsic motivation.

Table 1 Means and standard deviation of classification measures per cluster (K-means)

	Cluster 1 Low In, High Ex (N=182)	Cluster 2 Med In, Med Ex (N=152)	Cluster 3 High In, High Ex (N=415)
Intrinsic motivation to know	4.68 (0.94)	5.38 (1.02)	6.06 (1.10)
Intrinsic motivation to accomplish	3.95 (0.89)	4.09 (0.89)	5.42 (1.06)
Intrinsic motivation to experience stimulation	3.17 (0.95)	3.81 (0.99)	4.92 (1.18)
Identified regulation	6.04 (1.00)	5.58 (1.20)	6.48 (1.03)
Introjected regulation	4.61 (1.14)	3.24 (1.23)	5.35 (1.22)
External regulation	6.05 (1.03)	4.52 (1.43)	6.12 (1.23)
Amotivation	1.44 (0.73)	1.40 (0.73)	1.32 (0.62)

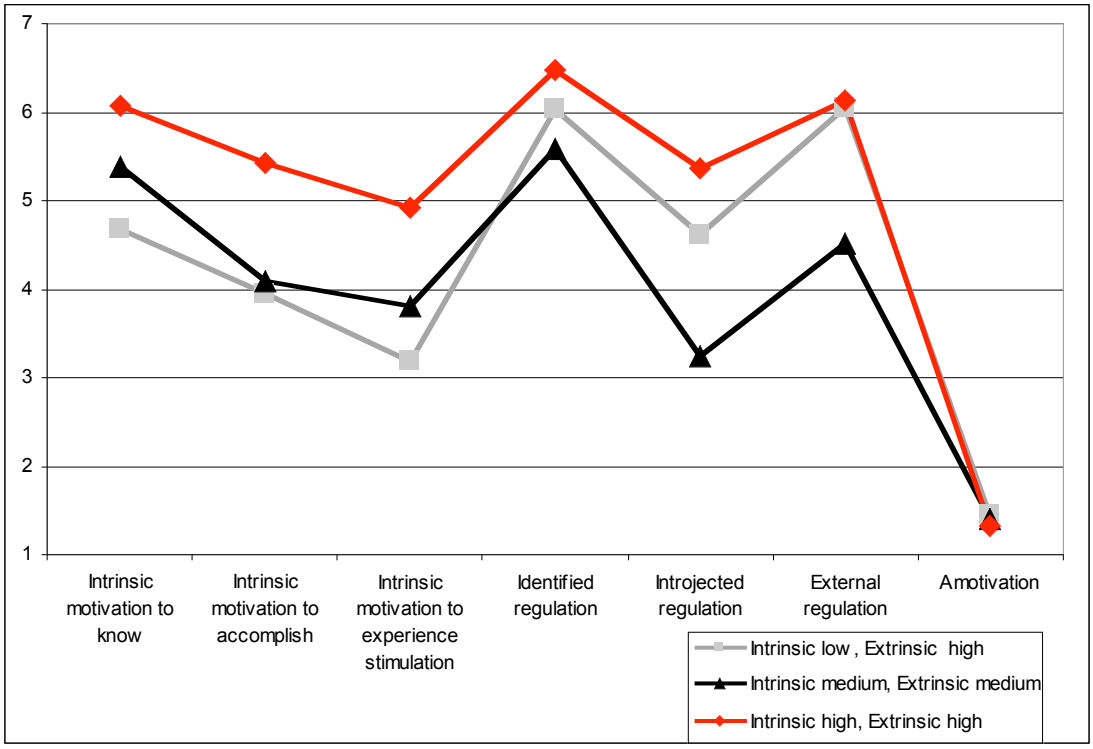

Figure 1 Mean scores of the 7 classifications measures per cluster

To assess whether the sub-group of summercourse participants differs with respect to motivation profile from the overall group of foreign freshmen on which the cluster analysis was conducted, we compared the number of participants in each of the three clusters. With respect to the first two clusters, no significant difference was found

between summercourse and no summercourse participants. In cluster 3 (high intrinsic and extrinsic motivation), a significant positive difference was found (F = 24.883, t = 2.030, p-value = 0.043), implying that the summercourse group counts a relatively larger number of cluster 3 students[1]. However, in a formal t-test on differences in means, no significant differences were found between summercourse participants and no-participants on any of the AMS variables, except for amotivation. Therefore, we can assume that the summercourse participants resemble the overall group of foreign freshmen with respect to type of motivation.

4.2. Relating students' motivation to Social Network Analysis

As a second step, the cluster memberships were added as learner attributes to the social networks of each of the six virtual teams. To illustrate the power of SNA in understanding the interaction patterns amongst learners, the social network of team 5 (Figure 2) and team 6 (Figure 3) are presented. Both Team 5 and Team 6 have a mix of learners with different motivation profiles. Learners for which no motivation attributes are available and teachers are represented by a light-coloured circle, while cluster 1 learners (low intrinsic, high extrinsic) are represented by a light-coloured square box, cluster 2 learners (medium intrinsic, low to medium extrinsic) by a dark triangle, and finally cluster 3 learners (high intrinsic and extrinsic) by a shaded diamond box[ii]. In this way, we were able to visualise the position of each learner in the network as well as to whom each learner was connected to depending on his/her motivational profile. Five aspects can be distinguished from these figures.

First of all, the social networks illustrate who is communicating with whom and what the direction of communication is (Freeman, 2000). For example, in Figure 2, Tutor 4 replied to a comment of Kathi, which is indicated by the direction of the arrow (Wassermann & Faust, 1994). In addition, Laura and Charles have a so-called "reciprocal link" as they reacted both to each other's contribution and the arrow goes in both directions. Second, some individuals within the network are more central than others (Russo & Koesten, 2005; Wassermann & Faust, 1994). For example, Katherina, Martin, Maria, Sylvia and Tutor 4 are central members in team 5, while Jonas, Veronica and Tutor 3 are central in team 6. Third, some learners are on the outer fringe of the network and are not well-connected. For example, Markus, John and Kathi as well as Bernard and Felix are connected with less than four ties in team 5 and team 6 respectively. Fourth, there are some learners who are connected with most learners but who are still on the outer fringe. For example, Laura, Charles and Judith in team 5 and Christina, Sandra and Paul in team 6 have more than 15 contributions but are still on the outer fringe of the overall network. This means that despite the fact that their number of links to others is high, they do not occupy a central position in the network.

Finally, when looking at motivation profiles, it appears that students with high intrinsic motivation are clustered in subgroups. For example, in team 6 most of the connections of Veronica and Jonas (cluster 3) are to students with the same cluster membership. Learners with low and medium motivation are positioned mostly on the outer fringe of the network and are mainly connected to high intrinsically motivated

[1] Given that attendance to the online summercourse programme is voluntary, it is reasonable to expect an overrepresentation of high intrinsically motivated learners.

learners, which is in line with the hypothesis of networks with preferential attachment. Furthermore, learners within cluster 1 (Kathi and Markus of team 5; Paul and Bart of team 6) and learners within cluster 2 (Judith and Laura; Elena, Christina and Bernard) are not well connected to other learners with the same motivation profile. In fact, most cluster 1 and 2 learners are only indirectly linked to each other through cluster 3 learners. For example, in team 6 Bart can only be linked to Paul via Jonas or Caroline. In sum, our learners differ with respect to the number of ties as well as with respect to the position in the network, which has also been found in other research (De Laat et al., 2007; Rienties et al., Submitted; Russo & Koesten, 2005). An innovative feature of this study is that by combining the results of the Social Network Analysis and cluster analysis, we were able to distinguish interaction patterns amongst individual learners based upon their motivation profile.

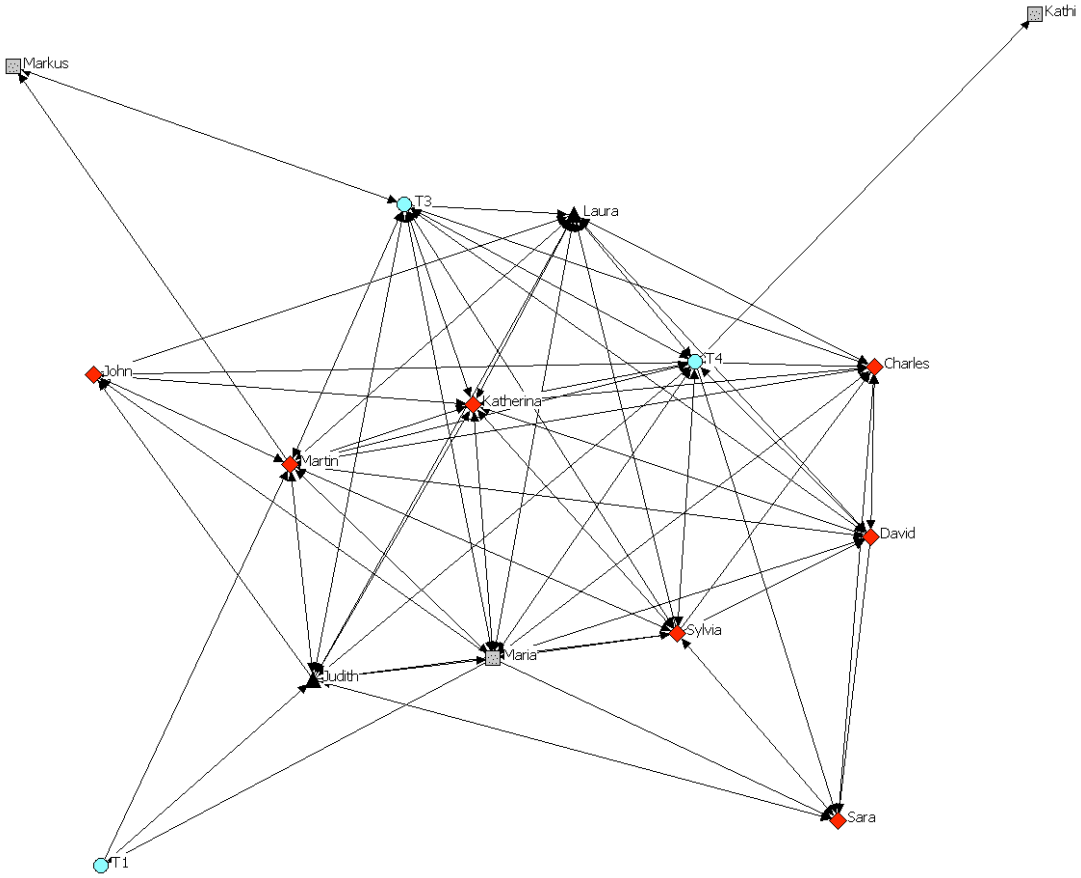

Figure 2. Social Network of team 5

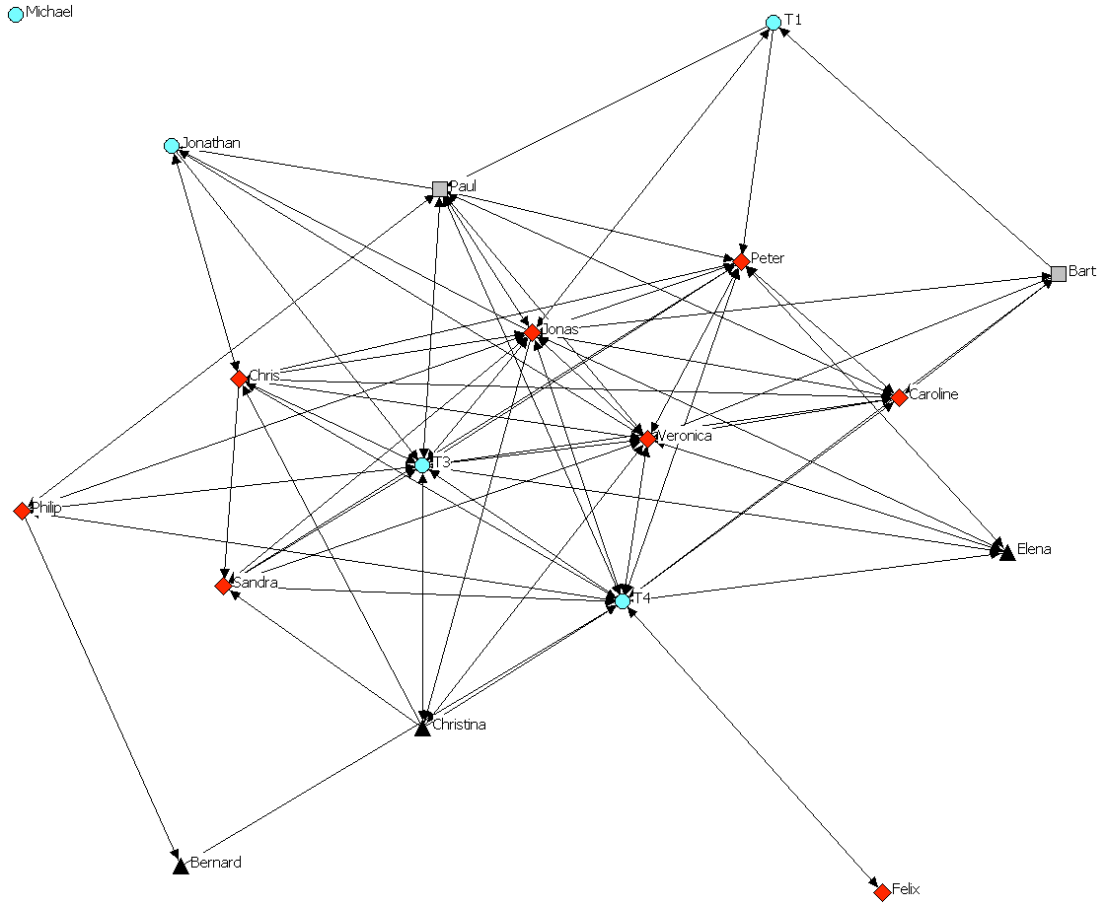

Figure 3. Social Network of team 6

4.3. Internal and External connections in clusters

Although the social network graphs of team 5, 6 and the other four teams (not illustrated) indicate some degree of preferential attachment to high intrinsically motivated learners, it is unclear whether this phenomenon is statistically significant in all six teams. Therefore, we first look at the overall distribution of each cluster type (Table 2) and afterwards assess whether particular profiles contribute more/less internal/external messages. In Table 2, the contributions to discourse per cluster within each team are provided. For example, in team 6 the two cluster 1 learners have contributed in total 24 messages. The two cluster 2 learners have contributed 22 messages, while the eight cluster 3 learners have contributed 227 messages.

In Table 3 we compare the average number of internal and external links of each learner within the three clusters, providing mean scores and standard deviations (in brackets). If we look at the absolute (total) discourse per learner of each cluster, the amount of discourse is positively related with the cluster type, as cluster 1 learners contribute the least amount of discourse (13.20 messages per learner), cluster 2 form a middle group (17.42 messages per learner), and finally the most active group is cluster 3 (26.04 messages per leaner). In almost all discourse intensities, the standard deviations are approximately equal to the mean scores. This implies that within each

cluster there exist large differences amongst individual learners in the amount of discourse; see also Rienties et al. (submitted).

Table 2 Contributions to discourse per cluster within each team

	Cluster 1		Cluster 2		Cluster 3	
	Messages	n	Messages	n	Messages	n
Team 1	25	2	110	3	81	5
Team 2	55	2	38	2	366	10
Team 3	85	6	5	1	70	4
Team 4	0	0	10	1	677	16
Team 5	52	3	88	2	290	7
Team 6	24	2	22	3	227	8
Total	241	15	273	12	1711	50

Table 3 Interaction among learners per cluster

	Cluster 1 Low In, High Ex (N=15)	Cluster 2 Med In, Med Ex (N=12)	Cluster 3 High In, High Ex (N=50)	t-test difference
Absolute				
Sent to internal cluster	2.20 (2.62)	3.17 (4.32)	18.72 (20.92)	3.96***
Sent to external cluster	11.00 (11.37)	14.25 (11.45)	7.32 (9.36)	-2.13*
Sent difference	-8.80 (10.55)	-11.08 (8.23)	11.40 (19.54)	5.30***
Received from internal cluster	2.20 (2.68)	3.00 (3.64)	20.28 (22.02)	4.15***
Received from external cluster	11.33 (11.30)	15.25 (13.23)	9.54 (8.89)	-1.46
Received difference	-9.13 (10.11)	-12.25 (11.66)	10.74 (21.35)	4.84***
Relative				
Sent to internal cluster	0.62 (0.67)	1.22 (1.54)	1.70 (1.71)	2.21*
Sent to external cluster	0.97 (0.98)	1.06 (0.95)	1.04 (1.18)	0.11
Sent difference	-0.35 (0.76)	0.16 (0.74)	0.66 (1.08)	3.32**
Received from internal cluster	0.62 (0.72)	1.17 (1.34)	1.83 (1.67)	2.73**
Received from external cluster	1.04 (1.09)	1.14 (1.07)	1.40 (1.16)	1.119
Received difference	-0.42 (0.86)	0.025 (0.94)	0.42 (1.10)	2.62**

Note: Independent sample T-test (2-sided) (Cluster 1 + 2 vs. Cluster 3)
* Coefficient is significant at the 0.05 level (2-tailed).
** Coefficient is significant at the 0.01 level (2-tailed).
***Coefficient is significant at the 0.001 level (2-tailed).

In the second part of Table 3, the relative interactions within and between clusters are illustrated, whereby we correct for the total number of each of the three profiles of motivation within a virtual team. For example, in team 6 there are five learners from cluster 0, two learners from cluster 1, three from cluster 2 and nine from cluster 3. For cluster 1 the number of sent messages to internal cluster is divided by two, yielding a relative measure for sent to internal cluster for each member within cluster 1. For all cluster 1 learners, this implies that on average 0.62 (0.67) messages are sent to each of the cluster 1 learners. At the same time, the number of sent messages to external clusters is divided by 17, implying that on average 0.97 (0.98) messages are sent by cluster 1 learners to each of the external learners. In this way, we correct for the relative size of each cluster type within each virtual team. Finally, using an independent sample T-test, no evidence is found that cluster 1 and 2 differ significantly from each other. In contrast, both cluster 1 and 2 differ significantly from cluster 3. The t-test outcomes of the last column in Table 3 illustrate the differences between the combined first two clusters and cluster 3.

Cluster 1 learners (low intrinsic, high extrinsic) send 2.20 messages on average to learners within cluster 1, while they send 11.00 messages to learners in cluster 2 and 3. If we use the relative numbers, whereby we correct for the number of learners within each cluster, learners in cluster 1 remain stronger externally focussed. That is, cluster 1 learners send on average 56% more messages outside their cluster and this difference is significant at 10% (T = -1.768, p-value = 0.09) in a paired-samples T-test. At the same time, cluster 1 learners received 68% more external messages from outside their cluster than from inside their cluster and this difference is again significant at 10% (T = -1.883, p-value = 0.08). Therefore, both sent to and received from measures indicate that cluster 1 learners are mainly focussed on communication with learners outside their own cluster, implying that the motivation profile has an influence on whom cluster 1 learners are connected to. Hence, we find (weakly significant) evidence that cluster 1 learners have a preferential attachment for higher intrinsically motivated learners.

After correction for the relative group size of each cluster, cluster 2 learners (medium intrinsic, low to medium extrinsic) send about an equal amount of messages to both within and outside their cluster. At the same time, they receive an equal amount of messages from within as well as outside their cluster. This implies that cluster 2 learners do not distinguish with whom they communicate when we cluster based upon the motivation profile. Thus, cluster 2 learners are connected to all other learners within the social network as predicted by random graph theory.

The last cluster (high intrinsic and extrinsic motivation) contributes the highest absolute number of messages, namely 26.04 messages on average per learner. After correction for differences in size between the clusters, it appears that learners in cluster 3 contribute larger amounts of messages to its own cluster, namely 1.70 message per learner in cluster 3, while only 1.04 messages are sent to each learner in cluster 1 and 2. In other words, cluster 3 learners were almost 40% more likely to send a message to their own cluster and this difference is statistically highly significant at 1% (T = 4.326, p-value < 0.01) in a paired samples T-test. In addition, the majority of the messages received by learners in cluster 3 originate from their own cluster (T = 2.748, p-value = 0.01). If we subtract the average number of contributions sent to external clusters (1.04) from those the received from external clusters (1.40), more learners from cluster 1 and 2 are connected to cluster 3 than vice-versa and this difference is again highly significant (T = -3.879, p-value = 0.00), in a paired-samples T-test. Hence, intrinsically motivated learners are the most active contributors to discourse but at the same time are contributing most within their own sub-group. In addition, the learners of cluster 1 and cluster 2 are connecting more to cluster 3 learners, implying support for the preferential attachment model.

5. Discussion

The results of the present study indicate that in our virtual settings learners connect to other learners depending on their motivation profile. We find evidence that learners with high intrinsic motivation receive a relatively large amount of contributions from learners with other motivation profiles. At the same time, intrinsically motivated students themselves are focussing more on discourse within their own cluster than outside their cluster. These findings indicate that in distance learning settings interaction patterns amongst participants of virtual teams do not develop randomly. In

fact, we find that extrinsically motivated learners are more likely to connect to intrinsically motivated learners than vice versa, which corroborates the preferential attachment model.

With respect to the position of the individual learner in the social network, large differences are found amongst learners, which is in line with previous findings (De Laat et al., 2007; Russo & Koesten, 2005). A new feature is that we are able to link the position of the learner in the social network to his/her motivation profile. The social network graphs indicate that learners with certain motivation profiles are more likely to connect to each other than to learners with other profiles. The majority of the central learners in the social network are intrinsically motivated learners. In addition, most of the cluster 1 and 2 learners seem to be stronger connected to cluster 3 students than vice versa. In fact, when we analyse the social networks of all six virtual teams, we find strong support of the idea that most learners have a preference to connect to intrinsically motivated learners. This amongst others implies that intrinsically motivated learners rather prefer to discuss with each other than to connect to learners outside their cluster. Communication patterns in cluster 2 do not provide additional support to the preferential attachment model. The differences we find between internal and external communication in cluster 2 are not that strong to produce statistically significant differences, implying that students' motivation profiles do not play such a crucial role in choosing communication partners than in other clusters.
In contrast, learners in cluster 1 are more externally focussed than internally focussed. Although the effects are marginally significant, most likely due to the relatively small sample size, we find some proof for the preferential attachment model for cluster 1 learners.

These findings might have important consequences as we find support of the idea of preferential attachment based on students' motivation profiles in distance learning. This implies that students strong in intrinsic motivation, who due to the nature of distance learning already have an advantage over other students (Rienties et al., Submitted), will in the duration of the course be further stimulated by extrinsically motivated students as well as other intrinsically motivated students that are keen to link to them. By receiving more contributions from others to initiated discourse (in particular from intrinsically motivated students), they can exchange more knowledge and receive more feedback than learners with low intrinsic motivation who receive little contributions from others. In a way, it seems like a self-fulfilling prophesy: active contributors to discourse receive further encouragements from others to continue, while these active contributors at the same time interact mostly with other active contributors rather than students on the "outer fringe" of the network. Intrinsically motivated learners are "well-suited" for our distance learning setting and continuously receive acknowledgements from other learners, while extrinsically motivated learners both contribute less to the discourse and, when they do contribute, are less successful in inviting responses from other students. As a result, extrinsically motivated learners receive less feedback and stimuli from others, which might further decrease their integration within the virtual team.

Research by Russo & Koesten (2005) on the position of learners with the network showed that being central is beneficial for learning outcomes. Furthermore, our own longitudinal research of summercourse participants in the first year of their bachelor showed that successful summercourse participants, who are mainly intrinsically

motivated, outperform their peer on study success and study performance (Rienties, Tempelaar, Dijkstra, Rehm, & Gijselaers, In press). Taken our findings and findings from others together, we find that motivational orientation has a strong influence of learning interaction processes in collaborative learning, which eventually might lead to large differences in learning outcomes. If our findings are replicated in other distance learning settings, this might imply that due to the nature of preferential attachment to intrinsic motivation extrinsically motivated students will be put at a disadvantage. Given the complex nature of distance learning (Bromme et al., 2005; De Laat et al., 2007; Resta & Laferrière, 2007), this disadvantage might be too large and detrimental for extrinsically motivated learners. This might explain why distance learning courses suffer from large differences in discourse among learners as well as high drop-out rates.

6. Limitations

The results of this study were based on a k-means cluster analysis of student self-scores of a questionnaire on academic motivation, which was afterwards linked to the social network of each virtual team using Social Network Analysis. This can be viewed as a potential limitation to this study in that no content analysis was conducted on the type of discourse. The aim of content analysis techniques is to reveal evidence about learning and knowledge construction from online discussions. In an extreme case, it might be that extrinsically motivated learners who are not central in the network and contribute to a low degree to discourse might actually contribute mainly to higher cognitive discourse, while intrinsically motivated learners contribute more to non-task related communication or low cognitive discourse, thereby minimizing the negative effects of preferential attachment. However, in our first study (Rienties et al., Submitted), we showed that extrinsically motivated learners underperform relative to intrinsically motivated learners with respect to contributions to higher cognitive discourse. In fact, we found strong correlations between intrinsic motivation and knowledge construction and hence we expect that a similar pattern will be found as reported in this article if we analyse interaction patterns of higher cognitive discourse.

As a second limitation, the long-term consequences on learning outcomes have not been demonstrated. The longitudinal effects of the motivational orientation on type of discourse and position within the network need to be assessed in future research. Preliminary findings indicate that active summer course participants outperform others in the first year of their bachelor programme (Rienties et al., In press). Besides the quantitative measures of learning, implementing qualitative measures of learning like critical event recall (e.g. De Laat et al., 2007) might provide further evidence of how motivational orientation influences learning in virtual settings. We encourage researchers to assess the role of motivation on type of discourse and position in the network in other settings in order to verify our findings.

A third limitation of this study is that no measures were taken to prevent self-selection in the summer course programme. Each novice student who was interested in joining the programme was accepted if his/her prior knowledge was below a pre-defined threshold. Although all students were informed by ordered mail about the opportunities of the summer course, given the voluntary nature of the summer course programme, a reasonable assumption might be that intrinsically motivated students

are more inclined to join than extrinsically motivated students. We established that the proportion of cluster 3 students amongst Summercourse participants is indeed somewhat higher than the proportion in all freshmen, yet cluster 1 and cluster 2 students are not statistically significantly underrepresented in our subsample. So selection effects, if present, are of limited size. In addition, our study does not aim to generalise findings from the summercourse participants to the group of all freshmen, so in that sense presented outcomes are immune for selection affects. On top of that: selecting or rejecting students based on motivational orientations rather than prior knowledge leads to ethical issues. For example, preventing externally regulated or amotivated learners to enter a preparatory course, while accepting strongly intrinsically motivated students, leads to obvious ethical problems. Alternatively, composing groups on the motivational orientation of students might also lead to ethical dilemmas. In our setting, which matches the practice teachers in online settings are confronted with (i.e. groups with a mix of various types of motivated students), we did not balance groups based on a pre-determined mix of motivational types.

7. Future Research and Implications for Education

Based on our findings, we will redesign the learning environment to capitalise on the merits of social interaction, peer-support and planning of learning processes. By increasing social presence in our virtual learning environment by using Web 2.0 tools like blogs, wiki's and webconference, we hope to increase the relatedness among learners, which has shown to increase the internalisation of a regulation (Ryan & Deci, 2000b). Socio-emotional support is an important factor in relational development of groups. In particular in CSCL environments, socio-emotional communication is not an automatic artefact.

These findings are relevant for teachers, managers, admission officers and schedulers as the results imply motivation orientation has a moderately strong influence on the type of discourse and position within the social network. Social Network Analysis tools can be used to assess who is contributing actively to discourse and can be used as a tool for teachers to identify learners on the outer ring of the social network. Appropriate strategies to deal with various types of motivation should be designed to assist each type of learner.

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views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

[ii] The names of the participants are replaced by fictitious names in order to guarantee privacy of the participants.

Knowledge Construction for Science Jobs: Employing Network Analysis to Identify the Scaffold of Competencies

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Abstract

How can we optimize knowledge uptake by exploring knowledge networks (knowledge spaces)? Such an optimization can significantly affect the work-related skills of the labor force yielding a better match to the requirements of the jobs, since every occupation requires a different mix of knowledge, skills, and abilities.

In this paper, we identify critical competencies for a specific job family by analyzing the characteristics of the jobs-knowledge bipartite weighted network for the 48 jobs and the 33 knowledge domains comprising the "Life, Physical and Social Sciences" job family of the O*NET (Occupational Information Network) database, USA's primary source of occupational information.

We calculate centrality measures (degree centrality, betweenness centrality, eigenvector centrality) of the knowledge domains in this job-knowledge network, in order to identify the critical knowledge domains (according to the O*NET typology). Knowledge domains rankings are compared and explained. For example, using a degree centrality measure, English language, mathematics, computers and electronics, education and training, customer and personal service, administration and management, law and government, clerical, biology and communications and media, comprise the top-ten knowledge domains; only biology qualifies from science! This is due to the fact that knowledge domains such as communications and media, or clerical, appear consistently at the middle of each job's rankings (but not at the top).

On the other hand, using betweenness centrality (a measure considered to be important in characterizing "transport" in networks) and identifying nodes in the infinite incipient percolation cluster (a cluster of high betweenness centrality nodes, which can be interpreted as the "superhighways" of the network), English language, biology, customer and personal service, education and training, physics, chemistry and mathematics appear in top; a ranking, which closely conforms onto a typical school education or university's knowledge domain structure (revealing however competencies not explicitly covered, such as customer and personal service).

Our findings can contribute to a better understanding of knowledge construction paradigms attuned to a) specific job families, b) what types of knowledge competencies are important and should be taught at the secondary, tertiary and life-long learning education levels, and c) help identify knowledge needs in the workplace, which are not covered by the "knowledge superhighways" and can be offered by e-learning.

Keywords: Knowledge building paradigms, knowledge networks, key competencies, network analysis, centrality measures

1. Introduction

There is a widespread belief that workers' skills and education are not adequate for the demands of jobs in the current economy (Handel 2003). Journalistic reports, employer surveys, popular and policy debates on school quality and education reform, sociological writings on the economy, and economic accounts of the recent growth of wage inequality all suggest a mismatch between the skills workers possess and what jobs require, what economists call an imbalance between the supply of and demand for human capital. Many believe that the problems will become even more serious because the pace of change is accelerating and the workplace is becoming increasingly high tech, service-oriented, and reorganized to involve greater employee participation in the workplace (Bresnahan et al 2002; see also Smith 1997).

In this paper, we investigate the characteristics of a specific job-knowledge network (knowledge space) with the objective to improve the uptake of knowledge toward the requirements of science jobs. In particular, we identify critical knowledge competencies by calculating centrality measures [degree centrality, betweenness centrality, and eigenvector centrality of the knowledge nodes (domains)] of the bipartite weighted network for the 48 jobs and the 33 knowledge domains comprising the "Life, Physical and Social Sciences" job family of the O*NET (Occupational Information Network) database, USA's primary source of occupational information.

The paper is organized as follows. Section 2 presents the O*NET database and the particular dataset we have used. Section 3 presents the methodological approach, provides the definitions of the different centrality measures of the network nodes. In Section 4, results are presented. Finally, Section 5 ends the paper with discussion and conclusions.

2. The O*NET Database

The Occupational Information Network (O*NET) database contains information on standardized and occupation-specific descriptors, and is continually updated by surveying a broad range of workers from each occupation. Based on the Standard Occupational Classification (SOC), the O*NET-SOC taxonomy includes 812 occupations which currently have, or are scheduled to have, data collected from job incumbents or occupation experts. The most recent O*NET-SOC 2006 taxonomy includes 949 occupational titles, 812 of which represent data-level occupations. The O*NET Program is collecting and disseminating updated data for the 812 data-level occupations. Data are gathered on approximately 200 occupations each year, with the goal of replenishing the database every five years.

The O*NET jobs-knowledge network is a weighted bipartite network. A bipartite network has two kinds of nodes, say, J (denoted as such for jobs) and K (denoted as such for knowledge), in which there are only links between two nodes of different kinds. Table 1 presents the weights of the links between knowledge domains and selected jobs from the O*NET "Life, Physical, and Social Science" job family. For

each job, the workers surveyed have graded the 33 knowledge domains with respect to the requirements of their particular job.

Table 1: Weights of the links between Knowledge and selected Jobs comprising the O*NET "Life, Physical, and Social Science" Job Family

JOBS / KNOWLEDGE	Anthropologists	Archeologists	Astronomers	Atmospheric and Space Scientists	Biologists
Administration and Management	51	56	30	26	53
Biology	46	38	15	7	98
Building and Construction	9	20	4	3	30
Chemistry	14	27	48	20	63
Clerical	55	54	15	32	55
Communications and Media	60	49	31	60	48
Computers and Electronics	46	47	74	76	61
Customer and Personal Service	48	26	12	80	60
Design	14	35	26	10	36
Economics and Accounting	29	29	9	8	18
Education and Training	75	60	52	57	52
Engineering and Technology	10	16	60	22	55
English Language	90	86	80	81	62
Fine Arts	28	18	2	3	0
Food Production	18	5	0	2	1
Foreign Language	74	44	20	8	8
Geography	65	76	16	84	56
History and Archeology	84	99	8	13	26
Law and Government	55	49	11	24	77
Mathematics	57	57	95	78	57
Mechanical	9	24	23	4	36
Medicine and Dentistry	32	15	1	3	30
Personnel and Human Resources	44	40	19	22	24
Philosophy and Theology	65	45	10	4	6
Physics	6	18	99	82	47
Production and Processing	22	12	6	34	13
Psychology	69	23	9	17	28
Public Safety and Security	26	26	9	33	59
Sales and Marketing	22	17	11	18	12
Sociology and Anthropology	98	97	6	12	1
Telecommunications	21	14	24	41	23
Therapy and Counseling	25	6	3	6	6
Transportation	19	24	7	16	35

3. Methodological approach

3.1 Network Centrality Measures

In large complex networks, not all nodes are equivalent (Barabasi 2002; Strogatz 2001). Centrality measures address the question, "Which is the most important or central node in this network?" The simplest of centrality measures is the *degree centrality*, also called simply *degree*. The degree of a node in a network is the number of links attached to it. However, degree centrality is a local quantity, which does not inform about the overall importance of the node in the network. A more sophisticated centrality measure is the *eigenvector centrality*. Where degree centrality gives a simple count of the number of links a node has, the eigenvector centrality accords each node a centrality that depends both on the number as well as the quality of its links (that is, the centrality of the nodes with which it is connected).

However, in terms of transport (that is, paths in a network), a good measure of the centrality of a node has to incorporate more global information such as its role played in the existence of paths between any two given nodes in the network. The *betweenness centrality* (BC) is the number of times a node is used by the set of all shortest paths between all pairs of nodes (Barthelemy 2004). High values of the betweenness centrality indicate that a node can reach others on short paths. If one removes a node with large centrality it will lengthen the paths between many pairs of nodes. For simplicity we call the "betweenness centrality" here "centrality". and we use the notation "nodes" but similar results have been obtained for links. This centrality measure, BC, quantifies the "importance" of a node for transport in the network. Identifying the nodes with high BC enables to improve their transport capacity and thus improve the global transport in the network.

3.2 Identifying high centrality nodes (the knowledge "superhighways")

Transport in weighted networks is dominated by the minimum spanning tree (MST), the tree connecting all nodes with the minimum total weight. The MST can be partitioned into two distinct components, having significantly different transport properties, characterized by betweenness centrality. One component, the "superhighways", is the *infinite incipient percolation cluster* (IIC), for which nodes with high betwenness centrality dominate (Wu et al, 2006). For the other component, that is "roads", which includes the remaining nodes, low centrality nodes dominate. The distribution of the centrality for the infinite incipient percolation cluster satisfies a power law, with an exponent smaller than that for the entire MST; the global transport can be enhanced significantly by improving the small fraction of the network, the superhighways.

To identify the IIC of the network, we start with the fully connected network and remove links in ascending order of their weights. After each removal of a link, we calculate

$$\kappa \equiv \langle k^2 \rangle / \langle k \rangle,$$

(where <k> is the average degree –that is, the average number of links- and $<k^2>$ is the average squared degree), which decreases with link removals. When $\kappa < 2$, we stop the process because at this point, the largest remaining component is the IIC (Wu et al, 2006), the knowledge nodes, which comprise the "superhighways" in the network.

4. Results

The second column of Table 2 presents the rank of the knowledge domains with respect to the total sum of weights, for the entire O*NET "Life, Physical, and Social Science Job Family". This is the "view from the workplace". As can be seen, the top 10 ranked knowledge domains are: English Language; Mathematics; Computers and Electronics; Education and Training; Customer and Personal Service; Administration and Management; Law and Government; Clerical; Biology; Communications and Media. Only Biology represents the "sciences" in this top-10 rank.

Such a rank seems to provide support to the widespread belief that workers' education is not adequate for the demands of jobs in the current economy (journalistic reports, employer surveys, popular and policy debates on school quality and education reform, all seem to suggest a mismatch between the skills workers possess and what jobs require, what economists call an imbalance between the supply of and demand for human capital). For example, it seems that universities do not adequately supply the "right" knowledge to the scientists at the workplace.

However, this is not actually true. The higher rank of "non-scientific" knowledge domains such as communications and media, or clerical, is due to the fact that they appear consistently at the middle of each job's rankings (*but not at the top*). The "pure scientific" point of view emerges when we calculate the centrality of the knowledge domains (nodes) in the network and identify the IIC, that is, the "knowledge superhighways" in the network.

The third, fourth, fifth, sixth and seventh columns of Table 2 present the total sum of weights for each knowledge domain but in ascending order of the weights. For example, the third column presents the total sum of weights above 50 (W>49) [that is, after removing links with weights with values less than 49]. The subsequent columns present the remaining sum of weights after removing, successively, weights with values less than 59, 69, 79, and 87, respectively.

As can be seen in Table 2, as weights are removed in ascending order, the rank of the knowledge domains changes. "Pure scientific" knowledge domains appear more prominent; their centrality changes. To manifest this effect more clearly, we calculate centrality measures (degree centrality, betweenness centrality, eigenvector centrality) of the knowledge nodes in this job-knowledge network, in order to identify the critical knowledge domains (according to the O*NET typology).

Table 3 presents the values of the degree centrality, the betweeness centrality and eigenvector centrality, of the knowledge nodes, for the W>79 case. As can be seen, the rank of "pure scientific" knowledge domains become prominent. Biology, physics and psychology enter the top-10 rank (which consists of only 8 non-zero values in the betweenness centrality measure).

The important question now becomes which ascending order of the weights to choose in order to calculate the "true" centralities. The answer to this question is provided by identifying the IIC of the network, a process which starts with the fully connected network, removing links in ascending order of their weights, and, after each removal of a link, calculating the quantity $\kappa \equiv \langle k^2 \rangle / \langle k \rangle$, which decreases with link removals. When $\kappa < 2$, we stop the process because at this point, the largest remaining component is the IIC, the knowledge nodes, which comprise the "superhighways" in the network.

Research findings from a companion paper (Neofotistos, 2007) on the identification of the IIC for the same O*NET jobs-knowledge network has demonstrated that W>87 provides the tipping point and, for this case, knowledge competencies comprising the "superhighways" of the jobs-knowledge network are: a) English language, b) "pure sciences" such as biology, chemistry, physics, geography, history and archeology, psychology, sociology and anthropology, and c) "general competencies" such as administration and management, customer and personal service, education and training, mathematics, law and government, personnel and human resources, and therapy and counseling.

The above-mentioned knowledge competencies comprise a cluster of high betweenness centrality nodes, which can be interpreted as the "superhighways" of the jobs-knowledge network, which closely conform onto a school-education and university's knowledge-domain structure (revealing however competencies not explicitly covered, such as customer and personal service).

5. Discussion

Our findings can contribute to better understanding of knowledge construction paradigms attuned to specific job families, b) key knowledge competencies (knowledge "superhighways"), which should be focused upon at the secondary, tertiary and life-long learning education levels (English language, "pure sciences", general competencies) and c) knowledge competencies, which can be interpreted as "roads" leading to the specific (life, physical and social science) jobs. Our methodological approach can systematically monitor the "coupling" between education systems and the evolution in the workplace (whether -and how- workers' skills and education are, or are not, adequate for the demands of jobs in the current economy, a problem which many believe will become even more serious because the pace of change is accelerating and the workplace is becoming increasingly high tech, service-oriented, and reorganized to involve greater employee participation).

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Table 2: Knowledge categories' total sum of weights and ascending order of weights, for the Jobs-Knowledge network of the O*NET "Life, Physical, and Social Science" Job Family

KNOWLEDGE	TOTAL SUM OF WEIGHTS	W>49	W>59	W>69	W>79	W>87
Administration and Management	2372	1239	697	246	176	94
Biology	1931	1262	1103	830	610	280
Building and Construction	822	247	137	0	0	0
Chemistry	1862	1304	1027	636	190	190
Clerical	2068	922	331	70	0	0
Communications and Media	1912	719	395	74	0	0
Computers and Electronics	2471	1635	808	295	0	0
Customer and Personal Service	2383	1686	1264	627	262	182
Design	1278	323	156	156	80	0
Economics and Accounting	1134	246	86	86	86	0
Education and Training	2436	1502	1057	540	173	88
Engineering and Technology	1692	813	487	301	0	0
English Language	3424	3291	3183	2537	1429	268
Fine Arts	254	0	0	0	0	0
Food Production	636	377	216	153	81	0
Foreign Language	763	74	74	74	0	0
Geography	1798	1250	928	549	182	98
History and Archeology	1186	514	457	327	183	99
Law and Government	2146	1302	872	615	174	94
Mathematics	2909	2518	1691	1229	341	95
Mechanical	1192	277	62	0	0	0
Medicine and Dentistry	874	274	221	221	0	0
Personnel and Human Resources	1532	206	155	95	95	95
Philosophy and Theology	924	234	126	0	0	0
Physics	1587	894	586	586	363	199
Production and Processing	1254	310	202	79	0	0
Psychology	1715	786	627	438	291	291
Public Safety and Security	1662	544	275	77	0	0
Sales and Marketing	1147	249	137	73	0	0
Sociology and Anthropology	1457	842	576	514	295	295
Telecommunications	991	0	0	0	0	0
Therapy and Counseling	732	297	297	297	297	297
Transportation	957	52	0	0	0	0

Table 3: Centrality measures for W>79

Degree Centrality Measure (W>79)		
RANK	KNOWLEDGE	Degree
1	English Language	0,43750
2	Customer and Personal Service	0,25000
3	Education and Training	0,18750
4	Psychology	0,18750
5	Administration and Management	0,15625
6	Personnel and Human Resources	0,15625
7	Biology	0,12500
8	Physics	0,12500
9	Geography	0,09375
10	Mathematics	0,09375
11	Therapy and Counseling	0,09375
12	Economics and Accounting	0,06250
13	History and Archeology	0,06250
14	Sociology and Anthropology	0,06250
15	Design	0,03125
16	Food Production	0,03125
17	Law and Government	0,03125
18	Building and Construction	0,00000
19	Chemistry	0,00000
20	Clerical	0,00000
21	Communications and Media	0,00000
22	Computers and Electronics	0,00000
23	Engineering and Technology	0,00000
24	Fine Arts	0,00000
25	Foreign Language	0,00000
26	Mechanical	0,00000
27	Medicine and Dentistry	0,00000
28	Philosophy and Theology	0,00000
29	Production and Processing	0,00000
30	28. Public Safety and Security	0,00000
31	29. Sales and Marketing	0,00000
32	31. Telecommunications	0,00000
33	33. Transportation	0,00000

Betweenness Centrality Measure (W>79)		
RANK	KNOWLEDGE	Betweenness
1	English Language	0,16028
2	Biology	0,05847
3	Customer and Personal Service	0,02621
4	Education and Training	0,00202
5	Physics	0,00202
6	Psychology	0,00202
7	Mathematics	0,00101
8	Administration and Management	0
9	Building and Construction	0
10	Chemistry	0
11	Clerical	0
12	Communications and Media	0
13	Computers and Electronics	0
14	Design	0
15	Economics and Accounting	0
16	Engineering and Technology	0
17	Fine Arts	0
18	Food Production	0
19	Foreign Language	0
20	Geography	0
21	History and Archeology	0
22	Law and Government	0
23	Mechanical	0
24	Medicine and Dentistry	0
25	Personnel and Human Resources	0
26	Philosophy and Theology	0
27	Production and Processing	0
28	Public Safety and Security	0
29	Sales and Marketing	0
30	Sociology and Anthropology	0
31	Telecommunications	0
32	Therapy and Counseling	0
33	Transportation	0

Eigenvector Centrality Measure (W>79)		
RANK	KNOWLEDGE	Eigenvector
1	English Language	0,4883
2	Customer and Personal Service	0,3872
3	Education and Training	0,3390
4	Psychology	0,3390
5	Administration and Management	0,3111
6	Personnel and Human Resources	0,3111
7	Physics	0,1980
8	Therapy and Counseling	0,1946
9	Geography	0,1791
10	Biology	0,1547
11	Mathematics	0,1318
12	Economics and Accounting	0,1035
13	History and Archeology	0,0978
14	Sociology and Anthropology	0,0978
15	Law and Government	0,0815
16	Design	0,0258
17	Food Production	0,0258
18	Building and Construction	0,0000
19	Chemistry	0,0000
20	Clerical	0,0000
21	Communications and Media	0,0000
22	Computers and Electronics	0,0000
23	Engineering and Technology	0,0000
24	Fine Arts	0,0000
25	Foreign Language	0,0000
26	Mechanical	0,0000
27	Medicine and Dentistry	0,0000
28	Philosophy and Theology	0,0000
29	Production and Processing	0,0000
30	Public Safety and Security	0,0000
31	Sales and Marketing	0,0000
32	Telecommunications	0,0000
33	Transportation	0,0000

Monitoring and Analyzing collaboration in e-learning environment: two case studies applied to vocational training

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1. Theoretical Background

Nowadays, the three key concepts that could best depict e-learning are the following: *learning objects*, *web groups* (or *web communities*) and *social networks*. We can conceive learning objects and web groups/communities as elements characterizing e-learning 1.0, while the social networks are more informal environments typical of e-learning 2.0. These three different key aspects are also representative of different ways of conceiving knowledge transmission and construction in e-learning environments. In everyday discussions, and often improperly, the concept of e-learning (*electronic-learning*) involves multiple aspects of distance education, which range from content selection to the organization and coordination of specific on-line courses. On the one hand, e-learning may be identified principally with forms of learning and training which are essentially based on interactions between group or community members. Learning processes that lie behind this mode of conceiving e-learning found their theoretical references on socioconstructivism (Doise & Mugny, 1997) and sociocultural approach to human cognitive development inspired by Vygotskij. From this point of view, individual cognitive development is conceived as a result of social interaction in which:

- the support and the sustain of either adult or expert peer/partner is determinant;
- there is the possibility of a simultaneous presence of different points of view, and the consequent necessity of a negotiation of common meanings or objects (i.e., the notion of *sociocognitive conflict*; Doise, Mugny, & Perret-Clermont, 1974; Carugati & Gilly, 1993).

In this paradigm we can insert also the social networking, one of the emergent phenomena of the Web 2.0. The essential characteristic of a social networking system is the definition of the personal relational sphere. User has to act for selecting personal contacts, for constructing the personal area and for defining which persons can access in it (usually a *blog*). Further, user can create his personal interest discussion groups and decide which persons can participate in it. Finally, user can also choose the level of the interaction: private one-to-one interaction (only the receiver reads messages), personal interaction (the message is sent to the receiver but it is public), interaction with the groups of personal contacts or interaction with the entire network.

On the other hand, e-learning is also conceived as a mere online transposition of typical educational models of face-to-face classes. According to this approach, learning is conceived as a simple content supply. Therefore, the "e" component (electronic) refers only to the content in terms of design, supply and fruition. This is the case of learning objects, by which one tends "to break educational content down into small chunks that can be reused in various learning environments, in the spirit of object-oriented programming" (Wiley, 2000, p. 7). Thus, content selection, construction and organization by educators, and content supply by web artefacts, become the very critical phases for learning processes.

2. From Individual to Collective Actions

In this contribution, the interest for the two conceptions of e-learning is connected to the monitoring of on-line actions performed by people involved in on-line courses. When we refer to actions, we consider the perspective of Leont'ev (1978) about human activity, in which activity is seen as always collective and sustained by some social motive or necessity. Each human activity is constituted by individual actions, achieved by individual or groups and directed to specific goals (fig. 1). Each action consists of operations, i.e. automatic acts without a voluntary control performed by the individual in the execution of some action (e.g., the mouse control performed by an expert user). Since actions could be performed by a single person (e.g., the student's utilization of the resources proposed by the teacher in web platform), but also by a group (e.g., the discussions in a web forum), we can consider actions as individual (a student interacts with web artefacts for downloading/reading/learning contents, e.g., a web platform,) or as collective (a student interacts with other students through web artefacts, e.g., a web forum).

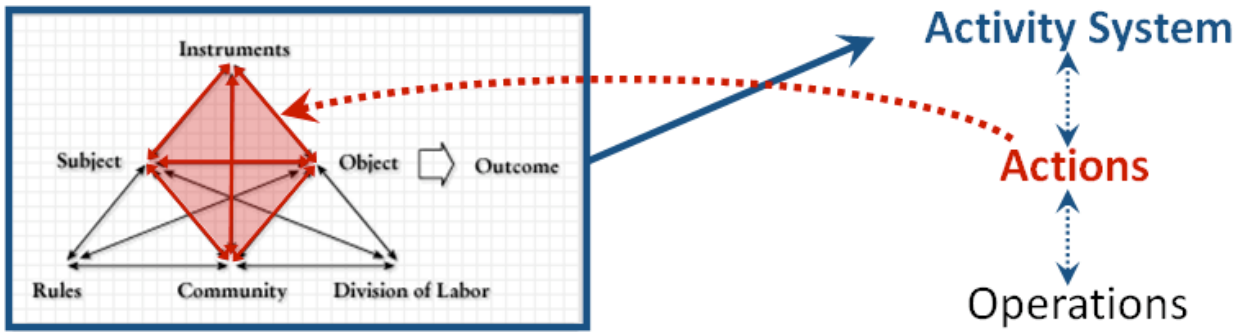

Figure 1: Activity system representation from the web site of the Centre for Activity Theory and Developmental Work Research (http://www.edu.helsinki.fi/activity/)

In all of these cases, actions related to the student's activity may be considered in terms of competence acquisition; in fact, actions involve the use of web artefacts for knowledge acquisition (individual actions), and the manage of on-line interactions with others for collective knowledge, sharing and construction (collective actions). If we consider the importance of competences and learning outcomes both at university level (e.g., Dublin Descriptors), and at vocational level (e.g., the Lifelong Learning Programme 2007-2013 launched by the European Union, in which web technologies are seen as one of the key tools for achieving the objectives of the programme - Pépin, 2007), we may easily realize that this issue is crucial not only in the field of academic research, but also in the field of European policies.
Starting from these considerations, how can we monitor students' on-line action in e-learning environments?

3. From Web Tracking to Social Network Analysis

A quantitative technique for data collection about "what user do" in an on-line environment is the *web tracking* (Calvani, Fini, Bonaiuti, & Mazzoni, 2005; Mazzoni, 2006; Proctor & Vu, 2006). Through web tracking it is possible to collect a number of data about the frequency of visits and time spent on web pages during the surfing on web artefacts (e.g., web site or web platforms). This data

collection technique is a feature that characterizes almost all of the existing web platforms, and it is also provided by the Italian legislative decree concerning Distance University as means for monitoring and evaluating students' on-line activities. If, on the one hand, we can consider web tracking as a good technique for collecting data about individual actions, i.e., about the frequentation and the usage of web contents by students (e.g., learning objects, documents, hypertexts, etc.), we cannot affirm the same as far as the application of this technique to web communities or social networks is concerned. Of course, web tracking allows us to collect data on interactions between students, which may consist, e.g., of sent or received messages or replies. However, these data refer to individual level (how many messages a student has sent, received, etc.) and do not provide any indication about addressees. Relational aspects, therefore, are not taken into consideration by web tracking. Nevertheless, this information is available. In other words, web tracking may be employed also in order to collect data about to whom a message/reply is sent, and about the identity of the receiver of a given message/reply (the so called relational data), but these data are normally used only for summing and displaying the quantity of messages sent and received by single students.

Now, if we consider web groups or web communities in e-learning environment, we have to consider that the final outcome of a collective activity does not derive from simple individual actions, but principally from collective actions performed by the group/community. In this case we consider individual actions as separated from collective actions, and we have to take into account that group performance does not derive from a sum of individual actions, but rather from indicators that allow us to map the collective actions of a group/community.

As previously outlined, relational data of web group/community could be collected by web tracking; this possibility, besides facilitating the application of quantitative analysis, allows to construct the adjacency matrix of relational data for applying the *Social Network Analysis* (SNA) to group exchanges. Starting from the transposition of relational data in a matrix, SNA allows, on the one hand, to graphically represent the network of relations by sociograms and, on the other hand, to transform this network in concepts for describing the communicative structure of the network. Now, a very interesting aspect is that we can develop an analysis considering two levels, i.e., by focusing on the single members and their relations in the network (*ego-centred analysis*) or by focusing on the network and its structural characteristics (*whole network* or *full network analysis*). Obviously, these two aspects are related. This means that for each whole network structural indexes we have also specific individual measures. E.g., the density of a network, i.e., "the proportion of possible lines that are actually present in the graph" (Wasserman & Faust, 1994, p. 101) or more simply the percentage of aggregation of its members, derives from the degree of each member, i.e., the totality of direct contacts he/she has activated or received by others. Considering the centralization, i.e., the dependence of a network from its "most important" actors, we have, together with this whole index, also the centrality index of each member, i.e., his/her importance/prominence for the communicative structure. Thus, these related networks and individual measures allow us to perform map description of collective actions of a community. On the one hand, we can monitor and depict the role and function of each member in the community knowledge exchange (e.g., wideness and aggregation of his/her neighbourhood or direct contacts, central or peripheral role in information exchanges/transmission, participation in subgroups, etc.); on the other hand, we can monitor the group/community while considering the aggregation of the communicative structure, the reciprocity in discussions, the number and density of possible subgroups, etc..

4. Web Tracking, SNA and Web artefacts for online communication: some critical issues

Compared with classical analysis models based on the characteristics of single subjects, like those coming from web tracking collection, the SNA focuses attention on relational data such as links, contacts or ties between a group of people or organizations such as family, associations, societies, nations etc.. Application of the SNA starts with the creation of an *adjacency matrix* (e.g., with contacts, connections or exchanges within a particular social network or a web forum). The relational interaction network data is presented in the resulting adjacency matrix where each line corresponds to the sender of a message and each column to the recipient. The interaction box between sender and receiver shows the number of messages exchanged, or the existence (1) or absence (0) of a contact (fig. 2).

		Receivers					
		Stud1	*Stud2*	*Stud3*	*Stud4*	*Stud5*	*Stud6*
Senders	Stud1	0.0	0.0	3.0	4.0	0.0	0.0
	Stud2	0.0	0.0	2.0	0.0	0.0	0.0
	Stud3	3.0	4.0	0.0	0.0	0.0	0.0
	Stud4	2.0	0.0	3.0	0.0	0.0	0.0
	Stud5	0.0	0.0	0.0	0.0	0.0	0.0
	Stud6	1.0	3.0	2.0	2.0	0.0	0.0

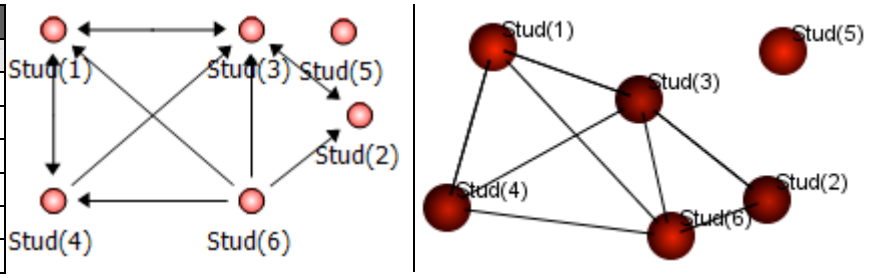

Figure 2: Adjacency matrix of students' exchanges between a web forum and bidimensional and tridimensional sociogram representation elaborated with Cyram NetMiner 3 (2007).

Despite the apparent simplicity, creating an adjacency matrix is strongly influenced by the type of communication found in the web artefact used. The first important aspect to consider in creating an adjacency matrix is a correct understanding of the terms *sender>recipient*. In the case of an e-mail, it is not difficult to identify the sender/receiver, as well as the contents of the message, for whom it is explicitly intended and, therefore, the connection between a reply and the message it refers to. It's the same with social networks personal communications and contacts, in which there is an explicit definition by the sender of the receivers of messages or contacts. This is more complicated when considering the adjacency matrix referring to web forum exchanges which have the essential characteristic of sharing information, contents and resources between participants, with the aim of reaching a common objective. Many important consequences arise regarding the definition of sender/receiver. Above all, gathering relational data to create an adjacency matrix in relation to web forum exchanges can be carried out in two principal ways:

- tracking the web data in its specific data base, e.g. *a log file*;
- based on a content analysis, which allows recipients of web forum messages to be identified.

As far as web tracking is concerned, the correct identification of senders/receivers must take into consideration two important factors in the creation of an adjacency matrix: 1) the opening messages in a discussion are not tracked as they do not have a specific receiver, but are posted to a common area; 2) the display interface of messages posted on a web forum influences the way data is tracked. As web forums are based on the idea of sharing and collaboration within the group or community, therefore, unlike e-mails or personal messages and contacts on social networks, these messages do not explicitly identify a receiver but are posted to the entire group or community.

Although it is possible to track the data regarding the display of a message on the screen, a correct understanding of it depends on the type of display interface used by the web forum. Two different interfaces are considered:

- SI (*Sequential Interface* of messages),
- DDI (*Deep Discussion* Interface).

The SI web forum makes it impossible to identify which messages a user has read as he/she clicks only on the discussion for opening all the messages and not on the single messages for seeing it. In the DDI web forum, on the other hand, the user has to click on the message to display it, thus facilitating the creation of an adjacency matrix on the basis of messages read. The user is also well aware that the reply command refers only to that message and the answer is linked to it. As can be seen, a rather critical picture emerges regarding the use of relational data from web tracking to create an adjacency matrix and apply it to the Social Network Analysis. Despite the criticisms outlined, the adjacency matrix built on the DDI basis of reading messages is a reasonably efficient way to represent the network of information and contents created within a web group/community.

Alternatively, the researcher can always base his/her research on an analysis of the message contents. Compared with tracking, the analysis of message contents allows a much more precise definition of sender, and above all receiver. As outlined above, the SI web forum often has single messages or replies which in reality have more receivers than the one who is automatically linked to the message through tracking. The content analysis allows creating an adjacency matrix starting with the sender and therefore re-establishes the correct direction of the interaction, i.e. sender>receiver. A content analysis also makes it possible to differentiate between the types of message content and therefore to create adjacency matrixes with multiple factors regarding the information and content networks activated (e.g. social support, help requests, information, awareness building etc.).

Despite these positive aspects of content analyses, it should be borne in mind that this type of analysis cannot give information about who has opened and read a message since it is taken almost for granted that the message has influenced only those who have answered it, while at the core of web forums are the presuppositions of total sharing and collaboration. Therefore, even the simple reading of a message can have a profound influence on the reader, albeit in a latent manner, and on any of his/her subsequent postings. Therefore the reading of messages appears to have a bearing on understanding how information and content is propagated within the group/community/network considered.

5. A model for monitoring on-line activities

In order to illustrate how web tracking data and SNA indexes may be utilized, we proposed a model for monitoring and analyzing on-line activities used during three blended-learning experiences (two groups of teachers in vocational training and one group of university students). This model permits to represent individual and groups profiles based on both individual (coming from web tracking indicators) and collective (SNA indexes) actions.

The first step of our model is the data collection by web tracking. These data have been elaborated for having indicators that are not simple frequencies, but measures of individual's actions in web environment. The second step is the application of Social Network Analysis (SNA) to web interactions carried out on collective discussions in web environments. The model we propose is constructed considering both types of indicators. Web tracking data are considered indicators of individual actions, while the SNA indices concern two levels: collective indices of the activities carried out by groups but also individual indices about the role members play in collective e-Learning activities.

The model consists of 5 areas of actions: 3 areas of individual actions, collected by web tracking (platform use; loquacity; participation to discussions) and 2 areas of collective actions collected by SNA (role in group collaboration; dealing with group).

INDIVIDUAL ACTIONS

Platform use
- Sum of content visits
- % of contents visited
- Sum of visits to web forum discussions

Web Loquacity
MLU - Mean Length of utterances (elaboration of web tracking data concerning messages)

Participation to online discussions
- N. of started discussions
- N. o sent messages
- N. of received messages

COLLECTIVE ACTIONS

Group collaboration
- Information centrality/centralization
- Betweenness centrality/centralization
- Eigenvector centrality/centralization

Dealing with group
- N. of contact activated
- N. of contact received
- Ego-network density
- Cohesion: Participation to cliques

All web tracking indicators and SNA indexes have been elaborated so that we could obtain a graph for each participant, which describes his/her actual performance levels in each area in relation to the maximum performance level attained by his/her group. The same may be done for the entire group, in order to obtain a graph displaying the average performance of participants in each area in relation to the maximum performance level attainable by the group (fig. 3).

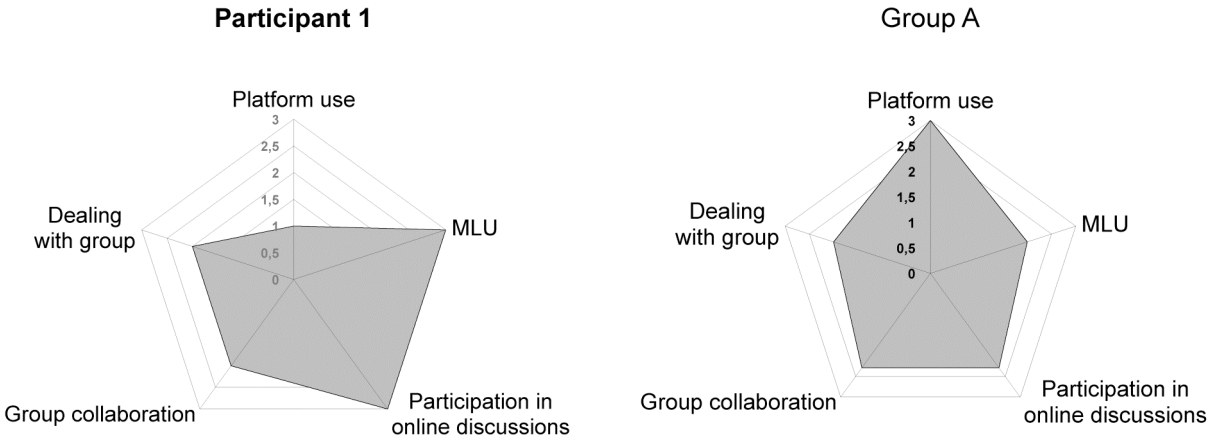

Figure 3: An example of performance attained by a participant and by his/her group.

By collecting and analyzing data longitudinally, e.g., every month for the during of a web courses, this model allow us to monitor and describe the evolution of the student's/group's performance in a determined period within his/her Zone of Proximal Development (Vygotskij, 1978).

In summary, this model allows us to take into consideration and represent not only the individual actions a student performs within an e-learning environment, in order to interact with contents, but also the collective actions he/she accomplishes for interacting with his/her colleagues during on-line group collaboration. Further, as we show in figure 3, we can use this model for representing group performances, and thus for comparing different groups involved in virtual learning environment characterized by collaborative activities. Finally, with this model it's possible to monitor and analyze the evolution of student's/group's performance during the period of a specific e-learning courses.

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Interaction humaine et e-learning en contextes universitaires

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Résumé

A partir d'une réflexion sur l'introduction des technologies de l'information et de la communication dans une situation d'apprentissage, la question à la fois de l'importance du recours à l'interaction et à la médiation humaine ainsi que l'identification des types d'usages en jeu dans des situations de formation en ligne apparaît. Notre préoccupation est la prise en compte des processus sociaux de communication entre les apprenants susceptibles de les aider à surmonter les obstacles aussi bien techniques que de compréhension et de maîtrise des contenus.

Mots-clés: TIC, TICE, e-learning, interaction, médiation humaine

1. Des TIC…

Les Technologies de l'Information et de la Communication (TIC) sont couramment définies comme des techniques capables de saisir, de stocker et de communiquer l'information. Cependant cette approche fonctionnelle mérite d'être élargie pour atteindre un second niveau de définition : les TIC sont des dispositifs techniques rendant possible l'échange, l'interprétation, la production de connaissances dans la société (Jeanneret, 2000). Il s'agit en fait, d'ensembles hybrides d'outils, de services et de fonctions capables d'apporter une plus value informationnelle aux usagers.

Les TIC ne prennent pleinement sens que dans un processus de communication médiatisée et dans l'articulation avec un tissu social complexe. « *Il faut redonner aux dispositifs techniques leur épaisseur, ce qui en fait des médiateurs et non de simples instruments ou encore, pour reprendre les termes de Simondon, ce qui en eux-mêmes peut être décrit comme un mixte stable d'humain et de naturel, de social et de matériel ; il faut montrer comment se constituent conjointement les techniques et leur environnement social et naturel […]* » (Akrich, 1993).

Josiane Joüet parle à leur sujet de « double médiation » en précisant qu'elle « *est à la fois technique car l'outil utilisé structure la pratique mais la médiation est aussi sociale car les mobiles, les formes d'usages et le sens accordé à la pratique se ressourcent dans le corps social* » (Jouët, in Beaud et alii, 1997). Ainsi, la sphère technique et la sphère sociale se trouvent-elles en interactions et interrelations permanentes. On peut donc, à la suite de Bernard Miège, accepter que « *l'avancée - incontestable - des Tic procède moins de sauts, de ruptures et d'innovations que de la poursuite de procès complexes et engagés de longue date* » (Miège, 2007).

Les travaux de Patrice Flichy ont montré qu'il existe de multiples manières pour les groupes sociaux de s'approprier une innovation dont l'origine peut être technique. L'auteur prône une

anthropologie de la technique qui envisage la combinaison entre « cadre technique » et « cadre de fonctionnement ». Cela aboutit à la constitution d'un nouveau cadre socio-technique qui, loin d'éluder l'importance de l'imaginaire, inclut les représentations des outils techniques et de leurs usages tant chez les concepteurs que dans le public. Par voie de conséquence, la dynamique du changement ne peut que s'inscrire dans la durée : *« une innovation devient stable à l'issue d'un processus long, lorsqu'il y a alliance entre le cadre de fonctionnement et le cadre d'usage »* (Flichy, 1995).

2. … aux TICE et au e-learning

Les TICE (technologies de l'information et de la communication pour l'éducation) peuvent être considérées comme « *toute application informatique, participant au fonctionnement d'une formation, et à la transmission et à la mise en commun des connaissances.* » Cela inclut « *les services et applications informatiques utilisant la technologie du réseau internet à des fins d'enseignement* » ainsi que les « *dispositifs intégrés (dits plateformes, environnement pédagogiques) disponibles à partir de serveurs* » donnant par exemple accès à des applications de type visioconférences, audioconférences, chat, production, édition et stockage d'informations pédagogiques et bien sûr courrier électronique (Bouillon, Bourdin, 2005).

Le *eLearning*[1] se définit comme *« l'utilisation des nouvelles technologies multimédias et de l'Internet, pour améliorer la qualité de l'apprentissage en facilitant l'accès à des ressources et des services, ainsi que des échanges et la collaboration à distance »* (Commission des Communautés Européennes, 2001). Le e-learning serait donc perçu comme un facteur qui favorise et améliore l'apprentissage et non pas comme un dispositif qui se substitue à l'existant. Dans ce contexte, c'est bien la dimension collaborative qui est essentielle. Nous reconnaissons que l'objectif serait de se former à distance, de manière individualisée, flexible, personnalisée, mais en rompant l'isolement dans un travail en réseau avec d'autres : enseignants, formateurs, tuteurs et pairs.

3. Dimension coopérative et interaction humaine

La dimension coopérative, voire collaborative représente en effet l'un des aspects clés d'une réorganisation des activités autour des techniques numériques en réseau. « *Les technologies de l'information et de la communication permettent aujourd'hui d'instrumenter cette activité collective, que celle-ci repose sur des échanges et coordinations d'individus à distance ou en présentiel* » (Peyrelong et Follet, 2006). Or, de nombreuses études menées[2] ont montré la difficulté à s'appuyer sur une panoplie d'outils pour co-construire une « intelligence collective ». Si la dimension « synchronisation des tâches et temporalités » sous-tendue par l'axe coordination s'opère généralement assez bien, il n'en est pas de même pour le travail collaboratif, visant une production négociée, progressive et collective autour d'un projet. On voit bien apparaître ici ce processus d'ajustements réciproques entre un microcosme social, une tâche à réaliser et une médiatisation qui s'opère notamment par le biais d'outils (avec leurs possibles et leurs limites).

Si une relative maîtrise en amont de l'instrumentation technique, mais aussi des stratégies informationnelles et communicationnelles paraît nécessaire voire indispensable en tant que pré-requis pour l'apprenant, ce n'est bien sûr pas suffisant. En l'occurrence, la médiation humaine incarnée par le rôle du tuteur / formateur permet de « socialiser » les outils

[1] eLearning est la notation retenue par la Commission Européenne, e-learning étant la notation habituelle que nous conservons

[2] On consultera par exemple http://ec.europa.eu/education/programmes/elearning/studies_en.html (consulté le 27.07.2008)

techniques, de contribuer à cette articulation entre cadre technique et cadre d'usage et in fine, d'accompagner le changement, notamment au plan des modalités de partage et de transfert des connaissances.

Les processus de mise en réseau des connaissances élaborent non seulement de nouvelles relations entre la production, la diffusion et l'appropriation des contenus éducatifs mais aussi de nouvelles modalités d'interaction et d'échanges entre tous les acteurs impliqués dans l'action d'apprentissage.

4. Le projet européen Minerva : présentation de la recherche

La participation de notre groupe de recherche au projet européen Minerva intitulé *Réseaux sociaux et promotion de la construction des connaissances en modalité e-learning* nous permet d'avoir une vision élargie des processus informationnels à l'œuvre et de dégager spécificités et convergences aux plans cognitif, psycho-sociologique et de résistance au changement.

Selon notre hypothèse, dans le contexte éducatif, les environnements numériques (forums, plateformes pédagogiques, environnements numériques de travail…) favorisent de nouvelles interactions entre enseignants et apprenants ainsi qu'entre apprenants et de ce fait améliorent les processus cognitifs d'assimilation de la connaissance, de la compréhension et de la mémorisation. Cela nous a amenés à formuler trois sous-hypothèses :

- Une bonne appropriation des TIC favorise l'autonomie des usagers et leur capacité d'apprentissage.

- Par conséquent cette appropriation accroît l'efficacité des apprenants qui sont capables de réinvestir ces compétences dans leurs études et leurs activités professionnelles.

- Si les TIC peuvent s'avérer être un moyen très important d'acquérir la connaissance (notamment désormais avec le recours généralisé et banalisé à Internet), elles ne sont pas suffisantes et doivent être renforcées par l'interaction et la médiation humaine.

La méthodologie utilisée est celle du questionnaire, adressé à 19 responsables et enseignants engagés dans des dispositifs de mise à distance d'une formation repérés en France et en Belgique et ayant accepté de participer à notre étude exploratoire.

5. Principaux résultats issus de l'analyse

Parmi les principaux résultats issus de cette analyse, nous notons tout d'abord que les cours mis à distance couvrent différents domaines mais souvent autour de matières ou disciplines à forte dominante technologique (informatique, mathématiques, réseaux, téléphonie…). Les formations correspondantes (aussi bien formation initiale que formation continue) se déroulent dans des établissements d'enseignement supérieur : universités, écoles d'ingénieur, instituts universitaires technologiques. Différents contextes de mise en œuvre peuvent être identifiés : formation de type « présentiel enrichi », formation « tout à distance » ou formation « mixte ».

Le recours aux plateformes de formation à distance comme Claroline ou Moodle devient général mais sans exclure des environnements spécifiques (pour des certifications professionnelles par exemple) ou des environnements web (SPIP, Yahoogroups ou ContactOffice).

Les critères de choix de ces outils reposent sur : le travail de groupe, la facilité de mise en œuvre, le logiciel libre, la facilité d'utilisation, la disponibilité. Les fonctionnalités principales attendues et mises en jeu sont désormais classiques et comprennent : un espace de dépôt de

documents, un forum, un chat, le recours à de la vidéoconférence, le courrier électronique, les QCM en ligne mais aussi les blogs personnels et les messageries instantanées comme Skype ou MSN.

Ces outils sont donc largement utilisés par ces formations, parfois uniquement pour diffuser des contenus de type travaux d'étudiants ou des documents réalisés par les enseignants. Dans ce cas l'interaction entre les apprenants reste faible. Le nombre d'étudiants se situe autour de 20 principalement (même si certaines formations sont dispensées pour 50, 70, 100 étudiants voire plus). Quant aux groupes, ils sont constitués majoritairement par 3, 4 ou 5 étudiants.

Enfin la valeur ajoutée d'une médiation humaine dans l'utilisation d'une plateforme est jugée « très grande », « très importante », « déterminante », « incontournable », « essentielle », ou encore « indispensable » rappelant aussi que sans médiation humaine une plateforme ne reste qu'un outil.

Nous retrouvons également dans les résultats de l'enquête le fait que les outils prescrits ne sont pas toujours les seuls utilisés par les apprenants. En effet, ces derniers utilisent des dispositifs parallèles (messageries instantanées, messageries électroniques personnelles tout en délaissant les outils correspondants fournis dans les environnements numériques de formation) qui échappent au contrôle des enseignants, rendant ainsi plus difficile le suivi à travers les « traces » (ou logs de connexion) laissées sur les plateformes.

6. Conclusion

Notre recherche consiste à identifier les types d'usages en jeu dans des situations de formation en ligne impliquant des plateformes pédagogiques ou des forums de discussion ou tout autre environnement numérique à vocation pédagogique. Nous rappelons que notre préoccupation concerne principalement la prise en compte des processus sociaux de communication entre apprenants susceptibles de les aider à surmonter les obstacles aussi bien techniques que de compréhension et de maîtrise des contenus. A partir des résultats obtenus, un certain nombre de pratiques intéressantes sont identifiées comme une réorganisation régulière des groupes avec redistribution des tâches et désignation arbitraire des responsables des groupes. Mais une bonne définition du projet faite avec précision et ce dès le départ est tout aussi importante. Si les dispositifs technologiques en ligne semblent être de plus en plus mis en jeu, s'ils permettent de développer les échanges entre pairs et avec les enseignants, ils ne sont pas pour autant auto-suffisants et il n'en demeure pas moins que le recours à l'interaction et à la médiation humaine restent indispensables.

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eLearning : l'innovation pédagogique des enseignants qui utilisent une plate-forme numérique

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Résumé/ Abstract

Nous vous proposons un extrait de notre recherche qui s'est développée dans le courant de l'année 2007, sous l'égide des Professeurs M. Lebrun et M. Bonami, auprès d'un échantillon d'enseignants d'Universités et de Hautes Ecoles en Belgique francophone.
Notre abordons le concept d'innovation de manière générale pour ensuite l'orienter plus spécifiquement dans le cadre restrictif de l'innovation pédagogique chez les enseignants. Pour appréhender correctement les différentes composantes de notre travail, il faut préciser que nous développons d'emblée une orientation pédagogique de type socioconstructiviste. Nous mettons l'accent sur l'interactivité et la production de tous les acteurs qui interviennent dans l'acte « d'apprendre ». Nous terminons par une synthèse partielle de notre développement théorique corrélé à de la grille sociopédagogique de Marcel Lebrun au départ de la recherche ACOT. Nous concluons par une proposition de grille d'analyse de l'innovation pédagogique construite expressément pour nos travaux (APATD) sur base des recherches ciblées sur la professionnalisation de l'enseignant (S.O.T.L.).

Mots-clés : apprentissage, innovation, pédagogie, processus, professionnalisation.

1. Introduction

La littérature qui concerne le concept d'innovation est variée et aborde différents aspects tels que l'innovation liée à l'entreprise, au politique ou plus généralement aux découvertes scientifiques.
Dans le dictionnaire de l'Education de Legendre (2005), on peut y lire que l'innovation n'est pas une notion qui implique nécessairement un caractère intrinsèque de nouveauté et que, ce qui est nouveau dans l'innovation, ce n'est pas l'objet en question, son contenu, mais bien son introduction dans un milieu donné.
Pour F.Cros et G.Adamczewski (1996), l'innovation exploite toujours ce qui la précède : son « art » consiste à adapter puis à faire adopter des réalités inventées, découvertes ou créées antérieurement. L'innovateur fait figure de « passeur », de traducteur et de conquérant. Il peut y avoir quelques astuces supplémentaires, quelques arrangements ingénieux dans l'action innovante mais ce qui la caractérise c'est le fait « de faire autrement » pour aboutir à une amélioration de l'existant. Une innovation est une novation contextualisée par des objectifs pratiques, c'est l'art de l'utile.
Toutes les innovations sont des changements, mais tous les changements ne sont pas des innovations. Une innovation est un changement spécifique, original et délibéré.
C'est à partir de ces premiers éléments que nous tenterons de définir l'innovation chez les enseignants qui utilisent une plate-forme numérique dans leurs enseignements.

2. Les processus créateurs de l'innovation

N. Alter [1]décrit trois étapes qui sont les fondements du processus d'innovation, à savoir :

- L'invention
- L'appropriation
- L'institutionnalisation

2.1. L'invention

Une invention doit être conçue comme une incitation à partir de quoi l'innovation peut se développer. Mais une incitation ne se décrète pas.
Cette étape est caractérisée par le manque de rationalité, parfois par le manque de sens, voire l'absurdité de l'invention présentée.
A ce stade, le risque de voir l'invention rejetée existe. Il peut exister une mésentente sur les attentes de chacun des acteurs. Dans les organisations, le lien entre les porteurs de l'invention (par exemple, vouloir améliorer l'offre de l'entreprise) et les opérateurs (les personnes qui vont appliquer l'invention) n'est pas automatique. « *Les premiers pensent pouvoir contraindre les seconds et les seconds pensent que les premiers vont mettre tout en œuvre pour parvenir à cette fin* [2] *».*
N. Alter fait remarquer que les opérateurs impliqués dans des opérations de management participatif peuvent n'y voir qu'un effet de mode passagère; d'autres y voient une manière de contrôler leurs activités et s'opposent à leur développement.
C'est un élément à ne pas négliger : il n'est pas rare d'entendre de la part des enseignants la peur de subir un « contrôle » via l'ordinateur et d'en rejeter l'usage pour cette raison !
L'auteur met l'accent sur le rôle des « chefs » qui doivent être ouverts à d'autres possibles, encadrer les conditions d'émergence de l'acte nouveau et développer une culture d'organisation capable d'intégrer les changements.

2.2. L'appropriation

Un des éléments qui ressort dans la première phase du processus est le déficit de sens qui peut être généré par l'invention. L'appropriation se caractérise donc par la création de sens par les acteurs de l'organisation pour combler le peu de rationalité de l'invention, *« pour faire échec à l'absurde* [3]».
Les promoteurs de l'invention devront ouvrir des espaces de contact afin de permettre aux « adeptes » (clients) de devenir partenaires et non plus des consommateurs à qui on impose l'invention. C'est la nécessaire confrontation des points de vue divergents entre les acteurs.
Ce nouvel ensemble (promoteurs + adeptes) va œuvrer face à l'organisation de la manière suivante. On le constate, le sens de l'invention n'est pas automatique : il se construit dans un processus complexe de va et vient entre la logique de l'organisation, qui veille à la stabilité, et celle de l'innovation, source de déséquilibre.
L'innovateur va profiter des interstices, des zones d'incertitude selon Crozier et Friedberg (1977)[4], qui échappent à l'organisation.

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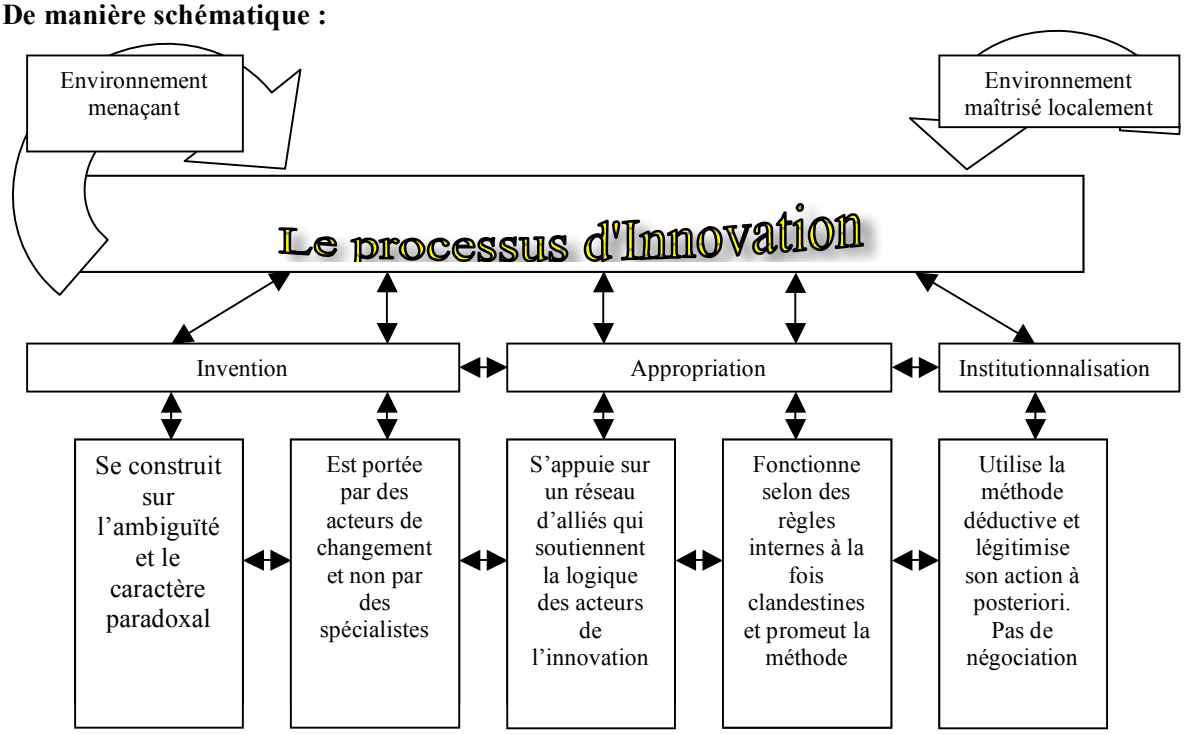
[1] ALTER, N. (2000). *L'innovation ordinaire*. Paris, PUF Quadrige, p 65
[2] Ibidem, p 68
[3] Ibidem, p 69
[4] BONAMI, M. & GARANT, M. (1996). *Systèmes scolaires et pilotage de l'innovation*. Bruxelles, De Boeck, p 61

Les porteurs de l'innovation vont s'allier certains usagers qui trouvent dans cette nouvelle méthode de travail, une source de renouveau et une « détaylorisation » de leur travail. Pour que cette phase d'appropriation se développe correctement, il faut que « les chefs » jouent l'ouverture et l'interactivité.

2.3. L'institutionnalisation

Nous l'avons souligné dans les deux premières phases du processus d'innovation, rien ne se décrète mais l'ensemble se construit par étapes. La phase de l'institutionnalisation a pour rôle de «*mettre l'action enforme* [5]» et d'intégrer les pratiques novatrices.
C'est à ce moment que les « chefs » transforment une partie de ces pratiques innovantes en règles. Ils jouent le rôle de médiateur entre les tenants de l'innovation, à qui ils interdisent la liberté totale d'utilisation des nouvelles pratiques, et les nouveaux utilisateurs (le reste du personnel) à qui l'innovation va être imposée, obligatoire. Ceci leur permet de récupérer leur pouvoir mis à l'épreuve dans la phase d'appropriation.
L'équilibre est rétabli mais non sans marquer un certain recul par rapport aux pratiques innovantes puisqu'il y a arrêt (momentané) du processus.
La rationalisation taylorienne est elle indépendante des pratiques sociales de l'innovation, elle définit les comportements à venir, de manière scientifique ; elle est inductive.
Le point commun entre ces deux approches est la réduction des incertitudes dans les pratiques de travail.
On se rend bien compte que l'institutionnalisation n'est qu'une étape, que la règle dans une première boucle du processus. Cette nouvelle norme sera elle-même remise en question par de nouveaux acteurs, menant à un nouveau cycle.

De manière schématique :



Le processus d'innovation. Tableau A. Lietart

[5] Ibidem, p 76

3. L'innovation chez l'enseignant

3.1. La recherche ACOT : le parcours des enseignants selon la recherche ACOT

Ce tableau est à mettre en relation avec le cheminement des professeurs dans l'intégration et l'usage des TICE proposé par M Lebrun (2004, p 103) et réalisé à partir des recherches ACOT[6]. :

Etapes selon ACOT	Description des étapes
« Entry »	L'enseignant découvre les bases, les fondements de l'utilisation des TIC. Il s'initie à l'outil
« Adoption »	L'enseignant utilise les TICE, souvent de manière traditionnelle et aussi pour son usage personnel
« Adaptation »	L'enseignant intègre la nouvelle technologie dans ses pratiques de classe
« Appropriation »	L'enseignant cible sur le travail de groupe, le projet et le travail interdisciplinaire. Il inclut l'usage de l'ordinateur avec d'autres outils dans sa classe. Il étend l'utilisation aux étudiants
« Invention »	L'enseignant découvre de nouveaux usages et détourne certains logiciels de leurs usages premiers. Il personnalise l'usage de l'ordinateur. Il adapte son utilisation aux situations d'apprentissage

Les cinq étapes du développement des professeurs à la découverte des TICE :
Tableau M. Lebrun

Dans ce tableau on remarque que l'enseignant commence par utiliser la machine pour réaliser des tâches qu'il exerçait autrement, il emploie l'ordinateur comme il utilisait sa machine à écrire,…). Ce n'est qu'une fois qu'il a la maîtrise de l'outil qu'il assure de nouveaux usages, une nouvelle pédagogie.

3.2. Les recherches de Hutchings et Shulman : le SOTL

Le métier d'enseignant tend vers la professionnalisation. Perrenoud (1993) rappelle que les enseignants ont toujours été des « gens de métier », des professionnels et que le courant de la professionnalisation décrit simplement un processus qui prend de l'ampleur *« lorsque, dans le métier, la mise en œuvre de règles préétablies cède la place à des stratégies orientées par des objectifs et une éthique* ».
Dans cette perspective, le métier d'enseignant devient de moins en moins statique : les enseignants apprennent donc comme leurs étudiants (cf. les phases de la carrière enseignante de M. Huberman, 1989).
On y retrouve, dans l'environnement eLearning, le spécialiste de la matière, le technicien du dispositif pédagogique ou de la plate-forme, la personne en interaction dans un contexte particulier, l'enseignant interpellé par l'apprentissage des étudiants qui seront bientôt eux aussi de futurs professionnels.
Dans chaque métier, le professionnel qui souhaite améliorer les objectifs qu'il s'est fixé, analyse sa pratique, évalue son action.

[6] **A**pple **C**lassroom **O**f **T**omorrow

Pour atteindre cette nouvelle étape, *« il se dote d'outils, s'inscrit dans des relations avec des services et d'autres enseignants. Il transforme son savoir, son expérience, sa pratique en nouveaux savoirs et connaissances* [7] *».*
L'évolution du métier fait que, dans bon nombre de cas, l'enseignant va ajouter un nouveau stade au développement de sa carrière : la diffusion et la communication de sa propre expérience parmi ses pairs qui deviendront à leur tour « communauté apprenante ».
Il participera à des colloques internationaux de pédagogie et partagera son savoir. On le voit, le chercheur et l'enseignant sont à la croisée des mêmes chemins.
Ce cheminement, cette carrière enseignante, les anglo-saxons l'ont appelé SOTL :
Scholarship Of Teaching and Learning. Le Savoir, la Science de l'Enseignement et de l'Apprentissage. Les auteurs (Hutchings et Shulman) y ajoutent les dimensions suivantes :

- le caractère public des développements ou des innovations
- l'ouverture de ces derniers à l'évaluation et à la critique
- leur adoption et leur développement par la communauté toute entière

3.3. Le modèle S.O.T.L : n'a-t-il pas de quoi A.P.A.T.D. ?

Acquérir	L'enseignant va utiliser les outils à sa disposition. Il découvre l'outil informatique. Il est technicien de son dispositif
Pratiquer	L'enseignant met en pratique les savoirs acquis. Il va commencer à nouer des relations, à interagir avec ses pairs et d'autres services
Analyser	Il réfléchit sur ses acquis, sur ses pratiques. Il s'interroge sur la pertinence de son dispositif pédagogique. Il accepte la critique et l'évaluation
Transformer	Il transforme ses connaissances, son savoir, son expérience en nouvelles connaissances et nouveaux savoirs et connaissances. L'impact est visible dans sa pratique
Diffuser	L'enseignant communique sa propre expérience parmi ses pairs qui jouent le rôle de communauté apprenante

Le modèle SOTL adapté à notre recherche. Tableau A. Lietart

La particularité du tableau A.PA.T.D. est de mettre en évidence le métier d'enseignant sous l'angle relationnel et d'y ajouter la capacité pour l'enseignant de diffuser son Savoir auprès de toute la communauté éducative.

4. Conclusion

Dans cet article, nous avons abordé l'innovation sous des angles différents pour finalement cibler plus précisément le rôle de l'enseignant dans ce dispositif.
Nous avons mis en exergue les trois étapes essentielles du processus : l'invention, l'appropriation et l'institutionnalisation.
La professionnalisation du métier d'enseignant transforme le métier lui-même et incite ce dernier à réfléchir et à communiquer ses nouveaux savoirs.
Nous avons proposé des modèles d'évaluation de l'innovation au travers des recherches ACOT et SOTL. Ces différentes étapes ont permis de faire ressortir certaines caractéristiques de l'innovation et d'esquisser le profil type de l'enseignant innovateur.

[7] LEBRUN, M. (2006*). SOTL vous aussi ?* U.CL. Article collectif, Résonances, n°93, p 1

On ne peut s'empêcher de constater, au travers des différents cadres théoriques développés ci avant, certaines similitudes. Par exemple, la notion de processus est omniprésente. La non linéarité des étapes est également à mettre en avant ainsi que des liens entre l'apprentissage et l'innovation.
On constate que la ligne de fracture imaginaire entre l'apprenant et l'enseignant n'est pas aussi clairement définie : dans les modèles explicités, l'enseignant n'est pas le seul détenteur du savoir et il peut aussi se trouver lui-même en situation d'apprentissage.

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For e-learning, also the « e » is important

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Abstract

Generally, ICT research in education gives a daily meaning to the training through the technology or amplifies the social discourse on socially constructed informal reality. Whatever option is chosen, the discourse on ICT gives foundation to the tools as training or learning outlines. e still are in the "learning" of the e-learning where the "e" becomes subordinate. However, the ICTs are not only a speech. They also are action upon the world. In this context, we already know the main role of intellectual and/or material tools in the structuration of knowledge.

Our communication presents a model in order to reach an ICT integration that passes beyond the instrumentation of pedagogical models. This model considers the ICT as a variety of devices produced by human activity and as means for establishing human relationships thoughout contrasted situations. This model is based on the idea that tools participate to the improvement of cognitive skills, that tools are transforming themselves through the time and that they change back those skills. Defining mediation as an interaction amplified by the tool, its role is to give birth to an artefactual process that authorizes the construction of new knowledge and innovations. In this context, the ICT activities are mediated by the tools and by the tool sets which are elaborated by our customs.

This model offers a new option for analysing e-learning situations. It is based on the artefact concept as well as on the approach of objective knowledge based, itself, on the theory of the three worlds (Popper, 1994).

The artefact is defined as an effect of art and as a gradually elaborated construction during mediation to reach the "quasi-real" representations ready to be methodically dismantled as methodically as there were imagined in order to make no doubt to the user regarding the artefact.

Accordingly to the three worlds theory - the physical realities world, the experimental consciousness world and the objective knowledge world - the artefactual process of constructing knowledge puts us in contact with the objects through our experiences. Taking into account that theses experiences are also lived into the symbolic world of representations, they are influenced by all the knowledge and the others representations we have. The passage between subjective knowledge (2nd world) and the objective knowledge (3rd world) is made by the modelisation of practicesthat becomes knowledge and that can be submited to criticism and experimentation.

Keywords : word, artefact, knowledge, experience

1. The report

Nowadays, ICTs are more focused on practicesthan on theoretical models. They are a tranversal knowledge based on practice and recognized by the outcome of various interdisciplinary fields of publication. They can be considered as actors of a paradigm based on experience who are involved in information society. Therefore, we are considering two options for thinking over ICTs. The first one gives a meaning to the real ICT formal: the technology.The second expands the social discourse on a socially constructed real informal: the information society.Whatever option is chosen, the ICT discourse is basing the tools on training or learning.In fact, we are in the « learning » of e-learning and the « e » becomes subordinate (Lebrun, 2008). On one hand, the arguments are « in accordance » with intrinsic sense of everyday life.In another hand, the arguments are « acceptable » by the here and now society. However, ICTs are not only a speech but also an action on the world.It is difficult to think over ICTs without taking into account the technique and the social involvements it results. How to consider ICTs thinking neither the tools through which teaching contents are produced or nor the tools through which knowledge is transmitted ? The choice made out of the tools creates situations that lead to new knowledge, modifying tools. In that way, the cognitive capacities adapt themselves to tools and to social practices to which they belong. Therefore, tools

are essential in any type of circumstances. How to forget the theoretical importance of tools in cognition ? How to forget that ICTs also call attention from the study of the technologies ?

2. The essential role of tools

ICTs are not only technical tools. They are technical, cognitive and culturale means. To use a browser on the Web requires as many technical skills as cognitive representation activity. The tool has got this kind of representation in the Internet user's mind. Therefore it is transforming mental processes, cognitive strategies of exploration and learning activity. Tools are not only ccessories in the human activity. They also transform it and amplify it (Vygotski , 1985 ; Tikhomirov, 1974). ICTs can be considered simultaneously as the product of a human activity as well as of social practices and of release mechanisms of an intellectual activity. They are also « crucibles » of the socially shared human knowledge at a certain aime (Norman, 1993 ; Lave, 1988). The interest of the ICT, used in situations of open and distance learning (ODL), lies in the various forms of representations which they can give and in actions which they can raise up. The tools facilitate the navigation between various graphical or calculatory representations and allow to weave links between the situations. In that way, students can increase their reflection on the activities they are leading. Eventually, about the « learning » itself, the main question remains to study the links which the pupils may make, considering the problems they are asking to themselves or considering the genesis state of the cognition. The techno-didactical difficulty is indeed located in the passage from the navigation between the situations proposed to the one between the underlain concepts.Regarding pupils, how to present and to connect various situations according to relationship network of the conceptual field ? According to the student's activity, what are the privileged links that he is going to weave ? If we consider that the instrumented situations have to reflect the abstract relations, the « e » becomes the intermediary between the conceptual field and the student's knowledge.

With an essential educational vision (Lebrun, 2008), the use of tools is made according to a linear progress in the course of which the pupil can reach a certain freedom at the navigation level. Indeed, the « e » ensures particularly its rôle: by leaving enough time to the slow student and enough motivation for keeping the attention of the most active one. This corresponds to the current educational models : the individualization, the autonomy and the motivation in the learnings.

In that vision, the tools analysis does not succeed in exceeding the questions of the human-machine dialogue which send back to the permanent mixture between the technical instrumentation of human action and its effective work through individual action.

From then on, once the « e » role is evacuated, how do we know at which level of representations development and cognitive operations, the activities based on tools intervene ? Today, the stake is not any more tthe « new » tools integration. The stakes are connected to the questions arising from the educational or not use of the tools. In the case of the ICT, tools belong to a « distributed cognitive system » (Hutchins, 1995). They are artefacts which amplify human capacities and modify the task and the activity. They organize our vision of the world through the distributed knowledge and the shared social practices which they authorize (Bateson, 1972). They propose resources for the structuralization and the execution of human actions (Norman, 1993 ; Lave, 1988). They facilitate reflection, thought, and start an intellectual activity. When they modify the cognitive activities, they are the cognitive artefacts. (Norman, 1993). When they modify the communication activities , they are « communicationnels artefacts » (Agostinelli, 2003) that amplify the communication, organize the human interaction, modify production ways of management and data processing …

3. The artefacts

The artefacts approach finds its source in objects which are produced by the man. Objects are social constructions (Simondon, 1989) and their development depends strictly on the specific operating mode and on the users'reflection on their aims. This active participation of the individual using the tool modifies its « nature ». From the tool, it becomes instrument. It means that it gives a direction to intentionality, to the reflection and changes the human activity. Eventually, it activates an intellectual activity.

The artefact mediatizes our vision of the world without including ourselves in the phenomena of which it instruments the reporting. It is a process to think our relation to the world, not the world of the globalization, but the local and private one. The world in which the man is member of a community, a group, a tribe.

For us, etymologically, the artefact is an *artis facta*, an effect of art. It is a gradually elaborated construction which happens during mediation in order to reach a representation that can be as methodically dismantled as it has been imagined. This happens in order to become undeniable to the user. Of course, art is understood here as a capacity, a skill to make « something », but also as a set of means, processes, rules regarding an activity or an occupation. It includes the activity that leads and considers the set of rules to be followed. It includes the set of creative human activities of works containing rules which become the rules of the discipline it concerns.

Concerning the word *effect, make*, (influence), we consider it as the result of an action and of what is produced by « something », provoking as an action as a reaction. In fact, all art of influence can give place to subjectivity following the context, the use and the practices. Some pieces of art become « good objects », good constructions because they are linked to social while they are making it partially. In this case, they have got the peculiarity to subscribe to the society through all their caracteristics. Others, as technical objects or « fetishe » objects (Latour, 1995), are detached or objective objects which we do not often know how to connect to the rest of the social world.

The art effects can then provoke interpretation or understanding mistakes and, even, hostile reactions. Therefore, a contextual vision is necessary for observing the artefact. It is neither coming from the means, because they considerably vary according to different points of view, nor coming from the purposes, because the possible issues which are authorizing them are not purpose in itself, strictly speaking.

As a result, practices are not any more the essential heart of the relation man-artefact considered as a single solution to the « taken into account » problem (Rabardel, 1995) but only an immediate situated solution which is not projective. In fact, the practices (or the uses) are not the demonstration of a relation man-artefact which is similar to itself, which would appear and would reappear at various times in an universe which would recognize this relation and that the relation would recognise this universe. They are as a passing concordance of diverse components. These components are deducted by reading in context the decision-making model which emphasizes the relationship between the observable actions and the decisions taken by the individuals in the context. From this point of view, the daily learning in a classroom is not more « natural » than an instrumented learning. In that case, artefacts are not « except natural ».

We insist then, not only on the results of the action, but also on its various phases in order to seize its coherence. The difficulty of such a reading lies in the nature of the operated processes: sensations, perceptions, values, knowledge… An artefact is at first a sight of the spirit which associates the human interactions, the mediation of tools, the cognition and the learnings.

In fact, the essential question regarding artefacts lies in the relation which exists between the world of artificial representations and the way we represent ourselves the « real » world. The artefactual process is thus a relational, individual process which builds an interpretative system of knowledge and manners in individual mind. This system helps an individual to understand the world, but only

regarding the idea that he has made of it and which is the foundation of the artefact. The artefactual process is the process of interdependence which gives meaning to the information on the context. It organizes these datas in the cognitive system which handle them and which is itself the engine of permanent learnings by linking the technologies and the practices to the educational situations and to the instrumented learning.

4. The theory of three worlds

The e-learning would thus be an artefact which teachers can use to demultiplicate their capacities of action on the trainings. It is also an artefact which the students can use to increase their potential of production and increase their power on the world of the knowledges. The actions from some and others constantly modify the educational context which becomes « shared » and which builds itself culturally as a possible world (it means to say as an artefact).

For us, ICTs belong to each of three worlds referred by Popper (1994). In that sense, ICTs allow at the same moment the production of ideas under material shape (tools, applications), but also a subjective use.

- The world 1 is the one of physical realities. It is the world of the objects that we can touch, manipulate. It exists independently of our experience. The ICT and our knowledge are real but absent objects, as is a jack in a car trunk which runs, or as physical laws which permit to elevate the car for changing the wheel.

- The world 2 is the one of our conscious experiences and the one of the knowledge which remains subjective because it does not exists out of the relation we have with it. For instance, it is the fear we can have in front of a machine or the pleasure as we are driving our car. It is also, the world of ICT virtual objects. Files, garbage, routine connection are not real or physical objects. To manipulate them, the user has to go through his mental and semiotical representations.

- The world 3 is the one of the objective knowledge, represented by all the theories, the models, the datas; all the information at our disposal which exist independently from the relation which we have with them.

Through these three worlds, the building process of the knowledge keeps us in touch with objects by our experiences in the world 1 . Our knowledge is lived in the world 2 which is the world of symbolic representations, the spirit and the thought. In the world 3, our knowledge is influenced by all the knowledge, the theories, the representations which we have.

The passage from the subjective knowledge (world 2) to the objective knowledge (world 3) is made by the formalization of models and theories which become, at their turn, knowledge and can be subjected to the criticism and to experimentation.

For example, when I am surfing on internet, my laptot computer or cellphone belongs to the world 1 of the material realities.

The feelings that I have by creating my profile on Facebook as the felt desire of meeting someone belong to the world 2.

My laptop computer is real and my feelings are also real because I am living with them. But they are not " objective " and timeless feelings because they depend on my knowledge, on my use, on my know-how of the world 3.

If I am able to objectivize my practices, therefore I can identify what are the psychosociotechnical models that I am using to communicate on Facebook. I can objectivize the role of the ICT on the observed phenomena and thus discuss presuppositions and/or theories to adapt them to the observed situations.

This approach is presenting two interests :

- In the world 3, the individual builds knowledge which have got an appropriated and superior wealth to those that he uses when he establishes this knowledge. The ICT is a good example: indeed, these technologies manage more information today and offer more interconnection capacity between them than an isolated human mind can handle. There is thus a stake in autonomy of a complex system belonging to the world 3. The such created knowledge enters in interaction with other knowledges and organize new forms of knowledge which are advisable to study.

- In the world 2, our subjectivity is influenced by the new forms of knowledge of the world 3. Among of that, they have an autonomous existential shape and modify the previous knowledge: all what we consider as stable as our culture and our perception of the world 1. All our knowledge, observations, practices are impregated with models having a theoretical or cultural background. This background gives a direction to what we think of being a « naive » observation of the reality.

If we know that the extension of our finger with the mouse to manipulate virtual objects on a metaphorical desk has nothing more intuitive, can we clarify at which collaborative level intervene tools in the construction of a common sense or a didactical contract in a virtual classroom ?

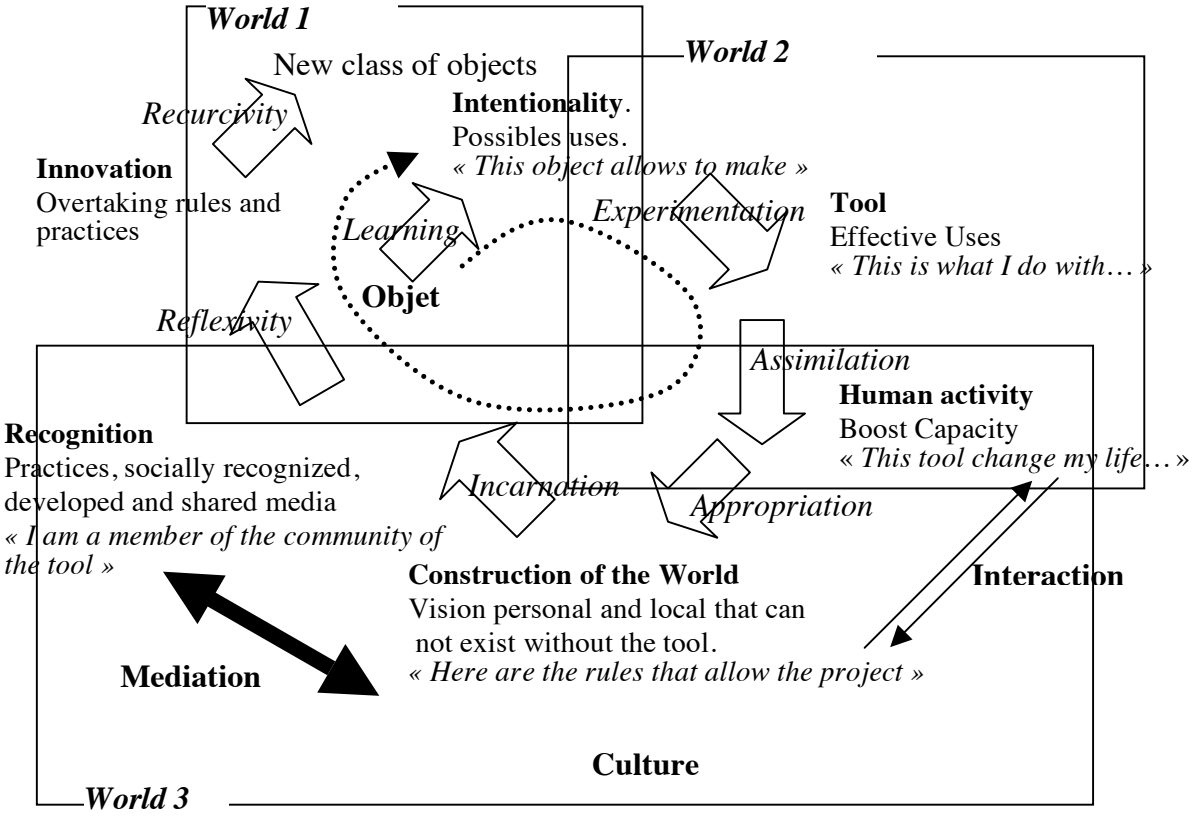
What are the models which are integrating tools and describing the role of instrumented communication in the negociation processes that are occuring in the communities of practices that are sharing knowledge ?

5. The artefactuel process of getting in touch of the worlds

Our model is looking at the artefactuel process in its cultural aspect within a community where objects are the product of human activity to which the members attribute intentionality. Its main aim is to seize ICTs as the performance of culture in which the knowledge is considered as human works which are the object of a cultural socially organized transmission (Meyerson, 1995).

In other words, the question is here to understand the artefactual process as a mediation for knowledge transmission process. The interaction is then seen as an act of contextualisation by which the tool allows the individuals to manage collectively the knowledge which is situated in a working environment. This contextualisation authorizes to outdistance th primordial construction of use situation and allows to look at the knowledge as a stable situation (because acquired and put in memory by the community). This also allows their probation in another context. This is the foundation of the learning and what has characterized the headway of the interpersonal exchanges through the time. In a situation of learning, what we call contextualisation is, in fact, a recontextualisation thanks to the other situations of the same type or the one close to the same type. The contextualisation becomes less and less present. The information is going to become « tools » (in the vygotskian spirit) that the individual can use in other contexts

The process begins in the world 1 with the *discovery of the object* and the associated questions; « To what kind of use? In what is it made? Etc. ». It is the *intentionality given to the object* that authorizes it a possible use, « this object allows me to make ». With the learning and the experimentation we build a subjective knowledge connected to the personal relation which we have with the object and with this knowledge, « here is what I make with… ». The tool evolves then towards a established and considered normal use, it becomes a personal tool and an announcement, by the terms « this tool changes my life », actions on, by, with the tool. It is between the worlds 2 and 3 that intervenes the interaction which recovers from the organization and from the genesis of the knowledge. The mental construction of the knowledge plays, in every stage, a central role in the apprehension of the environment, and in the possible effects on these same knowledge. In *the social construction*, the intersubjective reality is in permanent construction thanks to the conflicting representations. The representations, which elaborate, translate the interiorized constructions which transform the reality in successive really situationnal bit by bit. The individual builds himself then by a system of interaction.



Plan 1: the artefactuel process

This system is the building context result which is occurs simultaneously in the progress of the exchanges which allow the creation or the improvement of a voluntary and reflexive process. This process authorizes the individual, a planning of his action for achieving his aim thanks to a bigger structuralization of this context and a better management of its activity.

In the social construction (Berger & Luckmann, 1997), the intersubjective reality is in permanent construction thanks to the conflicting representations. The representations, which elaborate, translate the interiorized constructions which transform the reality in successive really situationnal bit by bit. The individual builds himself then by a system of interaction. This system is the building context result which is occurs simultaneously in the progress of the exchanges which allow the creation or the improvement of a voluntary and reflexive process. This process authorizes the individual, a planning of his action for achieving his aim thanks to a bigger structuralization of this context and a better management of its activity. In the construction of a personal and local world, the culture is « all the descriptions, more or less connected from some to others, more or less normative, which tell to us, among other things, how "work" the people, what look like our spirit and how we have to act in precise situations, which are the various possible ways of life and how it is necessary to stick to it » (Bruner, 1991, p. 49).

The culture bequeaths us « prostheses » (artefacts) which allow us to transcend the rough biological limits (the limits of our memory, for example). The mediation is envisaged here as an interaction amplified by a media (a tool) which has to consider two aspects. On one hand, a tool allows to realise actions that would be difficult to realise without it but restricts and models the actions which it mediatizes. On the other hand, according to a vygotskienne perspective, a tool is above all, a tool of the spirit. This mediation finds naturally its roots in the human relations and the forms of a ritual communication (Bateson, 1971) which allow to model the types of social interactions in specific cultural contexts. The second foundation refers to Hymes (Hymes, 1982) for whom, the daily linguistic practices of the people show the way they build up the social. From then on, to kick away

the rules of functioning of these practices allows to describe the way the individuals associate particular modes of dialogue, information and transmission of messages with places and specific activities.

The recognition is always a certains types of *social order* (Douglas, 1986) in which the individual becomes member because he is there predictable and recognized. The shared manners are permanently reconstructed by the facts, the gestures(movements), the exchanges (Goffman, 1963). The community is then based on the acceptability and the previsibility that have to offer in any situation the members of a given culture (Goodenough, 1957). The common knowledge *are the collection publicly shared by principles and by values used every moment to justify the behaviors* (Douglas, 1986) but also, this quite complex which includes the knowledge, the faiths, the art, the morality, the law, the customs, and the other capacities or the customs acquired by the man as member of the society.

Finally, the innovation finds its source in the overtaking manners, in the capacity to produce new objects in the world 1 by changing and by organizing those which already exist from the knowledge obtained in the world 3. The main characteristic of the innovation is then, a capacity to modify a way of thinking according to the context in which it is made. The new object discovers links between knowledge which, a priori, have nothing in common and nevertheless to transform the tool of departure.

To conclude this artefactuel process, the tool always has a mediating function on the man action on the world: it is used to act on and with the others; it also modifies its user because it also serves for acting on itself. A tool is always socially created and used by and for the purposes and the needs of the collective action. This social nature confers it a sharing function of the objectives; a coordination function of the community member activity; a communication function which builds itself through the interactions and the social mediations. It is also the mean, given to the community member, to become, at the same time, the subject and the object of his own activity on the world.

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Conquérir une autonomie en communication.

Une plateforme de formation à distance

pour des publics en difficulté en lecture et écriture

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Abstract

Dans certaines situations de formation utilisant le e-learning, il semble que les apprenants développent des compétences conduisant à une autonomie communicationnelle. A partir de l'étude d'un dispositif de formation associé à une plateforme numérique, « Le Pavillon des apprentissages », l'article relève les conditions favorables à l'acquisition de cette compétence.

Keywords:

Autonomie, illettrisme, compétences communicationnelles, plateforme numérique de formation.

1. Introduction

Pour répondre à l'exigence de la formation tout au long de la vie, les solutions du e-learning sont à juste titre largement reconnues. Notre hypothèse est que dans certaines situations, les apprenants développent une compétence spécifique : l'autonomie communicationnelle. A partir d'une étude de cas, « Le Pavillon des apprentissages », plateforme numérique pour les apprentissages en savoirs de base, nous souhaitons relever les conditions favorables à l'acquisition de cette compétence.

Le public concerné par cette plateforme est celui de personnes dites en situation d'illettrisme. Dans le cadre de la formation qui leur est proposée, l'usage de la plateforme multimédia leur permet d'acquérir une autonomie communicationnelle qui va au delà des contenus enseignés.

Cette communication n'analyse pas les compétences acquises par ces personnes, un travail de ce type est prévu ultérieurement. Il s'agit simplement ici, à partir d'entretiens et en s'appuyant sur l'observation et l'analyse du dispositif, de repérer ces conditions déterminantes pour l'acquisition d'une autonomie communicationnelle. On considérera qu'il y a autonomie communicationnelle lorqu'un acteur peut faire des choix adaptés et coordonnés concernant : a) les modalités de communication et leur mise en œuvre; b) la forme de l'expression; c) le contenu des messages et des arguments.

Le cadre de cette analyse se situe dans le champ des sciences de l'information et de la communication et s'intéresse à « l'émergence des normes nouvelles d'actions communicationnelles » (Miège, 2004).

2. Illettrisme et formation à distance

2.1 Les personnes en situation d'illettrisme

En France, le terme d'**illettrisme** a été choisi pour qualifier la situation d'une personne vivant en France métropolitaine, ayant été scolarisée en France et ne maitrisant pas les compétences de bases pour communiquer. Selon l'enquête IVQ de l'INSEE 2004-2005, (Information et Vie Quotidienne), ces difficultés touchent en France 9% de la population âgée de 18 à 65 ans.

Ces personnes se trouvent souvent dans l'impossibilité de rédiger sans aide une demande écrite, de gérer les comptes de sa famille, de lire une notice technique. La lutte contre l'illettrisme consiste donc à accompagner ces personnes pour leur permettre d'acquérir la maîtrise des savoirs de base et ainsi d'avoir la possibilité de rejoindre par exemple des voies d'apprentissage et de formation.

Au fléau de l'illettrisme s'ajoute aussi celui d'être exclu des ressources et services numériques, car plus l'usage des outils de la communication numérique se généralise, plus ceux qui en sont éloignés par leurs difficultés communicationnelles, se trouvent en situation d'exclusion.

2.2 La question de la Formation ouverte et à distance (FOAD)

2.2.1 Une question paradoxale

La FOAD requérant a priori des compétences en lecture-écriture et une autonomie pour apprendre, il semble paradoxal de proposer un tel environnement d'apprentissage à des personnes peu autonomes vis-à-vis de la lecture et de l'écriture. Un rapport (Billiau et al, 1991) note que « *avant de savoir comment former à distance des personnes en situation d'illettrisme, il s'agissait de vérifier s'il était possible de former en FOAD des publics en situation d'illettrisme* ».

2.2.2 Une question régulièrement posée

Malgré ces difficultés repérées, la solution de la FOAD pour soutenir des actions de lutte contre l'illettrisme est régulièrement envisagée et des expérimentations ont été engagées depuis les années 90. La journée nationale "*Quels usages des technologies de l'information et de la communication pour lutter contre l'illettrisme?*" organisée par l'ANLCI le 14 mai 2008 à Lyon, a rendu compte des pratiques en ce domaine et des résultats encourageants obtenus.

3. Analyse d'un dispositif

Le dispositif « Le pavillon des apprentissages » a démarré en 2001 au sein d'un organisme de formation basée à la Rochelle (France), Déclic-Formation, qui travaille depuis 1990 sur le champ de l'insertion sociale et professionnelle dans la région Poitou-Charentes. Cette plateforme multimédia, conçue par une équipe de psychologues, de formateurs, d'informaticiens et de graphistes, se présente aujourd'hui comme une des rares plateformes de téléformation en France destinées aux publics en difficulté avec les savoirs de base. Expérimenté par une dizaine d'organismes, cet outil de formation a impliqué plus de 150 stagiaires et de nombreux formateurs dans différents contextes.

3.1 La plateforme multimédia

La plateforme est organisée en « grains de formation », plus de 500 sont actuellement disponibles. Ce sont des modules courts, centrés sur un objectif d'apprentissage, basés sur des situations concrètes, présentant visuellement des situations du quotidien et élaborés pour amener le stagiaires à interagir. Ces grains se caractérisent par :

L'importance du son. Les consignes associées à la situation ainsi que les réponses du système aux actions de l'apprenant sont sonorisées. Ne sera écrit à l'écran que ce qui fait l'objet même de l'apprentissage. L'utilisation systématique du son se justifie par le public visé mais surtout elle renforce le sentiment de dialogue entre le stagiaire et la plateforme.

Un accompagnateur virtuel. A chaque séquence pédagogique est associé « Jules », un petit personnage qui accompagne le travail du stagiaire par une mimique, une remarque, un conseil. C'est un compagnon de route, compréhensif et stimulant.

Un point de vue pédagogique. Le choix est de ne pas donner de réponse mais de chercher à relancer la réflexion du stagiaire, « *renvoyer la personne à son raisonnement* » explique une des conceptrices. Apport d'indices, paroles d'encouragement, il n'y a pas de correction d'exercice car le souci est de la valoriser et de soutenir l'apprenant dans son travail de réflexion.

3.2 Un dispositif complet

La plateforme est un élément essentiel pour les apprentissages, mais l'efficacité de cet outil repose sur son insertion dans le dispositif global de la formation. Le dispositif observé associe trois éléments :

Un travail d'accueil et d'accompagnement par des formateurs spécialisés. Il s'agit en particulier d'accompagner chaque futur utilisateur dans la prise en main de la plateforme (entre 10 et 12 heures pour acquérir logique navigationnelle et maitrise de base de l'outil informatique (clavier, souris, ...)). Ce travail initial donne un statut et une valeur à la plateforme, on offre à l'apprenant un outil au service de ses apprentissages. Le formateur référent pilotera le parcours de formation, analysera les relevés du travail fait et adaptera les parcours en fonction de la personne.

Des regroupements de stagiaires pour des séances de formation en présentiel. Ces regroupements permettent de réinvestir, de confronter, d'évaluer les apprentissages des uns et des autres. Ces moments participent au renforcement des acquis et à la valorisation de l'effort de chacun.

Le travail autonome sur la plateforme. Ce travail est encadré par le formateur qui définit et ouvre un parcours contenant plusieurs grains. Dans le cadre de ce parcours, l'apprenant peut reprendre tel module et s'organiser comme il le souhaite, Le stagiaire sera donc toujours confronté à des questions qui concernent sa progression et qui sont pertinentes par rapport à ses compétences. Ce qui lui est proposé a du sens, porte l'image de ce qu'il est, de ses progrès et de sa relation avec le formateur.

3.3 Exemples de "grains"

Sur l'interface graphique, seul l'objectif d'apprentissage est écrit. L'apprenant revient autant de fois qu'il le souhaite sur le module. Dans le dialogue avec Jules, à partir d'indices verbaux et non vebaux, l'apprenant découvre s'il a acquis la notion visée.

Fig1. Rendre la monnaie

Les prix s'inscrivent au fur et à mesure de l'avancée des produits sur le tapis. Le total s'affiche, la cliente donne un billet. L'apprenant rend la monnaie en prenant les pièces et billets dans la caisse.

Fig. 2 - La notion de mesures.

Un ensemble d'objets et des mesures à leur attribuer. Un instrument de mesure est mis à la disposition de l'apprenant.

4. Facteurs favorables à l'autonomie communicationnelle

A partir de la situation présentée, nous relevons les éléments suivants.

4.1 L'accompagnement

Il n'y a pas d'acquisition de compétences communicationnelles sans un travail de médiation entre l'apprenant, les objets techniques qu'il doit gérer et les contenus disponibles. Cette médiation que l'on peut aussi appeler « accompagnement » permet aux autres éléments de s'intérioriser et de se stabiliser.

L'accompagnateur est celui qui présente, écoute, évalue et réagit. Il offre donc à celui qui est accompagné un modèle de communication, véritable repère pour construire sa propre autonomie dans ce domaine.

4.2 L'évolution de l'image de soi

La progression dans les apprentissages à partir de l'utilisation de dispositifs numériques développe la confiance en soi. Le non jugement de la machine, sa disponibilité absolue, valorise ce que l'on fait et donc fait évoluer l'image de soi.

Les dispositifs de formation en autonomie permettent d'agir par rapport à soi et non par rapport aux autres. Il devient donc plus simple de formuler point de vue et proposition. Si le contexte de formation est suffisamment sécurisant (adapté aux compétences de la personne), chaque étape franchie améliore l'image de soi.

4.3 La synthèse d'un parcours

L'autonomie communicationnelle se construit peu à peu par la synthèse de mini-capacités. Le dispositif observé offre une diversité de situations : seul face à un objectif d'apprentissage, en groupe pour partager un point de vue, en dialogue avec le formateur pour faire le point sur sa progression. La formation s'appuie et développe une diversité de compétences : une maitrise des outils pour naviguer dans un espace numérique, l'organisation de son temps pour la formation, l'appropriation de consignes et de raisonnements.

4.4 La compréhension de sa progression

La compétence communicationnelle repose aussi sur des compétences méta-cognitives comme comprendre l'enjeu d'une situation. Tout ce qui permet à un apprenant de prendre conscience de la façon dont il travaille et progresse renforce son potentiel d'autonomie.

Ainsi si *l'accompagnement* offert par le système de formation est assez riche, la personne ayant suivi la formation trouvera plus facilement elle-même des modalités de communication adaptées à ses objectifs. Si la formation a pu renforcer *l'image de soi* par une mise en confiance et une valorisation suffisante, elle choisira plus facilement des formes d'expression nécessaires et si grâce à la formation, elle a pu apprécier sa *façon de raisonner*, les messages et les arguments qu'elle aura à développer seront plus pertinents. Lorsque ces conditions sont mises en place, le stagiaire aura ainsi l'occasion de construire son autonomie communicationnelle.

5. Conclusion

De cette étude de cas concernant la plateforme de e-learning « Le pavillon des apprentissages », on retiendra que des modalités de formation peuvent amener les apprenants à acquérir des compétences communicationnelles qui vont au delà de l'objet même de la formation.

Il faut pour cela que se construise autour de l'apprenant un cadre de formation suffisamment cohérent et riche pour que s'enclenche à la fois l'acquisition des objets de la formation mais aussi ces compétences non forcement explicitées qui résultent de la pratique réfléchie d'outils et de procédures, dans des échanges avec des acteurs responsables et compétents .

L'autonomie communicationnelle est une compétence stratégique dans notre société de l'information et du savoir. Ouvrir des espaces de formation s'appuyant sur des logiques de e-learning est donc de plus en plus nécessaire à condition qu'une attention suffisante soit portée à la qualité du cadre de formation de l'apprenant.

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E-Learning : les stratégies managériales des organisations et les potentialisations d'acteurs

Paradoxes entre déterminisme technologique, hypermatérialité et coopération

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Abstract

Knowledge Management and E Learning will become a leader in the new global economy.In this article we will examine the role of general training in corporate and organizations like hospitals and universities settings in France and Québec and we will define E-Learning, compare its advantages and disadvantages for the company and the workers, and human capital. We then take a look at these organization's practices and policies that promote the adoption and appropriation of E-Learning technologies.In organizations, with regards to the appropriations we analyse factors that support it, to employees for accessibility of relevant and valued resources. To Higher Education, online learning is significantly growing and public institutions play a major role for this evolution. A new type of student is becoming predominant.Technologies non users exist still.

Keywords : E-learning, competencies, training, productivity, higher education

Résumé

Dans nos sociétés contemporaines où les structures croisent des modèles de plus en plus induits par les TIC et par la demande managériale marchande, un questionnement se pose : Comment réellement intégrer le E-Learning à l'organisation, à sa stratégie, à ses acteurs ? Notre base théorique est les théories des organisations, les sciences de l'information et de la communication, la sociologie et l'anthropologie de la communication.La problématique porte sur les interactions des acteurs à l'encontre des différentes volontés et pratiques. Existe-t-il des interrogations sur l'appréciation de l'innovation et de la matérialité des dispositifs de Knowledge Management et de E-Learning ?

Notre terrain se compose d'hôpitaux, d'universités, d'organisations du Québec et de France. Des études précédentes nous ont permis d'établir cette synthèse grâce à des méthodes inductives et systémiques Des acteurs aux appropriations nouvelles se révèlent chez les étudiants et salariés. Cependant, des individus sont exclus ou s'excluent d'eux mêmes.

Mots-clefs : E-Learning, compétences, formation, productivité, universités

1. Introduction

Un processus est en cours dans l'organisation concernant la diffusion et le contrôle des connaissances : Le.Knowledge Management et le E-Learning en sont les manifestations. .Ceci découle de la technologie inhérente à Internet.. Le Knowledge Management et le E- Learning traitent de connaissances, de compétences et de partage tout en transformant .les formes de communication et les stratégies managériales des organisations en espaces de travail de la communication en réseau. L'enjeu porte ,dés lors, sur la coopération de tous les acteurs du système.

2. De l'organisation technique vers l'organisation sociale

Le déterminisme technologique. Apports théoriques

La mise en forme de la communication collective et globale en réseau révèle la construction d'un espace de communication d'entreprise où savoir et contrôle de l'information sont étroitement liés . Ceci constitue un paradigme actuel qui illustre un glissement du domaine de l'information et de la communication vers une sphère managériale marquée, par un déterminisme technologique, voire par une hyper industrialisation des contenus dits immatériels.Stiegler désigne ce phénomène comme étant le symbole de notre société non caractérisable par l'immatérialité mais bien au contraire par son *hypermatérialité :*

« (…) je ne crois pas à l'immatériel : cela n'existe pas (…) il n'y a rien qui ne soit pas un état de la matière. Et pour produire ces états évanescents, il faut beaucoup de matériel : beaucoup d'appareils. Si bien que nous sommes plutôt dans une économie et une époque de l'*hypermatière* aussi bien que de *l'hypermatériel*. » (Stiegler 2008, p110-111).

Cette interstructuration entre le déterminisme technologique et le construit organisationnel s'attache à traduire le KM et le E- Learning comme des outils ou des projets de validation des compétences validés par les stratégies et le pilotage de l'entreprise. Ce qui fait du KM et du E-Learning, en général des artefacts de l'organisation informationnelle flexible.

3. L'innovation. Apports théoriques

L'innovation. est une construction formalisée associant une communauté d'acteurs à une évolution de ses moyens technologiques. Elle implique une mobilisation dans le temps du changement. Le dispositif sera alors défini comme lien indissociable entre le fait technique et le fait social.

Rappelons la définition de Rogers : « l'innovation est une idée, une pratique, un objet perçu comme nouveau par une personne ou un groupe. » (Rogers, 1983, p11). Silver précise de fait : « l'innovation est un processus qui vise mais n'atteint pas nécessairement une amélioration et qui peut inclure de l'originalité ou une adaptation »(Silver,1999, p.9)

L'intelligence orchestrée par le E-Learning ou par le KM, peut être analysée à partir des différentes approches de l'organisation.

L'apport de Gilbert Simondon, nous semble primordial. G. Simondon resitue les dimensions de l'objet par rapport à ce qu'il est : une interface entre une modélisation intelligente et

artificielle qu'il nomme *automate* et un objet technique qui reste *abstrait* sans l'intervention ou la *concrétisation* de l'homme, incarnation tangible de l'existence.

« Les objets techniques doivent être étudiés dans leur évolution pour qu'on puisse en dégager le processus de concrétisation en tant que tendance ; mais il ne faut pas isoler le dernier produit de l'évolution technique pour le déclarer entièrement concret ; il est plus concret que les précédents, mais il est encore artificiel »(Simondon, édition 2001)

G. Simondon, en réfléchissant sur l'assimilation de l'objet technique à l'objet naturel et spécialement au vivant, nous met en garde, justement, sur toutes ses conséquences.Et plus particulièrement sur la non-distinction entre la matière et la forme, de ces dispositifs complexes porteurs d'énergie et d'information . Cité par B. Stiegler, le propos s'actualise :

« (…) j 'appelle *hypermatière* un complexe d'énergie et d'information où il n'est plus possible de distinguer la matière de sa forme ce qui apparaît avec la mécanique quantique et ce qui nécessite le dépassement de ce que Simondon appelle le schème morphique, c'est-à-dire la façon depenser selon un couple de concepts, la forme (*morphé*) et la matière *(hylé),* qui consiste à les penser en les opposant. Et j'appelle *« hypermatérialité »* un processus où l'information -qui se présente comme une forme- est en réalitéun train d'états de matière produit par des matériels, des appareils, par des dispositifs techno-logiques où la séparation de la matière et de la forme, là aussi est totalement dénuée de sens » (Stiegler 2008, p 111)

4.Hypermatérialité et coopération Paradoxes

Si le E- Learning est une matérialisation de l'entreprise avec son environnement informationnel (économique, juridique, etc...) mouvant et complexe, il place chaque salarié dans un mouvement de contrôle opéré par l'organisation et dans une attente d'auto-contrôle permanent de ses actions.

Chaque acteur serait en droit, de fait, d'attendre une rétroaction, un avantage qui fassent sens. Ceci est proche du concept de la Métis grecque qui permet la dynamisation des compétences individuelles par la dimension collective , (Feron, 2002). Nous avons appelé cela *contre-don* accordé par l'organisation lors d'un projet établi sous forme d'*Intelligence active* partagée, (Etude d'Intranet dans 8 organisations, Thèse 2002).

5. Etudes de cas

Nous avons constaté par des études de cas basées sur les méthodes systémiques et anthropologiques que lors d'un déploiement de TIC,(Intranet, E-Learning et KM) dans les organisations comme les hôpitaux, les universités et les entreprises, les interactions entre l'acteur et le collectif se révèlent, sous forme de jeux, d'enjeux, de pouvoirs, voire de confrontations.

Si l'intention provient de l'organisation , l'acteur déploie des tactiques pour adapter la technique au vu de ses intérêts professionnels et/ou personnels En tout état de cause, ces interactions sont porteuses d'une dynamique basée sur la marge de liberté de l'acteur, mais aussi sur la combinaison de cette *Intelligence dite active* avec les autres stratégies de l'entreprise. Ceci constitue, selon nous, au final *l'Intelligence Stratégique de l'organisation* .

« L'acteur n'existe pas en dehors du système qui définit la liberté qui est la sienne et la rationalité qu'il peut utiliser dans son action. Mais le système n'existe que par l'acteur q[1]ui seul peut le porter et lui donner vie, et qui seul peut le changer .»(Crozier, Friedberg,1977)

Il est à noter que les distinctions entre le Québec et la France ne sont pas si sensibles. Nous nous appuyons sur la dernière étude concernant le réseau communicationnel : TIC des quatre hôpitaux de Québec,-ville , CHUQ dans le cadre d'une convention de recherche avec l'Université de Laval , Rapport rendu le 3 mai 2008.

Si les cadres et les étudiants sont motivés par des apprentissages ou des connaissances concertées et redéployées, en raison de demandes particulières de plus en plus fréquentes : promotion ou poursuite des études tout en travaillant , il existe une tranche de salariés ou de population qui est exclue ou s'exclue. Par exemple dans les hôpitaux et certaines organisations encore très marqués par le modèle hiérachique, il s'agit des employés techniques qui n' utilisent pas facilement les TIC dans leurs fonctions stipulées.

6. Conclusion

Il est à noter que l' appropriation de l'objet technique et de son contenu informationnel se trouve améliorée si l'individuel et le collectif se contractualisent grâce à un projet décliné par l'organisation, investi conjointement par la structure et l'individu.

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Cost-effectiveness analysis applied to a blended-learning-model

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Abstract

This paper describes briefly an attempt to evaluate the cost-effectiveness of the blended-learning-model characterizing the project OpenCampus. It was not possible to follow the methodology accepted by the main literature because of a lack of accessible cost data. For this reason a perceived cost-effectiveness ratio was estimated.

Keywords: blended-learning, OpenCampus, cost, effectiveness.

1. Introduction

This study intends to examine the applicability of the cost-effectiveness analysis to the project OpenCampus implemented in 2005 by the State School of Applied Computer Sciences and Economics (SSIG), a vocational 3-year advanced school in Bellinzona, Switzerland.

The OpenCampus project aims at introducing a modality of teaching/learning centred on the Blended-Learning-Model (BL) for some subjects in the two different curricula (full-time vs *en emploi*) offered by this school[2]. The stakeholders of this project are the teachers, the school's board and the students, but this paper takes only the students' perspective.

The actors directly involved in the project are mainly 14 teachers out of 23 engaged with the BL training offer[3] and approximately 100 students from the 1st, 2nd and 3rd years.

In this paper we intend to present a preview of the methodology and main findings of our analysis. The results are based on an *ad hoc* questionnaire distributed to the students at the end of the 1st semester 2008. The results of the 2nd semester 2007 questionnaire were used only in a few cases.

2. Methodology

We assimilate the educational process to a productive one. Therefore, our analysis is characterized by three different dimensions:

1. Outcomes: perceived learning effectiveness and quality of life of the OpenCampus BL model (compared to the traditional classroom model);
2. Process: quality of teaching and of didactic materials (still under study);
3. Input: perceived time dedicated by the students to study and/or to reach the school.

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[1] The authors thank Dr. Chiristelle Garrouste from Stockholm University for the precious advices and for the proof reading help.

[2] Some more details about the project are available in Cattaneo (2007).

[3] All the 23 teachers are asked to reach a minimum number of objectives concerning the use of the online learning environment, even if not teaching at distance.

With regard to the outcomes, we developed a specific "effectiveness index" on the basis of the definition of the term "effectiveness", i.e. the capability to reach, trough certain activities, a given target.

In the questionnaires distributed to the students there are few questions that aim at comparing the change, and its direction, induced by the BL model used in the OpenCampus project with the traditional face-to-face model. The answers can vary from the maximum positive change ("much better", with a statistical weight of 5) to the maximum negative change ("much worse", with a statistical weight of 1) passing through the *status quo* situation ("the same", with a statistical weight of 3). Our effectiveness index considers the status quo as the starting situation and the maximum improvement as the target situation.

The index is equal to the ratio between the observed change (the answer given by the student – statistical weight equal to X – and the status quo situation – statistical weight equal to 3) and the desired change (the difference between the maximum improvement – statistical weight equal to 5 – and the status quo situation – statistical weight equal to 3):

$$E = \frac{X - 3}{5 - 3}$$

This index varies between -1, maximum ineffectiveness, and +1, maximum effectiveness; if it is equal to 0 then the BL model is as effective as the traditional classroom model.

At the end of the questionnaire there is a section which aims at collecting information about the level of satisfaction expressed by the students on this BL experience. Considering the fact that to express an opinion it is necessary to weigh the positive and the negative aspects, we believe that the level of satisfaction is a good proxy for the cost-effectiveness ratio of this BL experience as perceived by the students.

3. Results

3.1. Outcomes: perceived effectiveness

4. In comparison to the traditional face to face model, with this BL model (face to face + distance lectures)	
4.1 the teaching effectiveness is 4.2 the teaching quality is 4.3: the quality of the didactic materials is 4.4: the teachers' didactic competences are	*much better (value 5)* *better* *the same* *worse* *much worse (value 1)*

Table 1. Questions concerning the perceived effectiveness

On average, the students, independently of the year of inscription, perceive the BL model at least as effective as the traditional face-to-face model, even if the average effectiveness perceived by the 2nd and 3rd year students is lower than the one perceived by the 1st year students (Table 2).

	Question	Average	Min	Max
1st year students	4.1	3,6	2	5
	4.2	3,4	1	5
	4.3	4,9	3	5
	4.4	3,8	1	5
2nd-3rd year students	4.1	3,2	2	4
	4.2	3,1	1	5
	4.3	3,3	2	5
	4.4	3,3	2	5

Table 2. Perceived effectiveness: average, min. and max. score.

This has an impact on the effectiveness index that is higher for the 1st year students (on average equal to 20%) than for the 2nd year students (on average equal to 10%) (Table 3).

	Question	Effectiveness index
1st year students	4.1	0,28
	4.2	0,21
	4.3	0,44
	4.4	0,39
2nd-3rd year students	4.1	0,11
	4.2	0,04
	4.3	0,16
	4.4	0,11

Table 3. Perceived effectiveness: effectiveness index values

These results indicate that OpenCampus had a higher positive impact for the 1st year students than for the 2nd and 3rd year students on the aspects analyzed by questions 4.1-4.4. A *t-test* confirmed the existence of a difference in perception between 1st year students and 2nd and 3rd year students.

3.2. Outcomes: perceived quality of students' life

6.The quality of students life regarding	
6.3 the possibility to interact with the teacher and with the other students is 6.4 the workload, in comparison to the traditional classroom model, is 6.5 the digital transposition of the contents (didactic materials) is 6.6 the quality of the interactions with the teacher is	*much better (value 5)* *better* *the same* *worse* *much worse (value 1)*

Table 4. Questions concerning the quality of students' life

The students enrolled the 1st year seem to perceive an improvement, even significant, in the quality of their life compared to the one that they could have had with a traditional classroom model. Because this aspect was not present in the 2008 questionnaire (1st semester) for the 2nd and 3rd year students, we made use of the answers provided in the 2007 questionnaire (2nd semester) by the 2nd year students. The answers given are two-fold: on the one hand, there is an improvement with regard to the digital transposition of the didactic materials but also a deterioration of student-teacher interaction and workload (Table 5).

	Question	Average	Min	Max
1st year students	6.3	3,6	1	5
	6.4	3,2	2	5
	6.5	3,8	3	5
	6.6	3,5	2	5
2nd-year students (2nd sem.2007)	6.3	3,0	1	5
	6.4	2,6	1	5
	6.5	3,4	1	5
	6.6	2,9	1	5

Table 5. Perceived quality of student's life: average, min. and max. score.

Comparing the answers given by the two groups yields a more significant improvement of the life quality of 1st year students. The effectiveness index confirms this result (Table 6).

	Question	Effectiveness index
1st year students	6.3	0,30
	6.4	0,12
	6.5	0,40
	6.6	0,24
2nd-3rd year students	6.3	-0,01
	6.4	-0,22
	6.5	0,20
	6.6	-0,06

Table 6. Perceived quality of students' life: effectiveness index

The deterioration of the quality of life endured by 2nd year students is however not surprising given the fact that the 2nd year program is the toughest of the entire *cursus studiorum* offered by the SSIG.

3.3. Input: time

7. Is the time of learning required by 1 hour of lecture at a distance equivalent to the time of learning required by 1 hour of face-to-face lecture?	*Si* *No, it's lower* *No, it's higher*

Table 7. Question concerning the learning time

The project OpenCampus seems to have a different impact on the time of learning for the 1st year students than for the 2nd-3rd year students. Whereas most 1st year students state that the learning time for 1 hour of lecture at a distance is equivalent or lower to the learning time for 1 hour of face-to-face lecture (56%), almost all the students of the 2nd and 3rd year state that 1 hour of lecture at a distance requires a higher learning time than 1 hour of face-to-face lecture (84%). These answers do not allow us to conclude that the BL is more *time consuming* than the traditional face-to-face lectures.

However, the results of questions 6.1 and 6.2 also show that the BL facilitates a better management of time by the students. Almost all the students state that the they can "much better" or "better" decide when and where to study (83,7% of the 1st year students and 65% of the 2nd year students) or the time to dedicate at each lecture topic (88,4% of the 1st year student and 62,5% of the 2nd year student).

Hence, the results of the time analysis contrast when considering both the learning and study time so we can not conclude, at least with regard to the 2nd year students, that the project OpenCampus had a net positive impact on time and, as a consequence, on the costs related to this aspect.

3.4. Students' satisfaction

16. On a scale from 1 to 10:	
16.1 How much do you want this experience to continue in the future?	*1-10*
16.2 How much do you agree with the sentence "don't stop it but improve it"?	
17.What is your overall opinion about this BL experience?	*Very good (value 5)* *Good* *Not good not bad* *Bad* *Very bed (value 1)*

Table 8. Students' satisfaction questions

As announced in the introduction, the main objective of this paper is to analyze the costs and the effectiveness of the project OpenCampus taking the students' perspective. Doing that, we encountered the common cost data access problem to the application of traditional cost-

effectiveness ratios (Rice, 1997; Levin and McEwan, 2002)[4]. Hence, we make use of the students' level of satisfaction, captured by the questions in table 8, as a proxy of the cost-effectiveness ratio. Table 9 describes the average, the min. and the max. score of the answers to these questions.

		1st year students			2nd-3rd year students		
		Av.	**Min.**	**Max.**	**Av.**	**Min.**	**Max.**
16.1	On a scale from 1 to 10	8,5	5	10	8,2	1	10
16.2		9,2	5	10	9,2	1	10
17	On a scale from 1 to 5	4	1	5	3,9	2	5

Table 9. Students' satisfaction questions: average, min. and max. score.

Given the fact that the level of satisfaction expressed by the students is rather high we can conclude that this BL experience produces a perceived net benefit. In other words, the OpenCampus project has been perceived as a cost-effective experience (even if the 2nd year students state that it is still possible to improve it).

4. Conclusions

As a first conclusion reachable with the few data here reported, we can briefly summarize as follows:

- it was not possible to follow the methodology accepted by the main literature (e.g., Levin and Mc Ewan, 2001; Muenning, 2002; Rossi et al., 2004) because of a lack of accessible cost data;
- for this reason a perceived cost-effectiveness ratio was estimated;
- the use of a perceived cost-effectiveness index could help to overcome the data collection problems characterizing almost all the cost-effectiveness analyses.

Further analysis and new data collections will allow us to deepen much more the problem, and eventually to reflect on the cost-effectiveness method presented.

[4] This problem is also the consequence of a missing parameter in the questionnaire: we asked to the students if the time of study required 1 hour of BL lecture is the same/higher/lower as the one required by 1 hour of face-to-face lecture. But we did not asked them to quantify the eventual time variation.

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Quality in eLearning.
Some results from a national research program

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Abstract

Quality is an open concept.
Something has a good quality when the most salient of its characteristics have a positive value. What are this relevant features? It depends on the interest of who is judging the quality.
Therefore the idea of quality can be separated neither from the object under examination, nor from the point of view selected by the evaluator.
It is important also to choose when and how to evaluate quality.
This paper -realized within the PRIN -National Interest Research Project- entitled "Comunità di apprendimento per la didattica universitaria in ambienti open source"[1]- analyses the criteria for evaluating the quality of an academic eLearning course and it claims that a quality analysis model needs to be created *ad hoc* for the context in which it is going to be applied. If the model we want to use was created for a different environment, it has to be carefully adapted for our one.

Keywords: quality in eLearning, quality assessment, method and tools

1. Introduction

Quality is a mutable and open concept.

Something has a good quality when all, or the most salient, of its characteristics have a positive value.

Unfortunately, to define the relevant features of something its a challenging issue, because they depend on the interest of who is judging the quality.

Therefore the idea of quality cannot be separated neither from the object under examination (here it is the eLearning in the academic environment), nor from the point of view selected by the evaluator.

Finally, once the salient characteristics are settled, we must choose when and how to evaluate their quality.

2. Stakeholders, levels and times for the quality analysis

2.1 Stakeholders

Priorities, expectations and needs change from one person to another, according to her/his

1 "Learning communities for university teaching in Open Source environments"

role.

eLearning stakeholders[2] are many, for instance:

- people in charge for decision;
- learners;
- teachers;
- tutors;
- ...

This list is widely variable, in fact the responsibilities pertaining to any role can be split and reassigned to the others, depending on the available resources.

Each stakeholder has his own aims, which should live together with the aims of the others. For this reason it's essential to define each role, to enhance its contribution and to underline the importance of the cooperation among all of the stakeholders and of the negotiation for the use of the available resources.

A shared knowledge about the assignment of duties and responsibilities is necessary, in order to facilitate and improve both communication and interaction.

2.2 Levels and times for the quality analysis.

Quality analysis must consider the whole framework in which the educational course takes place, to be really effective.

In literature we find three different level of academic eLearning quality analysis: the institution, the degree and the course.

Furthermore we can lead our survey in three different time points: *ex ante*, i.e. before the beginning of the educational activities; *in itinere*, i.e. in progress; *ex post*, i.e. after the activities are done.

Combining all these possibilities, we obtain nine level/time points of view for the analysis:

institution – ex ante	institution -in itinere	institution – ex post
degree – ex ante	degree – in itinere	degree – ex post
course – ex ante	course – in itinere	course – ex post

We need therefore to define stakeholders, levels and times, since different dimensions, models, methods and tools can be more or less suitable for the characteristics of our quality analysis survey.

2 "Stakeholder: A person with a vested interest in the successful completion of a project. (http://www.learningcircuits.org/glossary.html) (2008/02/25)

3. Dimensions and models.

Besides stakeholders, levels and time points, there are four dimensions to take into account for an accurate analysis. This dimensions are: pedagogical, organizational, economic and technological. According to Barchechath, their hierarchic position can vary depending on the point of view, but in any case, they constitute a system and they cannot be considered separately.[3]

There are several factors, as we said, to consider. Therefore we need a model to help us to focus the relevant elements for describing the subject of our study.[4]

The SLOAN-C model, in our opinion, is really suitable for the eLearning quality analysis.[5] SLOAN-C is an american consortium that has been dealing with eLearning quality for years and that summed up its point of view in *The Sloan Consortium Report to the Nation: Five Pillars of Quality Online Education*.[6]

These five pillars are:

I. LEARNING EFFECTIVENESS – interaction between learners, teachers and contents is the key;

II. STUDENT SATISFACTION – quick and customized services; high-quality learning results;

III. FACULTY SATISFACTION – moral and administrative support, reciprocal respect between eTeachers e traditional teachers;

IV. COST EFFECTIVENESS – cost control. For example use of the technologies to improve the learning efficacy, decrease the drop-out rate, solve the problem of the overcrowded buildings and lower expenses;

V. ACCESS – students (impaired or not) must be given the opportunity to find out by themselves how effective, satisfying and financially convenient eLearning is. It is essential to pay attention also to the "digital divide", which is still a problem.

4. Defining a contextualized approach. The experience of the University of Trento.

Within the theoretical framework of the SLOAN-C model, we took into consideration the methods and the tools available for the quality evaluation.

By **method** we mean an organic set of rules and principles, that constitutes a basis for an

3 E. Barchechath (1996), La progettazione dei sistemi formativi a distanza dal punto di vista economico, pedagogico e organizzativo, in M.A. Garrito (ed), *La multimedialità nell'insegnamento a distanza*, Garamond, Roma.

4 A model can be seen as a theoretical scheme that delineates an object by highlighting the most salient features. The word "model" can be defined in many other ways, beside the one here suggested. See: Ghislandi, P. (2005), Didattiche per l'università, Edizioni Università degli Studi di Trento.

5 LabIndia, Laboratorio di Innovazione Didattica Accademica, i.e. Innovation in Higher Education Laboratory is a laboratory of the Cognitive & Education Sciences Department, University of Trento.

6 The Sloan Consortium is a consortium of institutions and organizations committed to quality online education http://www.sloan-c.org/ (27 February 2008)
See: Lorenzo G. & Moore J. C., *The Sloan Consortium Report to the Nation: Five Pillars of Quality Online Education* (2002) available at http://www.sloan-c.org/effective/pillarreport1.pdf (27 February 2008)

activity.

A **tool** is what we use to get something. In our case, it is the mean by which we can collect the information we need.

The most common methods and tools for the quality analysis are:

- standard
- best practices
- guidelines
- benchmarking
- rubric
- checklist[7]

The approaches we can use vary depending both on the level and the time we choose for the survey. When we design a course, we can use guidelines, best practices, checklists and standards. At the same time, rubrics, checklists and benchmarking are suitable for the evaluation -*in itinere* or *ex post*-, to check the presence of all of the necessary requirements, and to assess their implementation degree.

We notice that the factors leading to excellence are always similar among different approaches to the quality evaluation (Quality On The Line,[8] MECA-ODL,[9] Quality Matters Rubric[10], ...).

Anyway those approaches present at least two limits:

- they were created choosing one level of application and the point of view of one stakeholder;
- they were developed in their own particular context, so they may not fit other situations.

Within the "PRIN 2006 research program" many methods and many tools have been considered, in order to find the best one to evaluate some courses of the Cognitive Sciences faculty. None of the approaches we met suits perfectly our case, because we need a means of assessing courses which pays particular attention to the online learning communities.

To define a quality approach, that:

7 For a description of tools and methods see Pedroni A. *La qualità nella progettazione di eLearning.* Tesi di laurea. Università degli studi di Trento. 2007

8 *Quality on the Line. Benchmarks for success in Internet-based distance education* di Jamie P. Merisotis and Ronald A. Phipps (2000) is freely downloadable from the site of the Institute for Higher Education Policy (http://www.ihep.org 2008/02/20)

9 *MECA-ODL Methodology for the analysis of quality in ODL through Internet* is a benchmarking project of the Fundación Universidad-Empresa de la Universidad de València, supported by theEU within the Socrates Project. The whole material is at disposal at http://www.adeit.uv.es/mecaodl/ (2008/02/21)

10 The QM Rubric was developed within the Quality Matters Project (http://www.qualitymatters.org/), sponsored by MarylandOnline, a consortium for the promotion of excellence in eLearning, that joins together colleges and universities of Maryland http://www.marylandonline.org/ (2008/02/27)

- can be applied *ex ante*, *in itinere* or *ex post*, as needed;
- can be applicable at each stage of eLearning development

we have to formalize the procedures we implement and adapt day by day to solve problems arising during the design and implementation phases.

This will result in a collection of methods and tools classified according to their purposes and to the stakeholders they can be useful to. This will also be constantly growing and improving through use and, above all, this will suit perfectly the context in which it is going to be developed and applied, in our case the University of Trento.

Once this is done, we have to define level, time and dimension we are interested in, to chose the right methods and tools of quality course analysis.

To reach this goal the steps are:

1. define an approach suitable for the context;
2. evaluate and improve this approach;
3. apply it to the online courses;
4. use the feedback to improve:
   - the courses
   - the infrastructure underpinning the courses
   - the evaluation instruments themselves.

This way we get progressively to a tailor-made solution for quality evaluation, giving the right importance to the last stage of the instructional design, the quality evaluation, which is often neglected.[11]

5. One step toward our contextualized approach.

As we said, we chose the SLOAN-C five pillars as framework and we set that a suitable quality approach should be defined expressly for the context in which it is going to be applied.

Bearing in mind the importance of each one of the five pillars, we focused mainly on:

a. analysis of the faculty satisfaction concerning the quality of the online learning communities;
b. analysis of the student satisfaction, collecting the student's opinion through questionnaires and focus groups;

After a carefully analysis of methods and tools available in literature, we decided to create an

11 The ADDIE Model can give an idea of these stages, similar in all approaches. ADDIE is the acronym of: Analysis, Design, Development, Implementation, Evaluation. The last stage, evaluation, should be implemented during the whole process. A good description is available at http://ed.isu.edu/addie/index.html (2008/03/05).

ad hoc tool for the courses of the University of Trento. The kind of instrument we developed lies between a rubric and a checklist. It consists in a set of 40 items based on literature and on the direct experience of both the Trento research team and DOL designers (Dipartimento di Didattica Online – Online Didactics Department of the University of Trento).

These items are divided in 8 areas:

1. introduction to the course and general informations
2. educational objectives
3. learning assessment
4. resources and materials
5. students participation
6. technologies
7. students support
8. accessibility

Every item has a score (from 1 -important- to 3 -essential-), it can be ticked as present or absent and it is followed by the comment of the evaluator.

Each course should be evaluated at least by three different people (like teacher, designer, etc.)for the survey to be really effective.

As we explained before, this tool should be applied on the courses and then the feedback should serve as a basis for improving the courses and for reviewing the tool itself.

Of course, it is far from being a definitive tool. It need to be improved through use and revision, as we said, but moreover each one of the eight areas have to be evaluated more deeply, always taking into account the specific course under study.

Other research lines within PRIN06, in fact, are related to

- the creation and the validation of a tool for the analysis of the asynchronous forums of a learning community (in relation with the learning assessment and the student participation);
- the study of the accessibility problem, in particular for purblind people (related to the accessibility area of our tool).

Cultural capital, learning and ICT in a southern Italian university

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Abstract

In the university setting, e-learning courses represent a flexible resource that can tackle a range of difficulties pertaining to primary degree courses and post-graduate qualifications. With reference to the teaching of Social Science Methodology within a primary degree course in an Italian university, this article suggests that e-learning can help new students with weak cultural capital to overcome some of the difficulties that can often lead them to drop out of university.

Keywords: cultural capital, quality, e-learning, social science methodology

1. Introduction: E-learning and quality

With reference to other industrialised countries in Europe, Italy has relatively low rates of educational attainment. In 2007, half of the Italian population between 25 and 64 years of age had only a lower intermediate Secondary School qualification, placing Italy at the bottom of the list of European countries. Sadly, this percentage is even higher in the South of Italy (OECD, 2007; Istat, 2008).

As far as the secondary school and third level education systems are concerned, although the percentage of people with higher qualifications is increasing, Italy remains below the European averages (OECD, 2007).

Efforts to increase the educated section of the population encounter difficulties which cannot be described fully in this article. The quality of teaching (understood as involving the quality of the courses themselves as well as the means of communication used to transmit the contents of these courses to students) undoubtedly plays a crucial role. The "quality challenge" is equally relevant to traditional as well as online teaching, although we will only refer to the latter in this work.

In the context of online teaching, the scientific debate has emphasised the role of context and the specific needs and profiles of students, encouraging us to avoid overly-general discussions and to assume a more specific approach (E-learning papers, 2007; Ehlers, 2004; Ehlers et al., 2005; Trentin, 2008). For university teaching specifically, it is important to refer to the distinction between the primary degree cycle and post-graduate degree courses introduced by the most recent reform. In fact, quality can assume different meanings at these different levels, given their different learning objectives and the different needs and profiles of their students. As far as the Humanities, Social and Political Science are concerned, university teaching often has to deal with the weakness of students' cultural abilities (reduced reading and writing skills, poor general knowledge, a lack of specific knowledge about the area of study, weak study methods). This situation powerfully conditions the transition from school to university, a critical passage that has been characterised as being largely based on self-reflexive processes and practices (Coulon, 1997). Becoming a university student implies a continuous work of *bricolage* concerning the rules, a work of sedimentation and reorganisation of meaning and new experiences and an integration of new methods for the comprehension of social life (Coulon, 1997). The cultural inadequacy of students often translates into a strong sense of disorientation, which has been identified as one of the most typical characteristics of students during their first experience of university life (Portelli, 1995); it hampers, also, the establishment of relationships with fellow students and teachers and entering into

university life as a whole. Over time, these behaviours can decrease or even disappear or they can lead students to drop out university or to adopt a lower profile of work and expectations.
The teaching objectives of the primary degree courses, specific as they are, cannot bypass this situation. At the post-graduate level, however, the lecturer must seek to trigger a deeper understanding of research activities and to foster applied knowledge. In order to confront these different challenges, it is necessary to construct different kinds of courses at each level.

2. The student's cultural capital in a southern Italy university

In this article, we will try to reveal the logic which we referred to when constructing a course in Social Science Metodology within the degree course in Sociology at the University of Salerno. The course in Social Science Metodology, one of the first to be attended by students during their first year, poses specific challenges. These depend on the very nature of the discipline, essentially involving "meta-skills" (Meraviglia, 2004), as well as the many references it contains to the history, epistemology and philosophy of the social sciences.
These difficulties are much more serious where students are lacking an adequate preparation for third-level study. Here it is relevant to refer to the concept of cultural capital, comprising different forms of knowledge, skills, education and advantages (Bourdieu and Passeron, 1970). As indicators of such capital for our students, we used:

- Their parents' educational attainments
- The students' final mark in their secondary school diploma
- The students' geographical area of origin

As a result of this research, it is clear that our Sociology students have a very weak cultural background. In only 3.6% of cases, both parents have a university degree, while 38.5% of students come from families where both parents have, at most, a primary school education.
As regards the school experience of students, 34.6% of students received a final mark below 70 (out of 100). A more careful reconstruction of the educational background of Sociology students in relation to the type of school attended and the mark received by the student (which studies have shown to be strongly linked to the success of the university career (Diana, 2004) shows that only 7.4% of students can be referred to as *high profile* (having received a high school mark above 90 out of 100 from one of the prestigious "licei" secondary schools). On the other hand, 13.4% of Sociology students may be described as *low profile* (with a mark of 60-70 out of 100 from a less prestigious technical or professional high school) (Based on our own analysis of data from the SEDA UNISA system, 2006-7 academic year). The geographical and urban distribution of the student population, investigated in 2001, underlines that many students come from the interior rather than coastal areas, from small or very small towns rather than cities (Errichiello, 2004).
To this we must compare the statistics on early dropout. With reference to students entering the university during the 2005/6 academic year, early dropouts accounted for no less than 42% of students (Our analysis of data from the SEDA UNISA system, 2005-7), not far from the figure registered by Sociology students years earlier, and similar to that indicated by Fasanella in relation to 2003/4 for students of Sociology in southern universities including Napoli, Lecce and Catania (Fasanella, 2007).
Such high dropout rates can be explained, in our opinion, also as a consequence of the distance between university standards in relation to knowledge acquisition, modes of communication and social interaction, on the one hand, and the cultural capital possessed by many students, on the other.

3. Teaching Social Sciences Methodology online: a report from a primary university degree course

The idea of supporting traditional lessons by using online courses developed amongst sociologists at Salerno on the basis of these kinds of considerations. This initiative was linked with broader considerations regarding the characteristics of the student population, including differential and irregular rates of attendance at lectures and the widespread intention to increase attendance rates in order to improve quality (D'Esposito et al., 2005). Nevertheless, the context described above also played un important role.

From 2001 onwards, online teaching has developed along two different trajectories which were subsequently generalised to the university as a whole (Vento et al., 2008): blended courses (with online schedules, calendars, course materials and exercises), and truly online courses, to which belongs the Methodology course. Its design, with teaching staff playing the most important role, has been developed by singling out teaching aims – general as well as specific (in this article, however, we will only illustrate the former) – and the subsequent choice and implementation of specific solution.

Both are summarised in the following table:

General objectives	Solutions
• to create a community and networks between students	• asking students to represent themselves in the course using words, images, and audio files • offering a student communication space (online café)
• to create structured pathways of studying	• dividing work into modules and units • scheduling of course activities • general structure of pages
• to foster regular and continuous relationships with teaching staff	• mail • forum • occasional recourse to simultaneous online teaching
• to foster acquaintance with the wider academic community	• short video interventions by qualified sociologists on specific topics • audio files • identifying and visiting the best professional and academic web sites
• to stimulate student activity • to connect the student to the wider web learning society	• forum and collaborative tools • encouraging frequent research on the web
• to overcome reading and writing difficulties by using multimedia approaches	• asking students to frequently produce short papers on all kinds of subjects

Table 1: Objectives and resources employed by Methodology's course

One of the aims at the centre of the planning process was to create, via the web, a social context of learning that connects different students, that brings students and lecturers together within the context of the wider scientific community (Siemens, 2008), helping them to overcome their educational weaknesses and to acquire scientific methods and a shared professional identity.

In addition to the specific solutions outlined in Table 1, great emphasis has been placed on designing user-friendly pages for each "lesson", in order to provide a pleasant and supportive study environment, with the aim of encouraging, by their design, regular work habits and stimulating the autonomous search for new knowledge (see Figure 1). In fact, each page contains links to different kinds of materials – written articles, exercises, online resources – which are organised in different sections. We also rely on written as well as visual and audio communication.

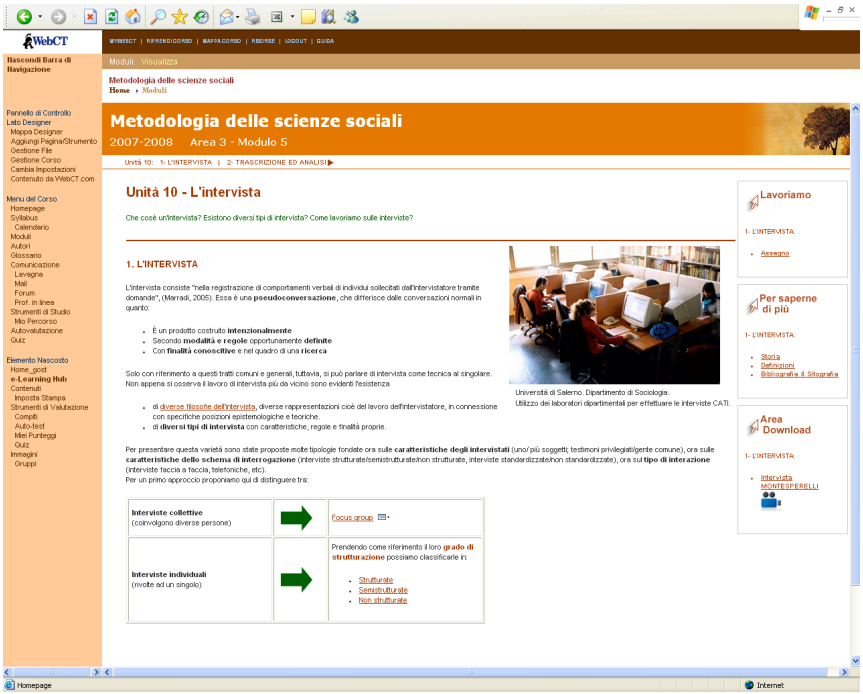

Figure 1: A page from the online Social Science Methodology course

Concluding these brief observations, and as an indication of the results of our work, we merely note that the monitoring activities carried out since 2001 have revealed the consolidation and stabilisation of a real student "learning community" which has demonstrated the capacity to generate a significant improvement in communication with lecturers. In any case, the exam results for the online Methodology course have been broadly satisfactory.

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Argument elaboration during structured and unstructured dyadic chat discussion in secondary school

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Abstract

This study aims to investigate whether structuring an interaction supports students' elaborative argumentation. The study compares the quality of secondary school students' (N = 16) argumentation during dyadic structured and unstructured computer-based chat interaction. The results suggest that structuring an interaction increases the proportion of argumentative discussion, whereas unstructured discussion seems to produce more elaborated argumentation. However, the results indicate that the discussion topic must be debatable in order to achieve critical and elaborative dialogue. Structuring an interaction can be used to foster counterargumentation on the topics that do not spontaneously provoke different viewpoints.

Keywords: argumentation, argument elaboration, structured chat, unstructured chat, secondary school

1. Introduction

Participating in general debates on many societal questions requires that we can express our thoughts and statements in a clear and convincing way, as well as consider and judge others' views and arguments constructively. This, in turn, depends on the quality of persons' argumentation skills. However, several studies have shown that adolescents have difficulties with these skills (e.g. Felton & Kuhn, 2001; Marttunen et al., 2005).

In addition to the need to learn to argue, argumentation can be seen as a means to learn. Argumentation is a dialogical and dialectical phenomenon which can be integrated with a transformative view of knowledge. An argumentative dialogue helps students to elaborate their viewpoints by broadening and deepening them. However, engaging constructively in an argumentative interaction is a demanding task. This study focuses on whether structuring a synchronous chat interaction promotes students' elaborative argumentation.

In synchronous chat discussion a number of issues can be considered concurrently. Having to articulate opinions and arguments more precisely clarifies participants' own thought-processes (Burnett, 2003). Synchronous chat interaction has also been found to help students to express more substantial, sound, and logical arguments, and to offer examples and justifications more sharply to the point (Morgan & Beaumont, 2003). However, the pressure to contribute quickly can cause discussions to diverge rapidly, making it difficult to explore ideas in any depth or to explain argumentative relations between claims, reasons and justifications (Burnett, 2003).

Structuring a discussion by using prompts such as questions can help to maintain focus on the subject matter, decrease off-task talk, and lead to a more coherent discussion on the topic (Hron et al., 2000). In particular, structuring an interaction in order to facilitate counterargumentation is a good way to enhance the quality of discussion. According to McAlister et al. (2004), the argumentation process was more coherent, varied, and deeper when structured chat with sentence openers (such as "I disagree because…") was used compared to unstructured chat.

The research questions of this study are the following: 1) How argumentative are students' dyadic chat discussions?, 2) Does the mode of chat (structured vs. unstructured) or the

discussion topic (Vivisection vs. Gender equality) have an effect on the argumentativeness of the discussions?

2. Method

2.1. Teaching experiment

16 students participated in a teaching experiment carried out in a Finnish secondary school as a part of a course in Mother Tongue. The experiment during two 90-minute sessions on different days consisted of four phases: 1) Introduction and motivation, 2) Preparation, 3) Discussion, and 4) Diagram construction. However, this study focuses only on the discussion phase of the experiment.

The discussion topic for the first session was Vivisection and Gender equality for the second session. The students were divided into two groups according to their schedule during the week the experiment was carried out. During the first session group 1 discussed the topic in pairs using the unstructured chat, and group 2 using the structured chat. During the second session the order was reversed.

During the introduction and motivation phase (25 minutes) the researcher taught the students the template categories of the structured chat and how they can be used during a discussion. To motivate the students to the discussion the students were asked to fill in a short cloze test on Vivisection, and in the second session they discussed the role of gender in working life and student counselling. Next the students prepared themselves for the chat discussion by reading (20 minutes) three articles consisting arguments both for and against the topic.

During the discussion phase the students engaged in chat in pairs for 15 minutes. The teacher formed the student pairs as to maximise the number of mixed gender pairs. The task was as follows: *Engage in a chat discussion with your partner on the following claim: Vivisection should be allowed (or: There is Gender Equality in Finland)*. After the discussions the student pairs constructed an argument diagram (20 minutes) on the basis of the discussion they had just finished.

Chat discussions were carried out using either an unstructured or a structured chat tool. The unstructured chat tool was an ordinary synchronous textual chat tool. The structured synchronous chat tool consisted of a set of templates (Hirsch et al., 2004). These templates (Table 1) contain four categorised sets of full sentences or partial sentences: 1) Argument, 2) Explore, 3) Opinion, and 4) Comment.

2.2. Data and analyses

The data consist of 16 dyadic chat discussions (speech turns, $N = 609$). Eight chat discussions concern Vivisection, and eight Gender equality. Eight discussions were carried out by using unstructured chat (420 speech turns), and eight by using structured chat (189 speech turns).

The data analyses focused on the *argumentative quality* of the chat discussions. First, all the speech turns were defined as either argumentative or non-argumentative. Second, the argumentative structure of the discussions was analysed by differentiating the claims, arguments, counterarguments, and rebuttals (Björk & Räisänen, 1996). Third, the following variables were formed: *Argumentativeness* of the chat discussions was indicated by counting the proportion of argumentative speech turns in the discussions. *Breadth of argumentation* was defined by counting the number of arguments and counterarguments directly linked to the main thesis. *Number of arguments for, and against* the main thesis were counted to assess how balanced the argumentation was. *Depth of argumentation* was defined by counting the mean length of all the argument chains (the number of arguments and counterarguments

successively linked to each other) included in the discussion. *Counterargumentativeness* of the chat discussions was indicated by calculating an index which depicts the critical quality of the argumentation in the discussions. The index indicated the proportion of counterarguments and rebuttals in relation to claims and arguments (if the students had reacted to every claims and arguments presented by expressing a counterargument or a rebuttal, they would have scored the value 1.0).

Table 1. The templates of structured chat including the examples of the data

Categories		**Templates**
Argumentative categories	Argument	1) Could you give an argument for statement X? 2) I support statement X because *several Finnish women have gone far in our country.* 3) Could you give an argument against statement X? 4) I attack statement X because *men don't yet seek their way equally also to "female fields".*
	Explore	5) Could you clarify statement X? 6) I would like to clarify statement X by saying *that in general gender equality comes true.* 7) There is a problem between statement X and statement Y because *men have, however, a full freedom to seek their way to "female fields".* 8) I retract statement X because *attitudes of society and circle of acquaintances affect greatly in the situation.* 9) Could you give an example to justify statement X? 10) I would like to justify statement X by saying *that in our school there is one nameless male teacher of maths who cannot understand that also girls can be good in maths.*
Non-argumentative categories	Opinion	11) I don't agree with statement X. 12) I agree with statement X. 13) I changed my opinion about statement X. 14) What is your opinion about statement X?
	Comment	15) Hello! 19) Hurry up! 16) Bye! 20) Slow down! 17) My turn. 21) I would like to talk about statement X. 18) Your turn. 22) I see what you mean.

3. Results

The results (Table 2) show that on average in the chat discussions half (49 %) of the speech turns was argumentative. The students expressed on average somewhat more argumentative speech turns in the structured chat discussions than in the unstructured chat discussions (54% vs. 45%), in particular when the topic was Gender equality (51% vs. 36%).

The mean breadth of the chat discussions was 3.0. The unstructured discussions contained on average more arguments and counterarguments than the structured discussions (3.5 vs. 2.5), but only in the discussions on Vivisection (3.8 vs. 1.8). In addition, in the unstructured discussions the argument chains were on average longer (depth of argumentation) than in the structured discussions (5.3 vs. 3.9).

During the unstructured discussions the students produced on average more arguments for the main thesis than against it (2.6 vs. 0.9). However, the result was reversed in the structured discussions (1.1 vs. 1.4). In addition, the structured discussions contained on average more arguments against the main thesis than the unstructured discussions (1.4 vs. 0.9), in particular when the topic was Gender equality (1.5 vs. 0.5).

The discussions on Vivisection were more counterargumentative than the discussions on Gender equality (3.1 vs. 1.2). However, the structured discussions on Gender equality were twice as counterargumentative as the structured discussions on Vivisection (1.6 vs. 0.8).

Table 2. Argumentative quality of the chat discussions by topics and modes of chat

Variable	Mode of chat	Topic		
		Vivisection (M)	Gender equality (M)	Total (M)
Argumentativeness: Proportion of argumentative speech turns (%)	Unstructured	53.8	36.0	44.9
	Structured	56.1	50.9	53.5
	Total	55.0	43.4	49.2
Breadth of argumentation	Unstructured	3.8	3.3	3.5
	Structured	1.8	3.3	2.5
	Total	2.8	3.3	3.0
Number of arguments FOR the main thesis	Unstructured	2.5	2.8	2.6
	Structured	0.5	1.8	1.1
	Total	1.5	2.3	1.9
Number of arguments AGAINST the main thesis	Unstructured	1.3	0.5	0.9
	Structured	1.3	1.5	1.4
	Total	1.3	1.0	1.1
Depth of argumentation	Unstructured	6.3	4.3	5.3
	Structured	4.3	3.6	3.9
	Total	5.3	4.0	4.6
Counter-argumentativeness	Unstructured	3.5	0.8	2.1
	Structured	2.8	1.6	2.2
	Total	3.1	1.2	2.1

4. Conclusion

The results suggest, first, that the argumentative quality of the chat discussions seems to be related to the mode of chat. Structuring a synchronous discussion seems to promote argumentative interaction between students. Second, structuring maintains the students' focus on a few arguments, and directs them to elaborate their arguments in particular through counterargumentation.

Third, the results showed that Vivisection as an ethical issue raised elaborative argumentation. But, the other topic, Gender equality, was not as a disputable topic as Vivisection. However, it seems that structuring an interaction can be used to foster critical discussion on this kind of topics that do not spontaneously provoke different viewpoints.

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Collaborative Knowledge Construction in Online Vocational Teacher Education

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Abstract

The purpose of this paper is to build a picture of knowledge construction models in online education. The study describes the knowledge construction process of a group of vocational teacher education students in an online learning environment. In the online studies, a model of progressive inquiry was applied. The students worked in small groups throughout the learning process. The phenomenon in question has not been previously researched very widely.
The student group was heterogenic, so the learning strategies were also individual. The students had varied backgrounds with Master's level or PhD degrees on very different fields. The field of specialisation also has its effect on the preferred learning strategies. The vocational teacher education programme consists of 60 credits and it can be completed within one academic year.
The research consists of three phases, in accordance with the hybrid model introduced by Schwarz-Barcott and Kim (2000). During the theoretical phase, information regarding knowledge construction was sought in literature and practical teaching work. In the empirical phase, a narrative approach was applied to compile information regarding the collaborative knowledge construction and knowledge processing of the teacher students during the online discussions of their online teacher education study programme. The narrators are 20 writers in a UAS (University of Applied Sciences) environment in Southern Finland. The material has been collected during the academic year 2007-2008. In the analytical phase, knowledge construction in e-learning is described as a synthesis of the theoretical and the empirical material.
The results gained in the analytical phase suggest that the collaborative knowledge processing in the online discussions is affected by a knowledge construction theory that will be introduced in this article. The knowledge construction process is dependent on various factors, such as cultural and social matters, learning strategies and features of the learning environment. Another crucial aspect revealed by the analysis is that the complexity of the learning content should be faced already at the beginning of the studies. At this point the need for guidance is also at its greatest.
The results of this study are preliminary and at this point we have only concentrated on knowledge construction in online discussions. The applications of e-learning are however increasingly versatile and deepening pedagogical understanding in different online educational contexts will require further research. Our purpose is to extend the knowledge construction study towards social media applications during next academic year.

Keywords: collaborative knowledge construction, narrative method, online discussions, hybrid model, vocational teacher education

1. Introduction

During the recent years, online discussion forums have become an increasingly used tool for educational purposes. However, the full potential of this tool has not been very widely studied. Very often the use of the discussion forums in teaching is limited to individual assignment submission, agreeing on practical matters, or it is used in a minor pedagogical role, as an attraction of novelty. While all the aforementioned undoubtedly serve their purpose, the interest of this study lies in online discussion forums as enriching knowledge-

building communities where the learning does not just include, but is based on collaborative knowledge construction.

The purpose of this paper is to describe the knowledge construction process of a group of vocational teacher students at the Teacher Education Centre of TAMK University of Applied Sciences. In order to gain understanding of how an online knowledge-building community is formed, how it works, and how the approach could best be used in teaching, the phases of the collaborative knowledge construction process were sought in the online discussions. A narrative research method was used for studying the data.

2. Methodology

The narrative philosophy derives from the problem of comprehending the uniqueness of human experience and existence (MacIntyre 1981, Taylor 1985). The concept of a narrative (lat. narrare) is understood as presentation of a story in form of symbols. According to Gudmundsdottir (1996), one narrative can consist of various stories that can be interpreted in different ways. When the narrative is understood as a research approach, we are referring to the ontology of the phenomenon being researched, the nature of knowledge and epistemology (Munhall 1993). According to the ontological grounds of the narrative, the narrator is an active, meaning-creating person, in this case a teacher student. The conception of an individual narrator modifies the common experience. Therefore the interest in this study lies in the phenomena brought up by the teacher students during the collaborative knowledge construction process. (Nilssen et al.1998).

According to Rauhala (1981e), experience is the relation of the mind to the world or itself. It is conveyed to the consciousness through perception in a given time and place. Vygotstky (1962) sees the development of inner speech as a fundamental step in the development of the psyche. When language is used for communication with others, it can also be consciously used as a tool for individual thinking. Vygotsky's idea of communication between outer and inner speech can be applied to describing the relation between the narrative and inner story.

The narrative is intertextual communication between the sender and the receiver. It can also be identified as spoken and written discourse on a phenomenon. (Magliola 1970, Burgos 1988, Cohan & Shires 1988, Genette 1990). Linguistic expressions form a window to the mind (Rauhala 1995). It is also the basis of human interaction and knowledge transfer. Knowledge is not restricted to what an individual person knows, but it is a composition of overlapping and nested knowing of various persons (Webb & Blond 1995, 624). Through this window one can also observe the experience that in this study evolves around knowledge construction.

3. Knowledge construction – adaptation to the environment

The findings of the study are also supported by Piaget's adaptation theory and his ideas regarding the significance of social interaction in knowledge construction. According to Piaget, knowledge construction takes place through assimilation and accommodation, the two complementary processes of adaptation. In assimilation, new information is adapted to the existing knowledge structure of the learner. Sometimes, however, the new information is contradictive, and does not seem to fit in the old knowledge structure. This leads to a cognitive conflict. In such cases the knowledge structure must accommodate itself to the new evidence and adapt to it. This process involves reflection, i.e. testing "what if" assumptions

in order to find an explanation to the new perceptions. (Piaget, 1985, Von Glasersfeld, 1997).

Piaget believes that social interaction activates individual thinking processes. He sees peer interaction as an especially effective tool for this as it creates cognitive conflicts. Relying on each others' feedback and interaction, learners work as a part of the mutual construction process. Not only is the experience shared, but the meaning of the experience becomes the product of joint construction (Youniss & Damon, 1992).

Sagan (1980, in Bielaczyc & Collins 2006) describes the early development of modern science among the Ionians who formed one of the first knowledge-constructing communities. Sagan sees three key characteristics in the Ionian society that enabled this development: 1) freedom and encouragement to inquire; 2) conflict of cultural perspectives and 3) the importation of writing as a tool for thinking (In Bielaczyc & Collins 2006, p. 39).

These characteristics can be found in the knowledge-constructing community of teacher students of our study. Based on progressive inquiry, the studying methods required active question-setting. Moreover, the diverse background of the students brought varying viewpoints to the discussions - not to mention the elemental role of writing as a tool for thinking and reflecting in online discussion forums. As Bielaczyc & Collins (2006) mention, an online discussion forum offers a space where ideas are visible for everyone and available for discussion and improvement. Thus a social context is formed, where, according to Glaser (1991, in Von Wright 1992), the thinking processes of the learners are displayed, enabling individual as well as collaborative reflection.

4. Analysis of the data

The analysis of the data was started immediately once the narratives were received. The data consists of 162 discussions, the number of entries varying from 6 to 34.

The analysis methods of studies applying narration derive from the sociolinguistic tradition, where the narrative is seen as a form of discourse. The aim is to convey the original narrative to the reader as accurately as possible, enabling the reader to evaluate the interpretations of the researcher (e.g. Riessman 1993).

The data was studied applying the analysis of narrative data in a holistic-content perspective manner described by Lieblich et al. (1998). The texts that were read repeatedly both as individual parts and as a whole resembled a dialogue where the data itself was telling its story. We formed thematic areas, searching for more exact themes concerning the knowledge construction. Conclusions were drawn on this basis, first from individual narratives and furthermore from the combination of narratives. The classification of the main themes enabled the observation of the constructed image from the viewpoint of similarities and differences.

At the beginning of the studies the knowledge construction through the online discussions was not yet fully used. The students mainly used the discussion forum for practical arrangements, e.g. agreeing on schedules and working methods. However, quite soon the group work became a topic that evoked more discussion and led to knowledge building by sharing experiences and ideas. The discussions always started by introducing opinions.

”I think it’s good that the groups are formed randomly. This develops team work skills much better than working with a familiar group. The students must learn to work with all kinds of people.”

At the beginning, when the students did not know each other yet, the entries added after the expressing of opinions tended to agree with the previous comments or add something that was in line with them.

”I find Student X’s comment realistic. I’ve been to many job interviews and have always been asked the same question: what’s your educational background. No questions about skills or grades, it’s always about the title.”

Later, as the students learned to know each other better, contradicting opinions were introduced more freely, which led to deeper knowledge construction.

“I don’t really agree with Student Y about cognitive and written skills being so inseparably connected. Of course if you can’t write you can’t convey your message to others, but I believe a person can have very profound ideas of things even if he or she can’t write at all.”

Another feature that became more and more prominent as the studied proceeded was asking different types of questions. The questions enhanced knowledge construction in three ways:

1. General questions for introducing new aspects for everyone to ponder.

“Can the activities of a school be dependent on grades? What if a school is closed because of bad results? The resources of the teachers are already too limited for improving results just by teaching!”

2. Questions for finding out more and seeking for better understanding.

”There’s something about the idea of constructivism that I don’t quite get... even if a teacher had the most constructivist approach, will the teaching be meaningful if the student just isn’t interested in it?”

3. Personal questions asking for further clarification of an opinion.

“You said you don’t believe there’s competition in all subjects, for example in reading. But don’t you think that the pupils might like to compete against themselves, or that the better grade would be a great joy and a prize to the pupil that has been working harder than before?”

Typically, the discussions that covered topics that all participants found interesting ended up as long dialogues where the participants tried to understand the topic together. In discussions like this general questions were frequent. Also these discussions always started with the expression of one’s own opinions.

The students had diverse backgrounds and varying background knowledge on education. Some students used the discussion forum for actual studying, which led to a great number of questions for finding out more information. However, the more typical strategy of the students was “*knowledge is generated by action, i.e. the individual seeks information*

independently and then communicates it collectively to other learners", as one of the students expressed it. Often the students had first e.g. tested some teaching methods or studied literature independently, after which they shared their experiences in the discussion forum for the benefit of all participants.

Sometimes the students were already familiar with the topic being discussed. In cases like this the discussion was used for knowledge construction by organising and classifying concepts. The discussions often revealed that the learners were using concept maps for the organisation of knowledge.

"How about drawing another arrow and adding a box in "recognizing and creating opportunity"? I was just thinking that this aspect should be included."

Some topics aroused emotions. Such cases involved a great amount of personal questions and arguing. This became more frequent towards the end of the studies, probably as a result of the learners getting to know each other better and becoming more unconstrained.

It was remarkable that the discussions never came to a conclusion or a summary of any kind. They just died out and were left open so that they could be continued later if needed. This was seen as a clear advantage of online discussions: "*this asynchronous online studying very well enables the flourishing of even impulses like this!"* With this the student referred to sudden perceptions and ideas that come to mind while being engaged with her favourite hobby.

5. Conclusion

The aim of the study was to find out how the collaborative knowledge construction process is expressed in online discussion groups.

The analysis revealed regularities in the proceeding of the online discussions. Typically the discussions started with the expression of individual opinions, which were then developed to a dialogue or even a debate on the question at hand. During this stage different types of questions were used for constructing knowledge. The discussions never came to a definite end or a conclusion, but were left open.

It could also be noted that the discussions became longer and deeper towards the end of the study programme, probably due to the learners knowing each other better. This finding supports the idea of the efficiency of a knowledge-building society. A society like this cannot be formed at once, but it is developed over time. Online discussions seem to be a useful tool for knowledge construction especially in a longer run. As the dialogues are saved in the discussion forum, they remain available for completing ideas developed during the studies.

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Supporting learners collaborative knowledge construction by external representations

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Abstract

External representations can be powerful to support learners' collaborative knowledge construction. They can focus learners on aspects which are particularly important for the task to solve. In this study, we investigate different styles of pre-structuring shared external representations, a collaboration script and a content scheme. 159 university students participated in the empirical study. They were assigned randomly in groups of three to one of four conditions in a 2x2-factorial design with the factors of collaboration script and content scheme. Results show that learners benefit particularly from the content scheme. The scheme was able to influence learners' spoken discourse and focused it on aspects necessary for the task solution. Furthermore, also learners' collaboration outcomes benefit from the content scheme.

Keywords: computer-mediated communication; cooperative/collaborative learning; distance education and telelearning; distributed learning environments; human-computer interface

1. Introduction

External representations can be powerful to support learners' collaborative knowledge construction. In the style of a representational guidance, they can focus learners on aspects which are particularly important for the task to solve. Moreover, they could also change learners' perception of a task in a style that learners are able to deal more easily with this task. In videoconferencing, learners benefit from a shared application, which is common for all participants and makes shared external representations to a central part of collaboration. This study investigates how far different styles of pre-structuring shared external representations, either the style of a content scheme or the style of a collaboration script, affect learners' spoken discourse and learners' collaboration outcomes.

2. Background

The term of external representations is a very broad one and describes knowledge and structure which is displayed by physical symbols, objects or dimensions (see Zhang, 1997). Two aspects of external representation have particular importance in the context of learning:

the rather permanent availability of external representations and the feature that can be accessed by different persons at different times. When learners create external representations themselves, they document important steps in their knowledge construction process (see Hayes & Flower, 1980). Furthermore, Peper and Mayer (1986) stress that creating external representations during learning also activates learners' with respect to their cognitive activities. In contrast, when learners work with pre-structured external representations, various learning processes can occur, depending on style of external representation the learners work with. In this paper we focus on external representations which provide structure for the learners. These external representations can focus learners on aspects which are of particular importance for their task. Suthers (2003) calls this mechanism as "representational guidance". Besides this, the representational structure may also have an effect on learners' perception of a task (see Zhang & Norman, 1994). Such a changed perception of a task may enable learners to solve a task better or worse depending on how explicit the structure facilitates learners.

3. Instructional support by external representations.

These effects of external representations can be applied for dedicate instructional support. Thereby, we will focus on two different styles of external representations, either a script for collaboration or content schemes.

Collaboration scripts. If external representations provide explicit support, they are often called *scripts*. Scripts describe important strategies for the learners to solve a task. They often apply methods derived from scripted cooperation (cf. O'Donnell & King, 1999) or cooperative teaching (O'Donnell & Dansereau, 2000). However, these may be rather limited to a sequential application of strategies and only provide representational guidance to a limited extent.

Content schemes. In contrast to scripts, content schemes provide implicit instructional support. They provide and modify the representational context of a task by placeholders for important aspects. This may be realized by either providing facilities for concept mapping (e.g. Fischer, Bruhn, Gräsel & Mandl, 2002; Suthers & Hundhausen, 2001) or by providing tabular structures (e.g. Brooks & Dansereau, 1983; Ertl, Reiserer & Mandl, 2005; Suthers & Hundhausen, 2001). The structure of the scheme remains salient during collaboration and guides and focuses learners during collaboration (see Suthers & Hundhausen, 2001).

4. Research Questions

Research question 1: To what extent can collaboration scripts and content schemes affect learners' spoken discourse?

Research question 2: To what extent can collaboration scripts and content schemes affect learners' collaborative outcomes?

5. Methods

One hundred fifty nine undergraduate students of Education and Psychology took part in this experiment. 53 triads were assigned randomly to one of four experimental conditions in a 2x2-factorial design. We varied the factors of collaboration script (with vs. without) and content scheme (with vs. without).

Learners' task was to solve a case about a pupil's problems in math. They had to conduct an analysis to solve the case according to attribution theory collaboratively. Thereby, it was necessary to extract the important information from the case information and to classify causes, consensus and consistency of the causes and the respective attributions according to

Kelley (1973) and Heider (1958). During the collaboration, learners were connected via a desktop videoconferencing system that included (1) an audio- and video-connection and (2) a shared application to support the learners' collaborative case solution.

Collaboration script. The collaboration script gave the learners a guideline for solving the case which structured the collaboration in four phases and which provided specific activities for each phase:

In the *first* phase, each learner focused on text reading and the extraction of the relevant case information, individually. In the *second* phase, learners had to collaborate to exchange the different information they were given. They were asked to discuss the different causes and their power to explain the pupil's problems in school and to make a proposal for a joint case solution. Then the learners were given five minutes for individual reflection on the appropriateness of this jointly developed case solution (*third* phase). Finally, learners had 15 minutes to find the most plausible solution to the case (*fourth* phase).

Content scheme. Learners who were supported by the content scheme received as tabular pre-structure of the shared application. The content scheme visualized important aspects of the task and thereby provided an implicit strategy for performing an attribution (see figure 1). In the content scheme, the cause of the pupil's problems was the starting point for collaborative case-solving. The next category comprised the concepts of consensus and consistency. For this category, learners had to identify the respective information from the case material and determine whether the particular instance had a high or low value. Based on these determinations, learners then had to identify the corresponding attribution patterns according to the theoretical work of Kelley and Heider.

Cause	Information about		Attribution according to	
	Consensus	*Consistency*	*Kelley*	*Heider*

Figure 1: Structure of the content scheme.

6. Data Sources

To measure the effectiveness of the interventions, the learners' spoken discourse and the collaborative case solution were analyzed.

Analysis of learners' discourse. For analysing learners' discourse, the videoconferencing session was taped and transcribed. The transcripts were segmented into turns and checked for correctness of transcription. Two coders marked each utterance with respect to the categories of "cause", "information about consensus and consistency" and "attribution". The inter-rater-agreement was rather high (r = .91).

Analysis of the collaborative case solution. We analyzed the joint case solution, which was created by the in the shared application, as a measure of collaboration outcomes. Correctly identified units of meaning in the category of cause, consensus and consistency and attributions were marked and summed to a score for the respective category. To ensure the

objectivity of the analyses, two raters marked 10% of the documents. Inter-rater reliability of the coding was good (r = .87).

Statistical analysis. The statistical analysis was done with SPSS. Results for both research questions were analysed by the multivariate GLM procedure.

7. Results

Research question 1 dealt with the issue about how far the collaboration script and the content scheme were able to affect learners' spoken discourse. Therefore, we will focus on the three important aspects the collaborative task—on causes, on information about consensus and consistency and on the assignment of attributions. In the category of cause were no significant differences ($F_{(4,45)} < 1$; *n.s.*). With respect to the category of consensus and consistency, learners with script uttered descriptively less and learners with scheme uttered more regarding this category. The GLM could prove a significant effect of the content scheme ($F_{(1,45)} = 6.40$; $p < .05$; $\eta^2 = .13$). With respect to the assignment of attributions, learners with script uttered less. However, the GLM revealed no significant differences between the conditions ($F_{(4,45)} < 1$; *n.s.*). Comparing learners' utterances of causes, consensus and consistency and attributions, figure 2 shows that learners of all conditions uttered least about causes, more about consensus and consistency and most about attributions.

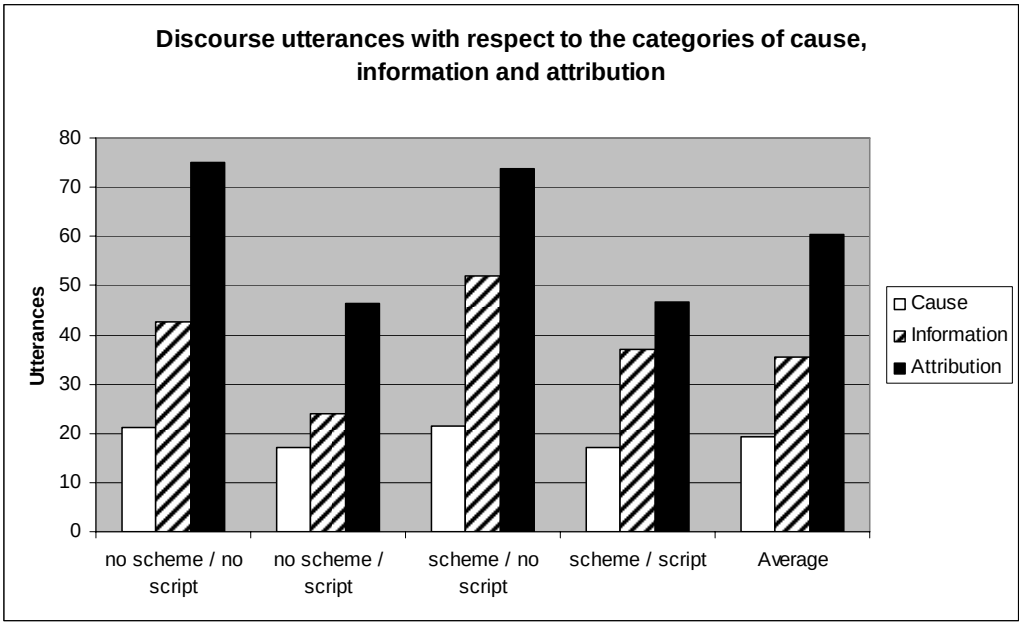

Figure 2: Discourse utterances with respect to the categories of cause, information and attribution.

Looking at *research question 2* and learners' outcomes, we can find differences between the categories of causes, consensus and consistency and attribution. With respect to causes, learners with content scheme noted less than learners without scheme (see figure 3). This effect was significant ($F_{(1,45)} = 6.88$; $p < .05$; $\eta^2 = .14$). Yet, regarding the category of consensus and consistency and regarding attributions, learners with scheme noted more. Learners with scheme noted significantly more about consensus and consistency ($F_{(1,45)} = 38.00$; $p < .001$; $\eta^2 = .46$) and also about attributions ($F_{(1,45)} = 27.47$; $p < .001$; $\eta^2 = .38$). Comparing the values of the three different categories (see figure 3), one can see that learners without content scheme worked more on causes than on information about consensus and consistency while learners with content scheme worked more on information about consensus and consistency.

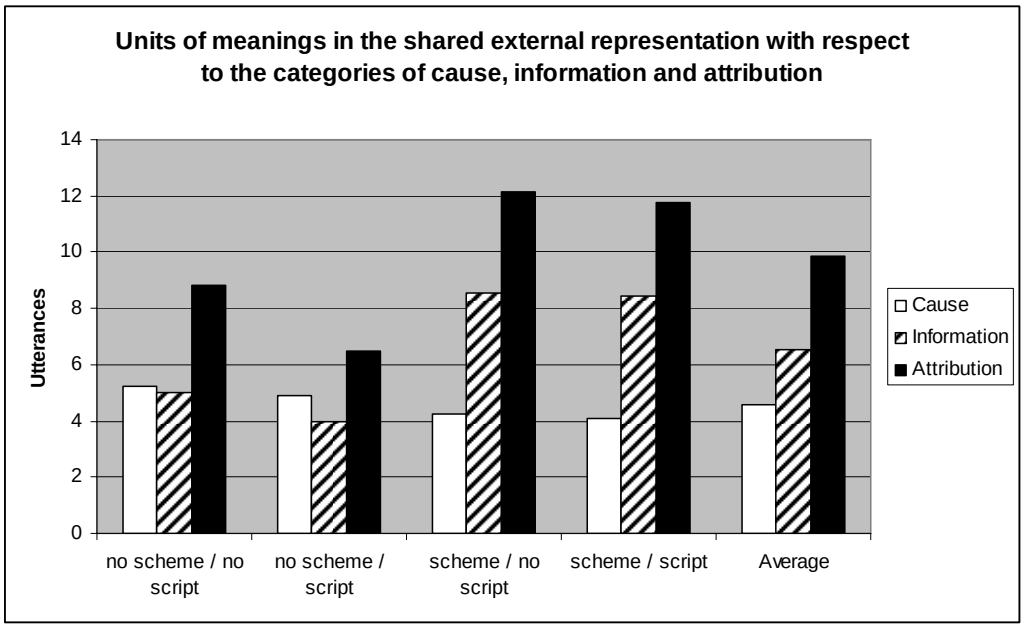

Figure 3: Units of meanings of learners' outcome with respect to the categories of cause, information and attribution.

Summary and discussion. Looking at learners' spoken discourse, the content scheme had an effect on the particular category of determining consensus and consistency. Learners with scheme were engaged more with respect to this category than learners without. This means that the scheme was able to facilitate learners' to work on consensus and consistency. Looking at the script, absolute values make obvious that learners with script made generally less utterances in all categories. This can be attributed to the reduced time of collaborative exchange for the learners with script. Yet, these learners had more time for dealing individually with the case material and respectively for reflecting about the case information. Considering learners' outcomes, the values reveal an interesting result: learners with content scheme were engaged less in providing causes, but more in providing the respective determination of consensus and consistency and in attributing the cause according to Kelley and Heider. The script did not make any differences with respect to learners' outcomes.

The results can disclose some of the particular mechanisms of the content scheme. Looking at the structure of the task, learners had to find causes (1 aspect), they had to determine consensus and consistency (2 aspects) and they hat to attribute the cause according to Heider (locality and stability, 2 aspects) and Kelley (one aspect). Therefore, the three categories should occur in the ratio 1:2:3 if applied appropriately. Looking at figure 2, learners kept these proportions quite well during spoken discourse in all of the four conditions. However, regarding the collaborative case solution (figure 3), learners without scheme focused mainly on naming causes but only determined half of the necessary aspects of consensus and consistency and also only a some of the attributions. In contrast, learners with content scheme named less causes, but they provided the respective determinations of consensus and consistency and the attributions for these causes. Therefore, content scheme was able to guide learners during working on the collaborative case solution by representational guidance (see Suthers & Hundhausen, 2001).

With respect to effects of the script, the study could not show any direct influences. Therefore, we have to assume that scripts hardly use the mechanisms of representational guidance—compared to the visual support mechanisms of schemes. Consequently, scripts may need additional trainings for being effective (see Rosenshine, Meister & Chapman, 1996).

Comparing collaboration script and content scheme, both support methods provided similar instructions for the task. However, the one worked as explicit guideline and the other as implicit visualization. This means that learners with scheme did not receive more instructional support, but it was implemented in an implicit style which may be easier for them to follow (see Zhang, 1997).

8. Scientific and educational importance

External representations can be quite beneficial for learning. By the mechanism of representational guidance, they can focus learners on important aspects for their collaborative task solution. This has consequences for the implementation of instructional support for learners. Designers of learning environments should consider how far they need to apply explicit instructional support. Maybe they could apply implicit support mechanisms and reach thereby an improved collaboration process and better collaboration outcomes.

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Collaborative strategies in on line communities of in-service teachers

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Abstract

The present paper analyzes a learning experience run at University of Macerata, during a post degree course for in service teachers and mature students. The course was delivered entirely on line, using a dedicated on line learning environment and proposed active and collaborative learning strategies to perform tasks and related activities. The whole course lasted one academic year and most of the 161 graduated applicants who enrolled in the Master were already working as teachers. During the intermediate phase of the course, students were asked to build collaboratively a didactic project to teach Italian language in their schools. The task focused on the final product, leaving the students free to choose how to design, organize and schedule their works. This paper aims to show how the ten groups, sharing both the path and the objectives, have negotiated their working modalities, in order to analyze different positioning in role setting, connections with the delivered materials, strategies implemented in decision making and during the design of the final projects. This research aims to inquire if there is a connection among groups' different working modalities and results obtained at the end of the course.

Keywords: collaboration, teacher, on line learning environment, project based learning.

1. Introduction

Collaborative strategies used in group activities have been the focus of a number of research areas in learning and didactics. Even a definition of collaboration is difficult to provide (Calvani 2005) and it is rich because of its complex factors and critical elements. According to Dillembourg (1999) it is possible to define collaborative learning as "a *situation* in which *two or more* people *learn* or attempt to learn something *together"*. From this definition a collaborative learning path is made of four elements: *situation, interactions, processes and effects*.

A *situation* is the context where the learning experience is proposed. There are situations that foster collaboration (e.g. discussion among peers and colleagues with a similar status) and something else that make collaboration more difficult. The *interactions* are the communicative relationships which take place among the group members. Different patterns of communication can have more or less collaborative meaning. Giving information or instruction is less "collaborative" than asking for advice or negotiating meaning. In the same way, some *processes* seems to be more intrinsically collaborative (e.g. grounding has a stronger collaborative flavour than induction) Dillenbourg, 1999). The *effects* of collaborative learning is the last element to analyze. It is quite difficult to define how to measure the effects in terms of learning, achievements and social skills and to relate these effects to the path or to the pattern used.

All the four elements are strictly linked (Dillembourg, 1999) as "the situation generates interactions patterns, these interactions trigger cognitive mechanisms which in turn generate cognitive effects", but they do not stand in such a linear connection. In fact most relations are reciprocal, so cognitive effects can impact on cognitive mechanism, that module interactions an so on.

Salomon (1992) states that effective collaboration is possible if there is genuine interdependence among the members of the group. Positive interdependence means that team members need each other to succeed. Salomon's description focuses on three points:

1. the necessity of *sharing information*, meanings, concepts and conclusions;
2. the necessity for *division of labour* into complementary roles
3. the necessity for *joint thinking* in explicit terms.

These three levels of collaboration represent a progressive shifting from a simple "sharing approach"(Rossi, 2005), which is the first level of group activity, through a cooperative work, to collaborative learning.

A similar approach is proposed by Rodden (1993). He suggests that collaborative activities often are managed by the group, as the teacher avoids to impose rules or strategies, which are created by the students during the activities. Strategies and work patterns must be shared and recognised by all the members engaged in the activity. Different activities require different levels of collaboration: Rodden (1993) calls *division of labour* and *shared mind* the two extreme polarities.

Division of labour is the simplest way to organize a group work: each member of the group works to complete a single part of the whole task. In this situation every student is directly responsible for a part of the product, and, at the end of the work, all the parts are collected to compose the complete artefact. The final collection is made directly by the group, or could be done by a coordinator, who leads the group and collects the various individual works in order to give coherence and cohesion to the whole project. Diaper and Sanger (1993) suggest to call this way of work *parallel strategy*, to outline that all the members work in the same time to different part of the work.

On the other side, *Shared mind*, is a strictly collaborative approach where each member of the group contributes to the creation of each single part of the final work. All the members of the group share positive interdependence and give each other continuous feedback related to the hypothesis and the proposals discussed by the group. Diaper and Sanger (1993) call this strategy *reciprocity strategy,* and point out that this strategy is linked to the most elevated interaction frequency. In fact it requires a remarkable degree of synchronism between the participants and a remarkable ability to debate and promptly resolve possible controversies and divergences with respect to the realization of the assigned task. These strategies are not mutually incompatible and often, according to the circumstances and the requirements, the collaborative work can adopt one or more strategies during the same project (Trentin, 1996; Manca e Trentin, 1996; Slavin, 1990).

2. Research Hypothesis

The present experience shows how working patterns used by the groups seem to define three main patterns of collaboration: 1. guided division of labour. 2. parallel strategy 3. reciprocity strategy. This paper aims to analyze how different strategies of collaboration could be related to results. Evaluation of result is provided by two evaluators: the first evaluator is the tutor who knows how the groups worked and how they managed to build the project; the second evaluator is a content expert, a university professor who did not focus on the learning path but only on the content and on the coherence of the product.

3. Context

The collaborative work we are going to present involved 45 teachers, attending the post degree course “Progettazione didattica curricoli disciplinari e ricerca educativa” for in service teachers and mature students. All the teachers work in the Humanistic subject area disciplines, and most of them teach Italian language. They were organized in 10 groups of 4 people, and 1 group of 5.

Teachers were asked to analyse some learning paths dealing with linguistic education, to choose one of those paths and finally to develop a project designing a learning path congruent with linguistic aspects, learning tasks and provided activities.

In particular, each group had to fulfil the following tasks:

- build a learning design according to the given indications. Your task is to research and manage materials to run the class work. Outline the chosen strategies and the phases of the project.
- use the forum to organize the work and, if needed, to divide the whole task in parts. Each member could upload his/her work as an attachment.
- Copy and paste all the parts in one complete document, write down the name of the authors of the work and finally one member of the group has to upload the complete document in the proper folder.

The whole task was to be completed in four weeks.

All the groups started with an initial preparatory phase, in order to choose the learning path and to start developing the learning project. Within two or three days, each group chose the theme to develop. Their choice was mainly based on criteria related to the possibility to use the activities in their real classrooms, to the ease in finding materials, to the content similarity with regard to the content traditionally offered within their schools.

The second phase started at this point and was developed using three main types of collaborative strategies that can be described as follows:

1) All the participants decided to assign a coordinating role to a member of the group, letting him/her distribute tasks and than structure in a single project the contributions of each member. Such a transfer of individual autonomy occurred in 2 of 11 groups and in both had a similar development. After the first phase, inherent to the choice of the proposal to be developed, three teachers have gradually delegated the fourth all functions related to the managing of work, in particular those related to building consistent application of various parties from the standpoint of content, structure, graphic representation. The choice of the leader rose, in both groups, from an explicit recognition of the competence of the teacher who assumed the role of coordination. At the same time, that teacher has repeatedly demonstrated his/her willingness to play the role by proposing arrangements for scheduling times, for structuring individual contributions and organizing the final document to be delivered. As regards the tools of the on-line platform, the two groups used similar methods: the forum was indispensable both for the allocation of tasks and for the individual contribution that has been sent as an attachment during the discussion. The final document had, however, been drafted by the constituent coordinator and the coordinator himself placed the document in the folder used for this purpose.
2) Each component of the group developed a part of the work, chosen on the basis of his/her needs and interests. Individual contributions are collected and placed without a further reflection, simply in a sequential order, to compose the final document. Three of the eleven groups have operated in this way, but this strategy does not seem to be the result of an explicit choice, but only a casual opportunity, due to individual needs and to the difficulty of finding shared meeting times to work in a different way. In one of the three groups the choices in terms of strategies and contents proposed have created some discrepancies among the members of the

group. This impasse has not been solved, and each teacher has left unchanged his way of thinking and his personal contribution. In the other two groups each component has posted in the forum the content of his individual contribution. At the end all the individual contributions were juxtaposed in a final document, approved and accepted by everyone in the group.

3) All the members of the group worked on a single document that was built in stages. They continually asked the others for feedback on the contribution they posted. Everyone can intervene and make changes or additions. This third way of working was adopted by 6 groups of 11.

   The specific characteristics can be summarised as follows:

   a) any decision is subject to review by all the members of the group, this implies a shared management of presence in the online learning environment and willingness to share and discuss their work;
   b) the construction of the document is made by interpolation, that is, starting with a first draft, everyone can make changes and additions;
   c) to distinguish individual contributions the groups adopted various strategies: Each member chooses a colour, or a particular font, or, starting from a single document, additions are posted in the forum, where everyone can attach the new document that is being built.

   The division of labour in a similar strategy is not a problem, because each teacher may seek materials, develop strategies, shape stages of work. Very important is the search for coherence that all members of the group undertake to ensure, through a mutual monitoring, especially passing through respect of individual contributions, which do not exclude a proposal of possible changes.

   One of these groups experienced contrasts linked to different ways of conceiving cohesion and consistency of work. In all these groups, on the other hand, there has been a mutual recognition through positive feedback and continued compliance of each proposal.

The first evaluator of the project was the tutor, who knew how the groups worked and how they managed to build the project. A second evaluation was made by a university professor who did not follow the discussion forums and the organizational modalities with which the final products were drawn. His opinions were based solely on the quality of products.

Table 1 – Evaluation

Group	Strategy	Evaluation1 (tutor)				Evaluation 2 (professor)			
		Individual participation	Group climate	Collective participation	Coherence	Relevance to the task:	Coherence and cohesion of the final product.	Richness of materials:	Originality of their use
Primary School 1	1	4 of 4	5	5	5	5	5	5	5
Primary School 2	3	3 of 4	5	5	5	5	4	5	5
Primary School 3	3	4 of 4	5	5	4	5	4	4	4
Primary School 4	3	4 of 4	5	5	5	4	5	5	5

Primary .chool 5	3	4 of 4	5	5	4	5	5	4	4
Primary School 6	2	4 of 4	5	5	3	4	2	5	5
Sec. .School 1	3	2 of 4	4	4	5	5	5	4	4
Sec. School 2	2	4 of 4	2	2	2	4	1	3	3
Sec. School 3	3	5 of 5	5	5	4	5	3	5	4
Sec. School 4	2	3 of 4	4	4	3	4	2	3	4
Sec. School 5	1	4 of 4	5	3	2	3	2	1	2

4. Discussion and conclusion

How can we read the correspondence between these marks and the collaborative strategies adopted? At first we can outline the positive evaluation of works carried out through reciprocity strategies (type 3). These projects have been appreciated for the choice of materials, and because the structure of the various parties is so cohesive.

We can also focus on the problems in projects developed using the strategy n.2. As shown in table 1 the three groups have lower marks, due to the lack of a strict consistency between the various parts that are not directly resulting from each other.

Finally we can try to explain the difference between the evaluation of the group who have adopted the strategy 1. One of the two group received an excellent grade (5), while the other group got the worst mark in terms of content quality and general issues.

It is possible to explain this difference reflecting on the role of the coordinator. In this kind of strategy the coordinator has the greatest responsibility for the final work, so the real relational competences of the leader, in disciplinary fields, professional questions and relational skills heavily influence the final product.

In conclusion we can suggest that there is a relationship between collaboration strategies and quality of the result obtained by the group, but it is not a causal relation. Collaboration, especially inside a reciprocal pattern, is a necessary condition to develop a coherent project, but it is not sufficient. In this particular context personal knowledge and professional skills have a great importance and affect heavily the quality of the product. In this course we find that groups who had a higher number of interaction had the better result in building the project, but it is difficult to generalize because there are a lot of factor that could affect the results. Of course a constant and participative interaction leads to greater reciprocal control and better guarantee of a harmonic and organic development of the final product.

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Learning translation strategies in a CSCL framework

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Abstract

This study investigated the extent to which the social constructivist approach can be applied to the teaching/learning of translation strategies in an e-learning environment. To advance the inquiry, three research questions were developed that focussed on: individual learning vs. social learning; knowledge seen as content versus knowledge sees as process; teacher control versus student control. The method of research was located within a qualitative, interpretive paradigm based on multiple case studies associated with the classes involved. Data collection included reports from participants, issued periodically in the semesters investigated.
Techniques of qualitative analysis were used to identify, describe and interpret the forms of argumentative collaboration and co-construction of knowledge participants were experiencing online. The main conclusions of the inquiry were: (1) evidence of a change in the ability of students to think and solve problems in ways that match the characteristic methods of the academic discipline (translation studies) and – to a certain degree – of professional experts; (2) critical issues revolving around the difficulties of effectively managing discussions and/or work progression as a result of the more or less effective management of the social relationships between students in the smaller and larger groups; (3) full blending of the contrasting pairs focussed on as research questions, leading toward integration rather than confrontation of the dual views of acquisition and construction of knowledge.

Keywords: social constructivist approach, e-learning, collaborative learning, knowledge construction, translation strategies.

1. Introduction

The objective of the present work is the investigation of the collaborative paradigm – as applied to translation-trainee groups collaborating in an e-learning environment – and its contribution to knowledge construction in the specific field of translation studies.

To define the scope of this study, we need to pinpoint the term *collaboration* first. As its definition tends to vary depending upon the interests and applications of those investigating, generally from a mono-disciplinary perspective such as fine arts, IT theory, network theory, educational theory, to name but a few, the paper's first goal is to contribute to the picture with further data from a different research context (Translation Studies) while supporting a transdisciplinary framework applicable to collaboration in every field of human activity. We'll base our discussion on the definition of collaboration provided by Schrage (1991): "Collaboration is the process of shared creation: two or more individuals with complementary skills interacting to create a shared understanding that none has previously possessed or could have come to on their own."

This paper explores the idea of *collaborative translation*, and describes a translation assignment designed to implement collaborative translation in translation courses. Unlike previous studies (Scott-Tennent at al., 2001), whose focus was primarily on learners' translation skills, the main objective of this paper is to evaluate the level of understanding that groups of students have achieved with respect to "real world" translation problems by using an online translation project. The project relied heavily on group interaction to increase the "quality" of the final, shared artifact, which consisted in the translation of a complex source text, managing complexity being one of the aims of the translation project.

The Learning Management System (LMS) based on the Dokeos platform offered the joint arena in which students could build their capacity to upgrade and leverage knowledge via argumentative communication and reflective conversations. The Learning Management System enabled students

to collaborate and coordinate their action through real-time and asynchronous tools, from anywhere, anytime.

2. Collaborative translation

The fundamental idea of collaborative translation is that individuals gain certain types of knowledge best through a process of communication with their peers (Vygotsky, 1978), and that especially knowledge involving judgment is learned best in this manner. As translating involves making judgments about a number of issues (e.g. linguistic and cultural equivalences, style, target readership, text cohesion, etc.), collaborative translation can be especially important in translation assignments, since students can learn to look at issues from different perspectives and may examine ideas that they may not have seen on their own.

2.1. Motivation of and communication of project requirements

The translation assignment described in this paper was used in the Spring of 2008 at Salento University in Lecce, Italy, in the 2nd and 3rd year undergraduate translation courses. The primary goal of the translation assignment was to give students direct experience with "real world" translation problems while giving them the opportunity to demonstrate translation skills and to learn to work as a group.

The major purpose of the translation project was to foster students' understanding of lexical coherence and text cohesion in the target text (TT) and of how TT quality could benefit from collaboration.

The parameters of the translation project were communicated to the students after a session on the different types of group interaction: the difference between cooperation and collaboration was focused on so that students could be aware of and make informed choices as to the best methodology – sequential, parallel, reciprocal – to apply throughout the project.

General guidelines were provided to ensure that each project report contained the minimum information necessary to meet the project goals: 1) a preliminary analysis of the source text; 2) the shared "artifact" (TT); 3) comments for equivalence problems, and the translation strategies used to overcome them, with reference to the translation theory studied during the course. Evidence of the relevant group work was available on the LMS.

2.2. Collaborative aspects of the project

The assignment relied extensively on group interaction firstly to improve the translation skills and communication product of translation students, and secondly to allow them to develop some sense of a community through the perception of mutual interdependence, the promotion of individual initiative and creativity, the negotiation of common lines of action, the research of common areas of interest. Reference was made to the online community classification suggested by Jonassen, Peck and Wilson (1999) which helped to identify the different forms of community the students were experiencing in their project work – discourse, practice, knowledge-building, and learning communities, while the related quadrant of online learning architecture (Rivoltella, 2003) provided a snapshot of the various discussion and collaboration strategies used by online communities, some of which were applied in students' group work.

Jigsaw (Aronson, 1978) and reciprocal teaching (Palincsar and Brown, 1984) were the discussion strategies used in the project at a macro (class) and micro (group) level.

The former strategy consisted in letting students decide how to manage and organize their own learning. Starting from a brainstorming session in which the whole class group (50 in the case of 3rd year students) was faced with the complexity of the translation task (step 1), students subdivided the source text based on the subsections contained in it, and created as many groups as the subsections selected (step 2). Each group was asked to work collaboratively on the translation of the subsection

assigned, of which they would become "experts" (step 3). After completion, new groups were created so as to host one "expert" out of each of the subsection groups. By sharing the knowledge of the individual members, the new groups were able to reconcile the translation problems faced and solutions found by adding lexical coherence and cohesion to the target text (step 4). A final brainstorming session with the whole class group (step 5) concluded the project work engaging students in inter-group review and editing activities to promote collaboration and improve the final product.

The latter strategy (applied to 2nd year students, 70 altogether) consisted in creating small groups (max. 6 members) and assigning each group a topic of their preference and the relevant translation task. Each group member was requested to take the leading role by stimulating discussion and inviting other members to provide and justify solutions to help group reflection. Four discussion strategies were applied: 1) summarizing, i.e. pinpointing the translation problems in the ST for group discussion; 2) question generating, i.e. pointing out different viewpoints regarding the same problem within the group; 3) clarifying, i.e. explaining the meaning of text chunks (words, collocations, extended units of meaning) for shared ST comprehension; 4) predicting, i.e. hypothesizing solutions for TT coherence in line with the author's intention.

Doc sharing, collaborative searching and online co-construction activities helped group members to contribute to the group decision-making process and the development of the project.

3. Evaluation of the project

Most groups functioned productively. Productive group interaction appeared to be highly correlated with the overall quality of the final report. The few groups whose evaluations reflected problems in working together produced a lower quality final report. The best reports also reflected extensive use of resources other than dictionaries and direct course material. Most reports reflected considerable gains in knowledge and understanding of translation strategies through teamwork. Furthermore, the "ability to use and negotiate with a plurality of propositions and opinions" (Pym, 2003) as part of translation competence was apparent in most reports.

Group coordination imposed time burdens on some students. In general, the need to plan and coordinate group activities is valuable experience for students, and vital to learning effectively in groups. However, these difficulties were overcome when necessary by allowing students to self-select into groups with compatible schedules and work attitudes.

3.1. Student responses

As part of the evaluation of their translation course, students filled in five self-assessment forms aiming at providing feedback as to the teaching/learning approach used, the learning goals achieved, class participation, project work and homework. Student comments and self-assessment suggest that students benefited from collaborative work; they found it useful to learn from their class mates, reflect with them on translation strategies, and be aware of different approaches to the same text.

For many students this project represented their first attempt at working together, on an online translation project. Initially, the effort proved frustrating for many students, especially for those in the 2nd year of translation studies, but the experience was then perceived as vital to a smooth transition from student to practicing translator. Students also gained experience reading, understanding and interpreting complex, "real world", source texts, and using electronic resources such as corpora and the web.

The assessment approach tried to capture the interpretative, situational, implicit, insightful, community-enacted nature of knowledge.

4. Conclusion

This paper described an online, collaborative, translation project designed for students in undergraduate translation courses. In this translator-training context, the process of creating new knowledge involved communication through a shared artifact (the translated text) for the sake of creating new understanding (of both translation problems and translation strategies) that the students could not achieve on their own.

The Learning Management System used provided a "learning space" where students reflected on their experiences, explored their thinking, suggested their ideas, and experimented their hypotheses. The LMS offered the space for *knowledge-in-action*, a space in which student competence was continually negotiated through direct participation.

The implementation and conclusion of the project provided evidence of a change in the ability of students to think and solve problems in ways that match the characteristic methods of the academic discipline (translation studies) and – to a certain degree – of professional experts (stigmergic collaboration), while bringing to the front critical issues related to the difficulties of effectively managing discussions and/or work progression as a result of the more or less effective management of the social relationships between students in the smaller and larger groups. Student's comments testify of the fact that the contrasting pairs presented as questions in the approach self-assessment form – individual learning vs. social learning; knowledge seen as content vs. knowledge seen as process; teacher control vs. student control – lead toward integration rather than confrontation of the dual views of acquisition and construction of knowledge.

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From daily language to scientific jargon: the role of peer interaction in web forum

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Abstract

The paper presents the activities and the results of the "Child Observation in school context workshop", an on line course realized during the last academic years at Macerata University.
The contribution is articulated into two parts: the first one describes the theoretical frame (Arfelli Galli, 1997; Bruner, 1990; Carugati et Selleri, 1996; Doise et Mugny, 1982; Mason, 2001, 2006; Mason et Boscolo, 2000) and the on line activities aims and design (Moroni et Nicolini, 2008; Nicolini et Lapucci, 2008; Nicolini et Moroni, 2006; Nicolini et al., 2007a; Nicolini et al., 2007b; Nicolini et al., 2007c); the second section illustrates some of the outcomes, in terms of changes in the language used by the participants while they are engaged in discursive interactions within the web forum. Our approach outlines the power of discursive interactions in teaching-learning process (Ajello et al., 1991; Galatolo et Pallotti, 1999; Nussbaum et Novick, 1982; Pontecorvo et al., 1995; Pontecorvo, 1999; Pontecorvo, 2005), confirming the conception of knowledge as a progressive development towards *different communities of practice* (Bereiter et Scardamalia, 1987; Scardamalia et Bereiter, 2002).
In fact the analysis of the web forum texts permits to show a continuing homogenization towards a technical jargon, which characterizes the subject matter. These processes demonstrate the progressive sharing of a common encyclopaedia and point out the moment in which the knowledge of the single individual (Gardner, 1993) is shared to the benefit of the whole group (Nicolini et Pojaghi, 2006).
We intend to present both a qualitative and a quantitative analysis, mainly based on psycholinguistic instruments.

Keywords: peer interaction, conflict, conceptual change, naïve theories, scientific jargon.

1. Introduction

Following socio-constructivism, learning processes are considered as activities through which participants acquire some of the peculiar skill and linguistic instruments of a professional community. It is language that, also in a communicative situation different from the traditional didactic context, plays an irreplaceable work of sharing.

2. Activities' structure: the online Child Observation in School Context Workshop

According to the presented theoretic motivation, we constructed a learning methodology, summarized in the Table n.° 1. The first column shows the plan of the activities; in the second column the related goals are specified; the third column refers to specific tasks. In the fourth column the methodological approach is illustrate.

Core activities	**Goals**	**Tasks**	**Guidelines**
Naïve theories recognition	Eliciting self explanation and using naïve theories	Write down an observation text after downloading the videotape available at the url… Publish it.	1. employ of several instruments in teaching-learning activities, 2. discursive negotiation, 3. interest both about contents and relationships;
Peer discussion: analogies and differences	Discussing among peer to realize limits and errors of subjective point of view. Promoting conceptual change	1st web forum: within your own group find analogies and differences among the realized individual tables	
Encounter	New knowledge acquisition	Read the recommended handbook	

with scientific theories	supported by the activation of personal conceptions. Promoting conceptual change		4.teacher's and tutor's scaffolding; 5.students' self regulation; 6. reflection about learning experience; 7. employ of several instruments in teaching-learning activities.
Peer discussion: negotiation	Searching and negotiating toward a possible agreement Promoting conceptual change	2nd web forum: within your own group discuss and negotiate till you agree to realize only one table containing the necessary and sufficient indicators to realize the most complete and correct observation written text	
Hands-on activities	Applying new learning and new achieved theories	On the base of realized activities and apprehended concepts, realize by yourself an observation text related to videotape available at the url…	
Peer discussion: evaluation and self assessment	Discussing among peer to evaluate the whole activities and encouraging metacognitive reflection	3rd web forum: speak about the realized activity within your own group, expressing a self assessment and an assessment on the Child Observation in school context Workshop	
		Send a personal dossier to the Faculty composed by written texts of every tasks	

Table n° 1. The teaching-learning methodology

As it can be seen, the on line Workshop is strongly based on peer interaction. The teacher is "silent" during all the time of the activities. A tutor is at disposal, but only for organizational questions.

3. The sample

Our sample is composed by the students of the online course during the academic year 2007/2008. They are 125 adults, moreover already graduated and employed, as it can be seen in the Table n° 2:

Sample characteristics	
Number of participants	125
Birth year range	1956-1985
School level	95 university graduated 30 high school graduated
Employment	56 employees in educational institutions 10 educationalists 5 other occupations 17 full time students
Geographic provenance	69 South of Italy 54 Centre of Italy 1 North of Italy 1 foreigner

Table n° 2. Sample characteristics

3. Qualitative data analysis

In this part we present some extracts of the three web forums from the Workshop. In particular we intend to stress the progressive work of negotiation of one of the thirteen groups. We start the analysis with some examples of the discussion realized in the first web forum. In the initial task the students are requested to see a video tape and to write a text describing the action they saw. The aim of the next forum is to permit to the participants the recognition of their conception about how to observe. In order to obtain this result, the

students are invited to read the other observation texts and to compare each other, focalizing their attention on analogies and differences.
The discussion of the Group n°. 1 begins with a critic intervention: a student declares her disagreement about the approach used in the observation text by one of her colleagues.

The text of B. disoriented me a lot, because there are very much different elements from my work. I read that the children join them spontaneously, but can we objectively affirm that? Do we know that? Also the assertion that one of them had the idea and the others collaborate because are attracted by the game, puzzle me (from what can you infer that?) [...] Also the affirmation that the child knocks down the wall to feel joy, seems to me a subjective deduction, not a descriptive data.

At the beginning the student speaks directly to the author (B) explaining her personal opinion (*that disoriented me*, *from my work*, *I read*), but soon afterwards extends her doubts to the group, using "*can we objectively affirm*", "*Do we know*". She then proceeds explaining her point of view and offering argumentations about her doubts. She suggests to reflect about a more general concept: the difference between interpretation and description. It's a crucial issue in order to develop toward a scientific way of conducting an observation. Another student immediately expresses her agreement.

I am agree with you. I read the observation text of B. and I didn't find in the video what she described. Especially the intention of demolish the tower and the purpose to feel joy. [...] We have to observe and to keep attention to what we saw without hazarding interpretations. The fact that many people disagree shows the different meanings that persons can give to the same actions.

The student investigates the matter of individual interpretations of facts and she underlines that "*we have to observe (...) without hazarding interpretations*".

The answer arrives from the author of the criticised observation text.

I affirmed the children join them spontaneously because it was a spontaneous game, not guided by adults, so that the children are pushed to organise by themselves. I wrote that because of my experience of apprentice in an infant school. There is a tendency of children to imitate the classmate: they play and they collaborate.

In a first moment she tries to justify her approach. The research of explanations in order to be understood by the others is an important process in the construction of shared meanings. She then offers a generalization of her personal experience: in this way a contextualized data is used as an absolute one. In the following assertion she shows awareness about the limits of her previous affirmation: the interventions of her classmates were useful to understand her own error and to reach another set of knowledge.

Maybe you're right when you tell me that I did some subjective deductions [...].

Soon afterwards other interventions follow, in order to discuss the same topic. The discussion starts again with a critic and gets in touch with a general reflection about the useful elements to realize a correct observation text:

Y*ou observed that the group of children is disappointed. In particular a child says: "Stop to do so! It falls down!", "Now you have to rebuild it!"* [referring to the structure they were building]. *I would like to know if you are sure about the words of the child, because I was not able to understand. If the child says distinctly that, I can't exclude the possibility to speak about disappoint, also because of objective data (the words of the child that I didn't considerate). Integrating our opinion, in this case we could say that some children express their disappoint, but the game seems to have the possibility of new developments. I know that it's a mix between objective and subjective data. Nevertheless it is quite impossible to do, because the observer is never free from her/his point of view.*

The discussion goes on and involves the whole group more and more. Other students note the same problem:

I read your text and I was been surprised because of the different aspects that you handed over. The division you used between objective data and subjective interpretation makes me reflect.

The relevance to distinguish objective and subjective data becomes a common idea and a shared starting point to build an expert observation text. This process leads to another fundamental acquisition: the use of adequate language to make the separation appreciable. In fact:

It's true that nobody separated objective description from subjective one, but I believe this distinction is very important in every observation text to avoid that our feelings at a precise moment could influence the analysis.

As it can be seen in the following text, the author quotes a classmate who used the verb "to seem" speaking about a common group's impression while observing the tape. She utilized the expression "In my opinion":

Hi S.! You propose to integrate our observation in four points: 1. The action is played in an Infant School, 2. The activity is not guided by adults; 3. It seems a spontaneous game; 4. It seems a cooperation game. In my opinion it isn't a real summary. We can considerate the four points as a results of the maximum possible group's agreement.

The process of knowledge construction becomes even more evident in the second webforum. During the exchanges the group builds a shared list of indicators to organize an expert observation, recommending the fundamental use of an adequate jargon. The same list (in part or completely) will be used from the majority of the team to realize the last observation texts. 9 components improve their final works. Only one student participates sparely at the negotiation webforum and so she doesn't use the shared indicators: she is the only one who doesn't improve the quality level of her final test.
The same happens in the other groups. We can assume that a low participation to the forums probably influences in a bad way the quality of learning. It can be seen in the last observation texts. Some quantitative data can be useful to clarify.

4. Quantitative data analysis

Comparing the observation texts realized at the beginning of the course with the last ones, we can see a general improvement of texts quality level, like it can be seen in the following Table (n° 3):

Initial observation text: total 125		
Low level: 39 (31%)	Medium level: 65 (52%)	High level: 21(17%)
Final observation text: total 125		
Low level: 8 (7%)	Medium level: 49 (38%)	High level: 68 (55%)
-30	**-17**	**+47**

Table n° 3. Outcomes: differences between initial and final observation texts

To conduct this kind of evaluation we used categories such as *text structure, context* and *linguistic expression.* In *text structure*'s category we consider for example its length and structure; in *context* we take into consideration dimensions as references about videotape duration, observation methods adopted, quotes from handbooks, concepts coming out from

the forum; by *linguistic expression* we intend descriptive or evaluative expressions, references to observable data - such as actions, language and observer's internal world - or to unobservable data - such as thoughts, feelings and intentions of the observed subject.

5. Conclusions

Assessing the final outcomes, we assume like a manifestation of an expert way of observing both the use of an adequate language and the process of collective construction of a professional point of view. The analysis of the web forum texts permits to show a continuing homogenization towards a technical jargon, as we assumed. The analysis of verbal exchanges demonstrates not only a progressive sharing of a common knowledge and encyclopaedia but overall a true conceptual change. The on line activities and the requested peer interaction seem to stimulate a modification in the way the participants can observe a group of children from the beginning to the final activities. It can be considered not only a grow of information but also an acquisition of correlate new competences, as the quantitative data stress.

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Effects of individual prior knowledge on collaborative knowledge construction and individual learning outcomes

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Abstract

This paper deals with collaborative knowledge construction in videoconferencing. The main issue is about how to predict individual learning outcome, in particular how far individual prior knowledge and the collaborative knowledge construction can influence individual learning outcomes. In this context, the influence of prior knowledge and two measures of instructional support, a collaboration script and a content scheme were analyzed concerning the collaborative knowledge construction. An empirical study was conducted with 159 University students as sample. Students learned collaboratively in groups of three in a case based learning environment in videoconferencing and were supported by the instructional support measures. Results show that collaborative knowledge construction had more impact on individual learning outcome than individual prior knowledge.

Keywords: prior knowledge, cooperative/collaborative learning, collaboration script, content scheme, collaborative knowledge construction

1. Theoretical framework

Individual prior knowledge is known to be an important prerequisite for *individual* knowledge construction and learning outcome. Theoretical approaches stress the importance of learners' prior knowledge when acquiring new learning material (see Weinert & Helmke, 1998) and empirical studies show the influence of prior knowledge on individual learning outcomes (e.g. Kalyuga, Chandler & Sweller, 2001; Shapiro, 2004).

In studies about collaborative learning, the individuals' prior knowledge plays often a role in group composition (see Cohen, 1994), while its influence as prerequisite for collaborative knowledge construction remains often unconsidered. However, studies of O'Donnell and Dansereau (2000) investigating effects of prior knowledge in collaboration indicate its influence also in collaborative scenarios. Furthermore, they found that prior knowledge could interact with other moderators of the collaborative knowledge construction – like instructional support measures for learners (e.g. collaboration scripts, content schemes). This means that it may effect results of collaborative knowledge construction (see Ertl, Kopp & Mandl, 2005; Ertl & Mandl, 2006).

2. Research Questions

For getting insights in these issues, we conducted an empirical study with following research questions:

- *Research question 1:* to what extent does individual prior knowledge affect the quality of collaborative knowledge construction supported by a collaboration script and a content scheme and
- *Research question 2:* to what extent do individual prior knowledge and the quality of collaborative knowledge construction affect learners' individual learning outcome regarding conceptual and applicable knowledge.

3. Method

An empirical study was conducted in the laboratory of Ludwig Maximilian University. The study comprised an individual and a collaborative learning unit (see figure 1). During the individual learning unit, learners acquired knowledge about attribution theory on basis of a theory text. After working on this text, learners' individual prior knowledge was assessed by an individual case solution and a short-answer test about conceptual knowledge. For collaboration, learners were connected with a desktop video-conferencing system, which included an audio- and video-connection and a shared application. Using this videoconferencing environment, learners had to solve a learning case according to attribution theory collaboratively. During collaboration, learners worked in one of four conditions of a 2x2-factorial design. We varied the factors collaboration script (with vs. without) and content scheme (with vs. without). 159 undergraduates of educational sciences took part in this experiment. There were 13 triads in each experimental condition and 12 triads in the control condition. After the collaborative learning unit, learners' knowledge was assessed on an individual base by solving a case and a short-answer test.

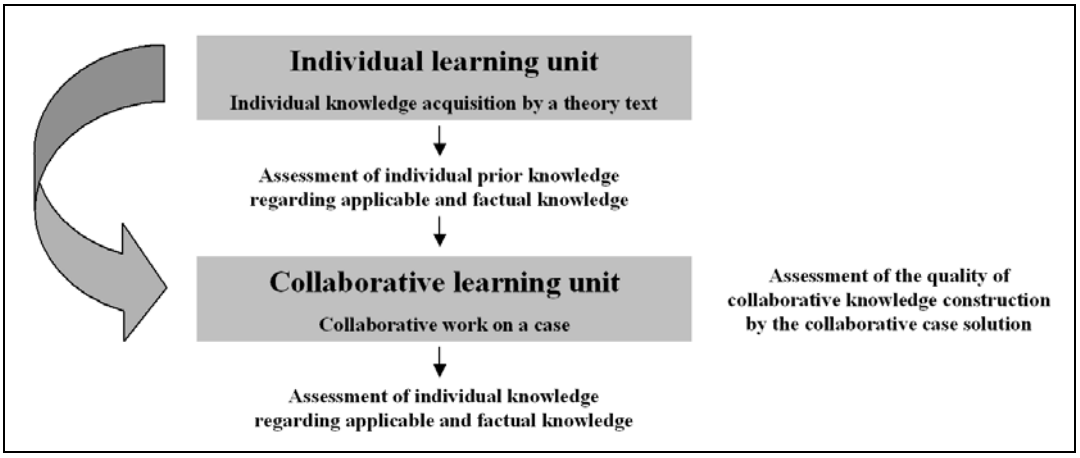

Figure 1: Design of the experiment

3.1 Instructional Support for Collaborative Knowledge Construction

As instructional support for the collaborative knowledge construction, a collaboration script, a content scheme and a combination of both was used and compared with a control condition. Collaboration script as well as content scheme pre-structured the collaboration of the triads.

The *collaboration script* structured the collaborative unit into four phases. In the *first* phase, learners had to read case material and extract important information on an individual basis. In the *second* phase, learners had to exchange information and resolve comprehension questions collaboratively. They used the shared application for writing down concepts that were important for the case solution. In the *third* phase, learners had to reflect individually and in the *fourth* phase, learners had to develop the case solution collaboratively.

The *content scheme* pre-structured the shared application and was realized as a table, which was divided into three main categories: *Cause,* for identifying possible causes for the problem described in the case, *Information* for case information and for giving evidence for the causes and *Attribution* for identifying the correct attribution of the cause. The categories *Information* and *Attribution* each contained two subcategories: *Information* was divided in columns for *Consensus* and *Consistency* for making these two aspects of attribution theory salient. *Attribution* was divided into two sections according to the theories of Kelley (1973) and Heider (1958) to help learners attribute each cause to the relevant source. Using this content scheme, learners were guided to formulate complete attributions according to Kelley and Heider with causes and case information about consensus and consistency.

3.2 Data Sources

Individual prior knowledge: conceptual knowledge was measured by a short-answer test. This test consisted of 8 items ($M = 26.3$; $SD = 9.51$; empirical max. = 43). The consistency of this test was sufficient ($\alpha = .69$).

Concerning *individual prior knowledge: applicable knowledge*, learners worked on a case individually. For assessment, this case solution was analyzed with respect to theory concepts and case information. Items used correctly for the individual case solution were summed up to a score ($M = 15.0$; $SD = 6.68$; empirical max. = 31). For ensuring inter-rater reliability of data, two evaluators marked analysis 10%. The consistency between these evaluations was high regarding all subscales ($\kappa_w > .91$).

For assessing the *quality of collaborative knowledge construction*, a collaboratively solved case was analyzed with respect to correctly used theory concepts and case information. A sum was built as measure for the quality of collaborative knowledge construction ($M = 58.0$; $SD = 18.73$; empirical max. = 92). For ensuring inter-rater reliability of data, two evaluators marked analysis 10%. The consistency between these evaluations was high regarding all subscales ($r > .87$).

Individual learning outcome: conceptual knowledge was measured by a short-answer test. It consisted of 8 items ($M = 29.1$; $SD = 7.75$; empirical max. = 42), which were similar to the items of the pre-test. The consistency of this test was sufficient ($\alpha = .62$).

For getting *individual learning outcome: applicable knowledge*, learners solved a case individually after collaboration. Scores were given for case information and theoretical concepts. The points for each category were summed together into a score ($M = 18.58$; $SD = 6.88$; empirical max. = 32). For ensuring inter-rater reliability of data, two evaluators marked analysis 10%. The consistency between these evaluations was high regarding all subscales ($\kappa_w > .90$).

4. Results

4.1 Research Question 1

As the results in table 1 show, over 45 % of the variance regarding the collaborative knowledge construction could be predicted by prior knowledge and the support measures. The strongest predictor was the content scheme, while the individual prior knowledge (conceptual) played only a marginal role. The collaboration script and individual prior knowledge (applicable) were not significant as predictor.

Table 1: Regression for predicting the quality of collaborative knowledge construction by prior knowledge, content scheme and collaboration script: Statistically significant predictors ($p < .05$) with standardized β-weights.

	Collaborative knowledge construction
Prior knowledge (conceptual)	.18
Content scheme	.68
R^2	.49
Adjust. R^2	.48

4.2 Research Question 2

With respect to applicable knowledge, 40% of the variance could be predicted by individual prior knowledge and collaborative knowledge construction. In the context of applicable knowledge, collaborative knowledge construction had more influence than each single measure of individual prior knowledge. The content scheme did not prove to be a significant predictor. However, content scheme may have had an indirect influence, as it is the main predictor for the collaborative knowledge construction. The collaboration script did not prove to be a predictor, again.

Table 2: Regression for the prediction of individual learning (applicable knowledge) outcome by prior knowledge, content scheme, collaboration script and collaborative knowledge construction: Statistically significant predictors ($p < .05$) with standardized β-weights.

	Individual learning outcome (applicable knowledge)
Prior knowledge (conceptual)	.27
Prior knowledge (applicable)	.22
Collaborative knowledge construction	.40
R^2	.41
Adjust. R^2	.40

Analyzing conceptual knowledge, 60 % of total variance was predictable (cf. table 3). The main predictor was conceptual prior knowledge; applicable prior knowledge played a minor role. Neither the collaborative knowledge construction nor the interventions proved to be significant predictors. However, one has to state that both tests for conceptual knowledge comprised similar items, even if arranged differently.

Table 3: Regression for the prediction of individual learning outcome (conceptual knowledge) by prior knowledge, content scheme, collaboration script and collaborative knowledge construction: Statistically significant predictors ($p < .05$) with standardized β-weights.

	Individual learning outcome (conceptual knowledge)

Prior knowledge (conceptual)	.68
Prior knowledge (applicable)	.16
R^2	.61
Adjust. R^2	.60

5. Summary and conclusion

These results show that the effects of individual prior knowledge are quite different regarding the quality of collaborative knowledge construction and individual learning outcome. For *collaborative knowledge construction*, the influence of individual prior knowledge is quite small compared to the influence of support measures, in particular the content scheme. Furthermore, conceptual knowledge proved to be a significant predictor while the influence of applicable knowledge was not significant. Our interpretation is that the conceptual prior knowledge provides the "bricks" for collaborative knowledge construction and the instructional support, the content scheme, provided the building plan for the collaborative knowledge.

In the context of *individual learning outcomes* one has to distinguish between applicable and conceptual knowledge. With respect to applicable knowledge, the quality of collaborative knowledge construction has more influence than both kinds of prior knowledge. Considering conceptual knowledge, there was no influence of the collaboration. Even, if all learners improved their level of conceptual knowledge, the main predictor was individual prior knowledge. However, this effect may be attributed to the similarity of the test items between pre- and the post-test.

These results are a first step to explain influences on collaborative knowledge construction and its outcomes. One can assume that during collaborative knowledge construction, the collaboration effect, including the effect of instructional support measures is much stronger than the individual learners' prerequisites. This means that collaborative knowledge construction can be modified quite fundamentally by instructional support. In contrast, regarding individual benefits from collaboration, the individual prerequisites show their importance.

To sum up, collaborative knowledge construction can be influenced by a well-designed intervention much more than by individual prior knowledge. Yet, individual prior knowledge gains weight regarding individual learning outcome, even if collaborative knowledge construction has still a great influence in this area.

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ScribaLab Ver. 2.0

http://lnx.funteaching.it/scribalab/

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Abstract

What is Scribalab 2.0? A system to create web communities and a modular toolbox for writing and publish on the web. It is made up of two main sections both designed to welcome users and visitors. You can find challenging and interesting tools into the Scriba section, such as ScribaMapping or Scriba6HATS with suggestions for cooperative group activities on creative writing or having the opportunity to create a podcast of your choice in ScribaPodcast. The tools offered to the users and learners are both personal and collaborative. A special section is reserved to the teachers who want to create collaborative learning objects to develop writing skills on the fly.

Keywords: network writing, collaborative learning and teaching, self- regulated personal learning environment.

1. Introduction: ScribaLAB theoretical background

Our major question is: How can internet software successfully support social constructionist epistemologies of teaching and learning? More specifically, what web structures and interfaces encourage or hinder participants engagement in reflective dialogue within a community of learners - by reading openly, reflecting critically and writing constructively in a way that engages their personal experiences? Our aims in answering these questions are, firstly, to improve our own skills at using the Internet to facilitate learning, secondly, to improve the pedagogical skills of other teachers by making our software tools freely available to every user and learner.

Relevance, Reflection and Interactivity and Peer Support are our four parameters to measure learners' motivation to practise their writing in the cyberspace.

1. **Relevance** - how relevant is online learning to students' professional practices?
2. **Reflection** - does on-line learning stimulate students' critical reflective thinking?
3. **Interactivity** - to what extent do students engage online in rich educative dialogue?
4. **Peer Support** - do fellow students provide sensitive and encouraging support?

Let's look at these four points.

- **Interface**: the users need to be brainfriendly connected to the materials offered, control and manipulate them comfortably and produce their own piece of writing.

- **Learning by doing:** learners can choose the categories of their interest and find samples, work on their own or use personalized tools, helpers and guidelines.

- **Media combination modalities:** the interactive lab generates static contents as well as web pages contents on the fly such as text files, audio and video files. In order to meet the requirements of the different writing modes, a section for video-clips streaming publication has been complemented.

- **Workflow management and tools:** the workflow is linear in the process of submitting and validate an article whereas the users' tools are designed to write a guided article according to the technique of the inverted pyramid Scriba5W or to map a story (ScribaMapping).

The theory of 'ways of knowing', highlights the existence of two distinct learning styles: separate knowing and connected knowing. Connected knowers tend to learn cooperatively, and are more congenial and more willing to build on the ideas of others, while separate knowers tend to take a more critical and argumentative stance to learning.These styles are independent of intelligence or learning capacity, and independent of each other: each of us may use both styles at different times. In our online discourse we try to encourage students to engage as connected knowers in order that productive educative relationships are more readily established in the scribaLAB Community.

2. Personal tools

ScribaLAB has a series of personal tools such as ScribaLetter, ScribaMapping and Scriba5W. Before presenting some of them in detail, there some general considerations to be done as fas as their design in concerned. Every personal tool acts mainly in the process of pre-writing and operates as a graphic organizer. They are tools to 'talk to' and not to follow slavishly. What the tools really do as a response it is just the final editing on the web, which is of a good quality and can be shared.

2.1. Scribaletter

As for a start we would like to present ScribaLETTER. Once the student is logged on his personal tools page, he can choose between a friendly letter and a business letter layout. The latter is introduced by a model letter in which the student is guided to become aware of the different parts of the letter by moving the mouse pointer on the Heading, the Inside Address, the Greeting (also called the salutation) the Body of the letter, the Complimentary Close and the Signature Line. This is what he is told: 'Click your mouse pointer on any part of the picture for a description and example of that part'. If he chooses to write a formal letter as the model suggests, he will be gradually introduced to the six graphic organizers, one for a single part of the letter, and guided in his/her writing process step by step. The format for a personal letter is slightly different. Personal letters, also known as friendly letters, and social notes normally have five parts. However, the student is assisted in the writing process with some interactive suggestions as well. The format can even be adapted for creative letter writing.

N.b. La parte corrente della lettera è quella evidenziata

2.2. Scriba5W

The correct composition of an article depends on clearness, organization and efficiency. Who? What? When? Where? Why? How? Those questions are the tools of any sincere journalist interested in telling a story in as fact-rich and objective a manner as possible. They help outline the essential details for almost any occasion, from birth, to scandal, struggle, triumph, and death, keeping the focus of a news report on the measurable. For it is only from the everyday material that we can derive what is immaterial and form theories and opinions. Reporting the news is not an easy thing to do— a journalist's task is to dig beyond the surface, to assemble and synthesize details to form a cohesive whole, a picture of something not readily apparent. Scriba5W 'tells' the learners how to write using the inverted pyramid, how to create an eye-grabbing lead, headlines to report important things happening locally, regionally, nationally, and globally.

2.3. ScribaMapping

This tool is an advance organizer to map stories into four sections: Setting, Charcters, Confict, Resolution. Once the learners are guided to map the first draft of their stories, they can save or print the different sections to be used as a 'database' for the actual story to be written.

3. Collaborative tools

The collaborative tools in ScribaLab are Neverendingstory, a cooperative story making tool with alternatives on the style of game-books, ScribaPodcast for mp3 file production and Scriba6hats which is being described in detail.

3.1. Scriba6HATS

Scriba6Hats has been designed as a mini-forum with thinking types based on Six Thinking Hats method by Edward de Bono. De Bono points out that one difficulty we often encounter when thinking is confusion. Our emotion and logic and creativity all vie for our attention. When we focus on one thing at a time, however, the whole process becomes less confusing, much easier and more productive. Students can practise six hats thinking on a wide range of topics. The emphasis is on using six hats thinking on a problem that confronts the class as a group or is troubling an individual student. As you wear each hat, you focus only on that hat's quality before posting and the possibilities of a good discussion forum are being implemented.

1. Begin by asking someone to state what the problem is. Wearing the white hat, we or our students can examine the facts in an objective manner. Focus on the presentation of pure facts and information. Like a computer, the white hat thinker isn't coloured by any particular emotion.

2. The blue hat represents to being logical and applying the ability to think about thinking. At any point , we and our students might take a look at facts through the cool, controlled approach of the blue hat.

3. Emotions are signified by the red hat: "What feelings does this problem bring up in you? What intuitive feelings and hunches do you have?2. The red hat reminds us that there is an appropriate place for emotions in our thinking.

4. The world of imagination and creative, fertile ideas is part of green hat thinking. Students can be encouraged to let themselves go and see what ideas show up while wearing a green hat before posting their messages.

5. Any negative feelings, judgments, and ideas about what won't work belong to the space reserved for black thinking.

6. To balance the black hat try on the yellow hat and take an optimistic look at what is possible. Constructive ideas and opportunities are to be posted under the yellow hat thread.

In the end the teacher-moderator of the discussion forum and the students may wish to return to the blue hat to review the process and take a final look at the discussion threads.

4. Challenges in re-designing Scribalab as an OER

In order to have tools work properly in a ScribaLAB 2.0 , **Ajax** has been chosen: Asynchronous JavaScript And XML. It is a set of techniques born to develop interactive web applications. The basic idea is to obtain web pages which appear quickly to users thanks to the exchange of data packages in background, a data processing that is completely hidden to users. This process avoids web pages to be uploaded every time the users modify some contents and facilitates the writing: the users see what they get in real time. The application of Ajax library Prototype and Jquery simplifies how you traverse HTML documents, handle events, perform animations, and add Ajax interactions to web pages.

Challenges in ScribaLAB re-design	**Is it an OER SOLUTION?**
Decontextualization	The answer has been provided by the editing tools: **personal advance organizers collaborative tools** in the LAB section,which may increase the value of localization for learners and educators.
Engagement	We think that a highly advanced OER may increase learner engagement. ScribaLAB is still a BETA version.
Social aspect of learning	Acknowledge the benefits of Web 2.0 and intertwine the functionalities offered by online tools and technologies while maintaining writing skills development as **foundation module.**
Reusing	The intrinsic openness will enable reuse. HTML/JPG/etc. sufficient for rendering in **webpages VS SCORM**
Producing LO for writing skills in ScribaLAB	Teacher can easily add a new LO choosing between two modalities: o 1. **Publicly shared**: every teacher can modify the LO o 2. **Shared with consent**: every teacher can modify the LO with the password given by the first owner of the LO

Educational Objects Models	Other Educational Models can be thought of, more suitable for the web.

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