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Self-regulated Learning in Technology Enhanced Learning Environments: Problems and Promises

Antonio Bartolomé, Per Bergamin, Donatella Persico, Karl Steffens, Jean Underwood

Editors

SHAKER VERLAG

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FOREWORD

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Self-Regulated Learning (SRL) is the process through which individuals control their own learning from a cognitive, meta-cognitive, behavioural, emotional and motivational point of view. SRL requires an important interdisciplinary set of competences which has increasingly gained attention in the past couple of decades because it leads to better learning and it helps people to cope with the challenges of life-long-learning. Today it is important for individuals to find ways of coping with the explosion of information and knowledge.

While the field of SRL has been widely and deeply investigated, at least from the point of view of educational psychology, there is a strong need to better understand the interplay between SRL and Technology Enhanced Learning (Greene & Azevedo, 2010; Schraw, 2007) because the latter has profoundly changed and is posing special challenges to the way we learn and live. It is on these grounds that the Targeted Cooperative Network on Self-Regulated Learning in Technology Enhanced Learning Environments (TACONET[1]), a community of researchers interested in this subject, was founded in 2004 and, after a number of years, keeps attracting new scholars. TACONET organizes regular conferences allowing its members to exchange ideas and discuss their research results.

On October 1, 2010, the fourth TACONET conference on Self-Regulated Learning (SRL) in Technology Enhanced Learning Environments (TELEs) took place at the Universitat de Barcelona in Spain. The conference was organized by Antonio Bartolomé and his team on behalf of both the TACONET and the STELLAR Theme Team "Self-regulated learning in technology enhanced learning environments". We would like to thank the STELLAR Network of Excellence[2] for funding the Barcelona conference as well as the publication of these proceedings. We also would like to thank the Universitat de Barcelona for hosting the conference and we are very grateful for the friendliness and care with which Antonio's team helped us to enjoy the conference.

[1] http://www.taconet.org

[2] STELLAR, **S**ustaining **T**echnology **E**nhanced **L**earning at a **LAR**ge scale, http://www.stellarnet.eu

The first TACONET conference on Self-Regulated Learning in Technology Enhanced Learning Environments took place on November 20, 2004, at the Universitat de Barcelona, Spain, the second one on September 23, 2005, at the Universidade Católica Portuguesa in Lisbon, Portugal (Carneiro, Steffens, & Underwood, 2005) and the third one on October 7, 2007, at Vrije Universiteit Amsterdam in the Netherlands (Beishuizen, Carneiro & Steffens, 2007). These conferences aimed at increasing awareness of SRL in TELEs among members of industry, academia and communities of practice. We also wanted to stimulate research in the field of SRL in TELEs.

Since its beginnings, the TACONET community has been growing steadily. It is not a well-defined community; depending on the location of our conferences, we have attracted slightly different kinds of people, but the number of conference attendants each year has been more than in the preceding conference. TACONET members have presented their ideas and research results in other conferences as well and they have also published in various journals. The researchers you might consider to be the core group are about to publish a joint book on Self-regulated Learning in Technology Enhanced Learning Environments (Carneiro et al., in press).

There was a wide variety of contributions to the Barcelona conference. Therefore we decided to assign them to three slightly different perspectives. While they all dealt with the topic of self-regulated learning in technology enhanced learning environments, the first group of contributions was focussed on teachers and students, the second group focussed more on learning in class while the third group dealt with learning beyond school. The variety of the topics, results and conclusions of the contributions support our previously formulated hypothesis that there still is need for more research on the topic of self-regulated and technology enhanced learning. But we found also in the different articles many answers to open questions and stimulation for future research.

We would like to thank all the authors for their contributions. We are aware that all of them are very busy, and that they had to invest time and effort to provide us with their manuscripts. All the manuscripts were reviewed by either one of the editors or by one of the authors. In addition we would particularly like

to thank those authors who on top of working on their own chapter were willing to help their fellow authors with comments.

The Editors,

Antonio Bartolomé,
Per Bergamin,
Donatella Persico,
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Jean Underwood.

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MAKING SELF-REGULATED LEARNING VISIBLE

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INTRODUCTION

The self-regulated learning (SRL) construct has been the focus of many studies in the field of education (Boekaerts, 1999; Boekaerts & Corno, 2005; Boekaerts, Pintrich & Zeidner, 2000; Corno, 2001; Pintrich, 2004; Schunk, 2005; Zimmerman, 1998, 2000, 2008). The challenge in measuring this construct in specific contexts has led researchers to create and assess instruments and methods that achieve this purpose. In an attempt to contribute to the existing methods and tools, we intend to focus specifically on assessment methods that capture the complexity of SRL in technological enhanced learning environments (TELEs). This paper also presents a reflection about the ways we can make SRL visible for students, teachers and researchers in these specific contexts. The pertinence of this paper also lies in discussing opportunities for students to self-regulate their learning in these contexts and help them make the SRL processes and strategies visible to them, to their teachers and other professionals so that reflection and change may occur.

SELF-REGULATED LEARNING - A BRIEF FRAMEWORK

The processes of SRL mentioned in different theoretical models (Zimmerman & Schunk, 1989) have stimulated a vast group of theoretical and empirical studies that examine actions which are regulated by the individual with the objective of promoting learning. The vast majority of theorists working in the area of SRL see learning as either (i) a multidimensional process that encloses personal components (cognitive, metacognitive, motivational and emotional), as well as behavioral and contextual components; (ii) an open process where learners perform cyclical activity that is developed in three phases, which, according to Zimmerman's (1998, 2000) triadic model of SRL are, the forethought phase, the execution and volitional control phase, and the self-reflection phase.

These theorists have also focused on the role of the teacher and student in acquiring, developing and applying the self-regulation processes, as well as their relation with successful academic learning. Nonetheless, the scientific community still has various challenges to overcome, namely, (i) the inconsistency in terms of defining theoretical concepts and results from empirical studies; (ii) the disagreement about the different phases of SRL and the relation that exists between these phases; (iii) the lack of research about goal achievement and behavior as a dynamic and simultaneous occurrence in contexts where individuals are inserted and where multiple changes take place; (iv) and the lack of studies about the processes that intervene in the execution and maintenance phase.

According to Boekaerts and Corno (2005), there have been also important changes since 2000 regarding the dependency of SRL on situational and contextual aspects. What's more, the authors specify how SRL is not a static capability, independent of contextual,

social and emotional factors and highlight the importance of learning objectives as key elements in the SRL process.

Considering these theoretical issues regarding SRL, the use of technology emerges in two different ways - (i) as a tool that fosters SRL processes and strategies in learners; and (ii) as a tool that allows learners to capture their SRL processes and strategies, allowing them to evaluate their own evolution and to rethink decisions they have made, while providing teachers with enough information to help their students.

It was in this framework that the Program for the Study of Self-regulated Learning (PEAAR http://peaar.cipul.ul.pt/?lang=en) was created and integrated in the Research Center on Psychology of the Faculty of Psychology of the Lisbon University**.** The objectives of many of the research projects developed in this program focus on creating and validating assessment methods that capture the complexity of SRL in learning contexts (more recently, in TELEs). These instruments have been and are being developed and validated, with the purpose of making SRL visible for students, teachers and researchers in specific contexts. The research team that is developing and validating these assessment tools, is comprised of individuals of diverse theoretical orientations and of different areas of Psychology and Science Education due to the complex nature of the SRL construct and how it should be assessed in different contexts and with the use of different measures that enclose important theoretical aspects, as well as practical issues concerning the specificity if individual learners.

Consistently, the principal lines of research that have been and are being followed in this program deal with the individual differences in an evolutionary model of self-regulation, as an affective, motivational, cognitive and behavioral process, which is characterized at different academic levels. Moreover, the ultimate goal of these studies is essentially to understand the relation between educational practices and the development of SRL competencies while analyzing the type of influences different educational and family environments have on SRL processes of learners.

CHALLENGES CONCERNING THE ASSESSMENT OF SRL

Assessing SRL is no doubt a challenge for any researcher due to its dynamic and complex nature. Nonetheless, different types of instruments may be used as complementary to each other in order to grasp all aspects of the SRL process. Winne and Perry (2000) for example, distinguish different types of instruments in the assessment of SRL. They give emphasis to instruments that measure SRL as an aptitude and that describe some of the qualities or static attributes of learners that self-regulate their learning and that predict their conduct (cognition and motivation). These may include self-report questionnaires and teachers' judgments. The authors also bring to light instruments that measure SRL as an activity and that are characterized by their complex measures, and which gather information about states and processes that learners implement during the time they self-regulate. Some of these include, think-aloud measures, error detection methods and observation methods during the execution of tasks.

We considered this perspective in our studies and propose the use of adequate and adjusted complementarities between quantitative and qualitative measures (multimeasure approaches), as well as the use of measures that value the execution of academic tasks of a particular domain in real time.

CHALLENGES REGARDING THE ASSESSMENT OF SRL AS AN EVENT

Assessing SRL as an event poses itself as a challenging goal considering our research options lean towards trying to conjugate evaluation with opinion instruments (interview, stimulated recall), and visible traces of the task execution process.

The instruments we have and are developing are organized around Zimmerman's (2000) triadic model of the SRL cyclical phases mentioned previously in this paper. The instruments and techniques we have and are developing, allow us to question and capture the way in which learners plan, execute and evaluate their work. Ultimately, they bring to light how they can serve as a means to an end. That is, how they can function as an aid for learners to perform tasks better and self-regulate their learning more autonomously. We have adapted our instruments to the learners' level of development, to their specific context, to their

specific objectives and to the moment these instruments are being applied.

The instruments we have constructed, such as the stimulated recall technique with a questioning guide, semi-structured interviews, a study program with computer traces, self-evaluation grids, self-efficacy scales and satisfaction scales, allow us to capture the complexity of learners' efforts to learn, as well as to conjugate learners' self-evaluation. These instruments provide us with opportunities to inform the individual of his position in regards to the objectives that are to be reached; have the individual self-evaluate his work; and inform the professional about the individual's evolution.

CHALLENGES REGARDING THE ASSESSMENT OF SRL AS AN EVENT: TRIGGERING AND TRACING STUDENTS' AUTONOMY IN TELES

Within contemporary academic contexts, Information Technology has brought many new challenges to learners as they may provide opportunities to plan, monitor and control aspects of their cognition, motivation, behaviour and environment in order to solve problems and reach objectives in a specific context so students self-regulate their learning (Veiga Simão, Duarte & Ferreira, 2008). In the next section, we present instruments and techniques we integrate with technological resources that have been or are in development at our PEAAR Program in order to assess SRL as an event.

Activating recollection processes in TELEs - Stimulated Recall

Learners of today are part of a digital and cyber generation that uses the Web, namely, for academic purposes as it allows them to decide how, when and where to participate in learning experiences and how to search for new information promoting self-regulation learning process. To capture the complexity of the self-regulating learning process while searching for information on the Web, our student recalled after tasks ended and reported thoughts, feelings and decisions that took place during task performance while they watched videotaped episodes of themselves workings. The stimulated recall methodology we use, emphasizes some interesting potentialities to promote learner awareness and control of cognitive, metacognitive and motivational processes by viewing themselves working as it seems to be a promise in the assessment of SRL in TELEs.

According to Veiga Simão (2001), this stimulated recall procedure will let learners analyze their learning process.

Below are a series of reaction/reflection questions which we used after students finished assignments during our stimulated recall sessions:

> How did you do the work?
> What difficulties did you feel?
> How did you overcome them?
> How do you evaluate your work?
> Do you want to change anything?
> What did you learn with this work?
> How did you manage time?
> Was using the Internet important? For what? How about using the computer?
> What did you like to do in this work? What didn't you like?
> If you started to do the work now, would you do it the same way?

The potentialities we identified of stimulated recall to promote SRL and make it visible emerged at different levels. On the cognitive level, we observed that the learner organizes information; focuses his attention on tasks; makes an effort to understand the studied topics and to solve problems and selects resources. On the metacognitive level, we verified that the learner selects strategies according to task demands and self-evaluates his results according to task aims. On the motivational level, we confirmed that the learner establishes self-efficacy expectancies; commits to task completion; resists distractions and gives values his work. On behavioral level, we observed that the learner manages time and efforts and persists working even when facing difficulties. Lastly, on a contextual level, we verified that he understands task demands and tries to accomplish tasks on time.

In students perspectives this procedure allows reflections on a decision levels ("Another aspect I found quite interesting was that the first animation I found was mentioned in every other site I visited. So I took that into consideration when making my decision because I thought that if they all mentioned it that's because it was probably an important piece of information" or "Meanwhile on my final review I took a second look to conclude if that was what I

initially intended), as well as far as the learning process is concern (Usually, when we do a project work, we don't have the perspective until the end, when we think "Now let's review and evaluate my work". … But we still don't have a camera recording us and that fact is extremely important because we have an actual image, we have present all we've done, we can move backwards and forwards, review it and , so, we're allowed to understand what is our work and if it is being effective).

The stimulated recall methodology we use does however, emphasize some interesting potentialities to promote learner awareness and control of cognitive, metacognitive and motivational processes by viewing themselves working as it seems to be a promise in the assessment of SRL in TELEs.

Computers exist. Now what? - Blended Learning

Many current studies have shown how Technology Enhanced Learning Environments have the potential to foster Self-regulated Learning (Hadwin & Winne, 2001; Steffens, 2007; Zimmerman & Tsikalas, 2005). But in which ways can we make Self-regulated Learning visible for teachers and researchers in these contexts? A learning method that triggers Self-regulated Learning as they use it and that registers students' actions throughout the process, could be an important opportunity.

We are currently developing a learning method that triggers SRL as students use it and that registers students' actions throughout the process with computer traces. Our main theoretical and practical resources in this environment include a computer, a classroom setting, Zimmerman's Triadic Model of SRL (2000), digital tools, such as digital animation and the Moodle platform, and pen and paper.

More specifically, based on Zimmerman's Self-regulated Learning Model, PEAAR is developing a blended learning environment that allows 4th-grade students to experience the various phases of SRL in a more conscious and overt manner. We intend to help students regulate and construct their learning, and ultimately, acquire autonomy while they study. We propose to make learning more meaningful and enjoyable by providing a Blended Learning Method that includes opportunities for students to perform a series of action in class.

Essentially, we expect students to observe strategy modeling provided by digital animation. To be exact, students can see videos, each depicting a short story of approximately tree and a half minutes. These videos are to be seen by the students in class. The main character, Bernard, goes through a number of situations which he must resolve. He uses different strategies so as to reach his objectives. Students have the opportunity not only to reflect on the strategies Bernard uses, but also to transport themselves into the video's situation and decide whether or not they would use the same strategies. The use of strategies is then further practiced in the exercises pertaining to each video. We also want to give students the opportunity to analyze learning tasks. Each task has a small description of what it entails and instructions, which can help students reflect on how they will go by completing it. Thus, they can set goals and plan their learning activity as they execute each exercise.

Another action we feel is important for students to do in class, is to make choices. That is, students can choose the videos they want to see and the exercises they want to do for each video. They get to choose from five different sports in each lesson. They then decide what and how they are going to learn about that sport. This can also give them an incentive to complete tasks because they're the ones choosing them. In this sense, motivation is the key. Guided practice is also included in our approach this study method. Although students have the freedom to choose which videos and activities they want to see and do, they have to choose from the ones offered in the learning method, which are in accordance with the Portuguese national English as a Foreign Language syllabus. They also have the support of the teacher, who is present at all times in case they have doubts.

With this study method, we intend to have students seek information. Bernard, the main character of the digital animation, will guide each student throughout the completion of the exercises. He will remind students of where they can look for useful information, namely, in the dictionary, the translation guide, their class wiki or even on an Internet search engine. Students can also review. They have the opportunity to see the videos more than once, if they feel it's necessary. They will be repeating what the narrator narrates into a microphone so as to practice pronunciation and fluency. This information will be registered on the computer system, which will enable them to review their participation and acquire a better

understanding of how they did and whether they want to repeat the activity.

Another interesting action students have the opportunity to experience, is monitoring. Students can monitor their learning progress as they move on. Bernard will help students by asking them questions regarding the difficulties they're feeling as they complete the exercises. This process is intended to help the students identify their strengths and weaknesses. Students will also be given the option to take notes if they feel necessary. What's more, students can structure their learning environment. That is, students will have the opportunity to work both individually and/or with colleagues, depending on the exercises. They can also choose to take notes either on the computer or on paper.

Keeping records of one's own work is another characteristic offered by this study method. Students have the option to keep work they complete in a portfolio in class, namely, the pen and paper exercises that complement the digital activities. The work they do on the computer will also be stored for them to consult further on, when they feel necessary. Moreover, students can also decided when they want to ask for help. Bernard pops up once in a while to remind students about whether or not they need to ask the teacher for help.

An essential part of this study method is that it allows students to evaluate their own work. In order to provide students with opportunities for self-evaluation, Bernard asks them about what they learned in class. Students may provide a written account of what they believe they've learned. Lastly, students can adopt and adapt strategies. To be exact, students may adopt some of Bernard's strategies or adapt them according to what they feel Bernard was lacking. These strategies may be connected to what students actually do in order to learn.

PROMISES REGARDING ASSESSMENT - SRL AS AN EVENT

Assessing SRL as an event can lead to understanding how an instrument/ technique itself functions. Developing tools with the potential to foster a greater understanding of tasks during the processes and strategies of individual's self-regulation, and that can function as a moment of reflection and change of individuals' perspective and practice of their own SRL process is still a promise for the future. Furthermore, developing instruments that foster moments of collaborative co-construction and serve as a guide during interventions is also a promise that if kept, could be very useful in assessing SRL as an event. The potential of these instruments and techniques could reside in understanding the SRL process of the individual in executing a specific task; in identifying the processes and strategies used by the individual during the execution of the task; and lastly, in obtaining data that provides information about the perception of the individual about his own SRL process during the execution of a task.

CONCLUSIONS ON ASSESSING AND MAKING SELF-REGULATED LEARNING VISIBLE

We consider that in order to promote the use of the instruments presented as opportunities to promote SRL competencies, so that these may be visible for learners and simultaneously give teachers information regarding their students' learning process, the following checklist should be followed:

a. Make learning a conversation topic;
b. Promote a reflective and strategic emphasis on the execution of learning tasks (forethought, strategic planning, execution, monitoring, volitional control, evaluation, reflection);
c. Identify conceptions about learning;
d. Include the social and affective side, giving emphasis to collaborative learning;
e. Promote reading and writing as support tools;
f. Increase the individual's confidence through the external assessment of self-evaluation;
g. Articulate self and hetero-evaluation because both help students elaborate and improve their planning skills in order to reach objectives.

We know from the studies we have conducted (Duarte & Veiga Simão, 2010; Veiga Simão, Duarte, & Costa Ferreira, 2009) and are developing (Costa Ferreira & Veiga Simão 2010), that it is not easy for learners to verbalize and reflect about their SRL processes. However, this verbalization and reflection drives learners to think about why things are the way they are: before, during and after performing tasks. The difficulties of students in responding to these questions can be connected to the lack of practice in thinking about their own thinking and about their own learning process. Furthermore, depending on ages,

explicit work allows learners to acquire indispensable vocabulary so that they may become familiarized with this process.

Teaching learners to verbalize their reasoning is to escort them to stop before acting, to facilitate task concentration, to stimulate the use of cognitive and metacognitive strategies, to monitor each step necessary to execute the activity, and to better confront their strengths and weaknesses.

Although the results of the different studies prove that the intervention of the SRL processes have an important role in changing individuals' behavior, it is still necessary to study in greater depth which processes, as well as when, how and why they produce these effects. Lastly, we believe further research is needed to explain the effects of the diverse components, the functions they have in the SRL process, which influence (moderators) and which intervene (mediators) in the process of goal pursuit.

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Use of learning strategies in an online-course at university – A situation-specific perspective on the use of self-regulated learning

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INTRODUCTION

This article describes an approach for research on the use of learning strategies in online-courses from a situation-specific perspective. Within this context, situation-perspective means that the use of learning strategies is regarded close to an ongoing learning situation.

Based on theoretical assumptions about the importance of learning strategies for successful self-regulated learning in online-courses as well as a review of research the necessity of a situation-specific perspective of research is demonstrated.

An explorative field-study is described that aimed at regarding and assessing the use of learning strategies from a situation-specific perspective on the use of learning strategies in an online-course at the university.

Results of this study show, that from a situation-specific perspective on the use of learning strategies differences in the use of specific cognitive, metacognitive and resource-related strategies can be identified. These differences seem to be associated with requirements of the specific learning situation of the online-course and a situation-specific assessment. Furthermore, situational components of self-regulated learning processes, such as learners' process-related cognitive and motivational characteristics and perceived elements of the learning environment, are highlighted as crucial factors for the use of learning strategies.

SELF-REGULATED LEARNING IN ONLINE-COURSES AT UNIVERSITY

The development of ICT made it possible to design sophisticated technology-enhanced learning environments (e.g. Azevedo & Cromley, 2004; Simons, van der Linden & Duffy, 2000; Weidenmann, 2006). Such technology-enhanced and web-based courses facilitate and require self-regulation of students' individual learning.

Potentials and requirements of web-based learning

Web-based courses enhance individual and active ways of learning (e.g. Germ, 2008; Reinmann, 2005; Schworm & Fischer, 2006; Tergan, 2002):

Learners can access information and communicate with other learners and their teachers independent of time and place. They have the possibility to learn at their own time and pace as well as to choose information and contents they currently need. Hypertext allows individual learning pathes through learning contents and enlarges the range of choices and sequences of learning contents. Furthermore the use of multimedia-based contents supports visual, interactive and authentic learning. Thus, hypertext- and hypermedia-based learning environments facilitate free exploration.

But web-based self-regulated, individual and active learning is quite challenging (e.g. Gerjets, Scheiter & Schuh, 2005; Schreblowski & Hasselhorn, 2006): Learners have to…

- …think about where they could find the required information and how to get it best.
- …decide, which content and information in which sequence they want to treat.
- …evaluate how far the relevant information fits to solve the current learning task.
- …to structure and plan their own learning time and goals.

Additionally, learners have to cope with specific characteristics of hypertext and hypermedia (Brünken, Plass & Leutner, 2004). Current findings of research on learning with technology-enhanced learning environments indicate, that learners often have problems to gain a deep understanding of complex contents (Greene & Azevedo, 2010; Azevedo & Witherspoon, 2009; McNamara & van Lehn, 2005). Two main problems are discussed within this context, called ‘lost in hyperspace’ and ‘cognitive overload’ (Conklin, 1987; Kuhlen, 1991).

Lost in hyperspace. Learners often don’t realise the various opportunities to navigate through the content and to use it purposefully. They consequently have a problem of disorientation due to the hypertext format. Disorientation can be conceptual as well: To recognize the semantic meaning of singular information units in hypertext or hypermedia contents is particularly difficult for learners with low prior knowledge (Tergan, 2002)).

Cognitive overload: Hypermedia systems are characterized by a high degree of extraneous load during processes of knowledge construction (e.g. Brünken & Seufert, 2006). Contents are presented in a complex and fragmented way. Thus, learners have to keep large amounts of information in mind in addition to specific learning issues as such. Cognitive resources are often occupied by handling the learning environment and content. There is a risk that learners suffer from cognitive overload and are not available to process semantics anymore (Heiß, Eckardt & Schnotz, 2003).

These problems of self-regulated web-based learning can be reduced by certain elements of hypertext and hypermedia environments, such as learning pathways or advanced-organizers. Those facilitation tools are useful measures to support effective and deep information processing during self-regulated learning. But these aspects alone are not a guarantee for successful self-regulated learning processes in online-courses (e.g. Mc Manus, 2000): Students have to be engaged to use contents and tools of technology-enhanced learning environments supporting learning processes adequately.

To cope with the requirements of self-regulated learning in online-courses they have to use appropriate strategies in order to learn effectively and successfully (Gerjets et al., 2005; Germ, 2008).

LEARNING STRATEGIES IN ONLINE-COURSES

Learning strategies are important process-related components of successful self-regulated learning (e.g. Zimmerman, 2000; 2008).

According to Weinstein and Mayer (1986), Wild and Schiefele (1994) and Pintrich and Garcia (1991; 1994) the following learning strategies can be distinguished:

- Cognitive strategies
- Metacognitive strategies
- Resource-oriented strategies

This classification is theoretically and empirically confirmed concerning conventional and traditional learning settings at university (Garcia & Pintrich, 1996; Wild, 2000). But cognitive, metacognitive and resource-oriented strategies seem to be crucial for successful learning in online courses as well (e.g. Flender & Christmann, 2002; Germ, 2008; Richter,

Naumann, Brunner & Christmann, 2005; Wirth & Leutner, 2006).

Cognitive strategies in online courses

Learners have to process information while learning whether they work on printed texts or with hypertext- or hypermedia-based contents (Wirth & Leutner, 2006). Cognitive strategies serve to select, organize, serve and process learning information. They can be divided into deep processing strategies respective elaboration, critical thinking and organization strategies and surface processing strategies respective strategies for rehearsing (Pintrich & Garcia, 1994; Weinstein & Mayer, 1986). The use of deep processing strategies helps students to gain an understanding of complex information and to support the handling of hypertext and hypermedia-based contents (Richter et al., 2005):

- Elaboration and critical thinking strategies help learners to understand the information and to recognize relations between contents in online-courses more easily.
- Organization strategies facilitate the understanding of the structure and learning paths through the contents.

Metacognitive strategies in online-courses

Metacognitive strategies are applied to plan, monitor and regulate the learning process. Related to the learner's autonomy in web-based courses concerning time, place, pace and way of learning as well as choice of information, these strategies are constitutive for learning success and the use of appropriate learning techniques and cognitive strategies (Bannert,2003; Friedrich & Mandl, 2006; Germ, 2008):

- Planning strategies help to define goals, to choose necessary learning techniques and to arrange learning steps and timeframes.
- If students use strategies for monitoring, they evaluate their understanding of the information and if the provided information is relevant for the current learning task and goal. Additionally, learners can evaluate their learning path through the contents and probably identify difficulties in navigating and orientating themselves (###).
- On the base of identified difficulties or problems through monitoring, the use of *regulation strategies* is useful for adapting learning behaviour. For instance, learners may repeat learning steps or adapt their learning pace. Regulation strategies seem to be quite useful to cope with the demands of multimedia- and hypertext-based learning contents (Azevedo, Cromley & Seibert, 2004; Bannert, 2001).

Resource oriented strategies

Resource-oriented strategies are used to provide necessary resources for learning in online courses. As mentioned above, self-regulated online learning is highly demanding and students have to use sufficient internal and external strategies to manage resources. These strategies can be divided into internal strategies and external strategies for resource management (Garcia & Pintrich, 1996).

Internal strategies seem crucial for successful self-regulated online learning with respect to the high demands of web-based courses (Brünken & Seufert, 2006):

- *Management of effort* is applied to work intensely on complex contents and to navigate actively through the learning environment. Management of effort includes keeping learning effort at a high level during the learning process.
- *Management of attention* are helpful to focus on relevant contents and information. With respect to the fact that web-based courses place high demands on the cognitive capacity of learners as mentioned above, the relevance of strategies for managing and focusing one's attention on relevant information becomes obvious.
- *Management of time* aims at investing sufficient time resources for learning. This means, that learners really use the time they scheduled for learning in the technology enhanced learning environment.

External strategies for resource-management even are assumed to be enhanced in web-based learning environments due to the opportunities of the World Wide Web (Reinmann, 2005; Schworm & Fischer, 2006). These external strategies are:

- *Getting information*: Web-based learning offers numerous opportunities for providing information. If students need additional information they can use various sources (online libraries, searching engines) within the world wide web, to search and find information independently of time and space.
- *Exchange with other learners:* Knowledge exchange and reciprocal support of students are essential for knowledge construction and effective learning. Using asynchronous and synchronous

tools for communication facilitate exchange with other learners.
- *Help Seeking*: If students identify problems during the learning process, purposefully asking and seeking for help is a useful strategy. An exchange with online-tutors and support services independently of time and space is possible.

Cognitive, metacognitive and resource-related strategies are crucial elements of successful self-regulated learning in web-based courses. But to which extent are these strategies actually used by students and which specific strategies are useful to effectively cope with the requirements of self-regulated online learning?

RESEARCH ON THE USE OF LEARNING STRATEGIES IN ONLINE-COURSES

To focus on the use of learning strategies in online-courses, activities of research should consider criticism on previous research of self-regulated learning concerning inappropriate perspectives on the use of learning strategies and methodological approaches (Artelt, 2000; Germ, 2008; Streblow & Schiefele, 2006)

A short review on previous research on learning strategies

Previous research on conventional self-regulated learning at university can be characterised by a wealth of studies (Streblow & Schiefele, 2006; Wild, 2000). Indeed, studies show that students use cognitive, metacognitive and resource-oriented strategies in general and contribute to confirm theoretical classifications of learning strategies. But previous research often focused on learning strategies from a general perspective (Schmitz & Wiese, 1999). So there is a lack of studies regarding the use of specific learning strategies in different learning tasks and learning situations. Interrelations between situational components of the learning process and the strategy use were mostly diregarded. For instance, those situational components are: perceived design elements of the learning environments, the situational motivation or cognitive load during processing information (Entwistle & Peterson, 2004; Rheinberg, 2002; Schiefele & Streblow, 2006; Sweller, 1994, 1999).

The following questions on students' use of learning strategies are still mostly unacknowledged: To what extent are specific strategies deployed in specific learning contexts and tasks (e.g. solving a practical problem, learning for an exam, working on a case study)? Which specific strategies lead to learning success concerning different learning tasks and contexts? Which specific didactical elements as well as used media for learning encourage students during the current learning process to deploy specific cognitive, metacognitive and resource-oriented strategies?

Furthermore results of studies on the interrelation between strategy use and learning success are quite inconsistent. The relevance of learning strategies for successful self-regulated learning is empirically still not confirmed. Inappropriate ways of measurement concerning the use of learning strategies and learning success in consequence of a predominantly global perspective on the use of learning strategies cause such inconsistent findings (Streblow & Schiefele, 2006; Wild, 2000).

Requirements for research on the use of learning strategies concerning online-courses as well as conventional learning tasks should take a situational perspective on the use of learning strategies:
- Cognitive, metacognitive and resource-oriented strategies should be regarded as situational components of the learning process on the level of theory and methodology
- Situational motivional, cognitive components and perceived elements of the specific learning environment should be taken into account

Current research concerning technology-enhanced learning environments

Turning to the state of recent research on learning strategies in technology-enhanced learning environments, increasing activities of research on the use of learning strategies and behaviour while using computer-based learning environments can be identified (Green & Azevedo, 2010).

In these studies and research activities, appropriate ways of assessment of learning strategies and the use of learning strategies during handling the demanding characteristics of technology enhanced learning environments are discussed in detail (e.g. Azevedo, Moos, Johnson & Chauncey, 2010; Schraw, 2010; Winne, 2010).

With respect to the high demands hypertext and hypermedia learning environments put on self-regulated learning and information processing, there are numerous studies that stress the importance of metacognitive and cognitive strategies during handling hypertext and hypermedia-based contents (Azevedo & Cromley, 2004; Azevedo, Cromley & Seibert, 2004; Bannert, 2003). But those studies mainly focus on the use of learning strategies while learning with hypertext and hypermedia, but rarely consider the complexity of learning situations and processes in online courses (Germ, 2008): Further situational components of self-regulated learning in online course such as learners' situational motivational and cognitive characteristics as well as perceived characteristics of the learning environment are often not regarded in association with the use of learning strategies. The use of resource-oriented strategies is often not considered, too.

Thus further research on the use of learning strategies in online-courses is needed. This research should assess the use of learning strategies relating to the particular learning situations in online courses. Interrelations between the use of strategies and structural, as well as situational components of self-regulated learning should be regarded.

A SITUATION-SPECIFIC PERSPECTIVE ON THE USE OF LEARNING STRATEGIES

Considering current state of research on the use of learning strategies in online-courses and criticism on previous research, this study regarded the use of learning strategies from a situation-specific perspective of research. Within this context situation-specific means, that the use of learning strategies is regarded close to an ongoing learning situation. Thus, it was a central aim of this study to analyze the students' use of learning strategies relating to a specific situation of self-regulated learning chosen from an online-course at university.

A situation-specific framework model of research

Combining theories and models of self-regulated learning (Boekaerts, 1999; Friedrich & Mandl, 1997; Schiefele & Pekrun, 1996; Winne, 2001; Zimmermann, 2000; Zimmermann & Kitsantas, 2005) as well as results of research on the use of leaning strategies in conventional and technology enhanced learning a framework model of research (Germ, 2008) was developed (see figure 1)

This framework model includes structural and process-related components of the learning process that interrelate with the use of learning strategies during a self-regulatory learning phase of an online-course (Germ, 2008). In addition the model contains interrelations between the use of learning strategies and leaning outcome.

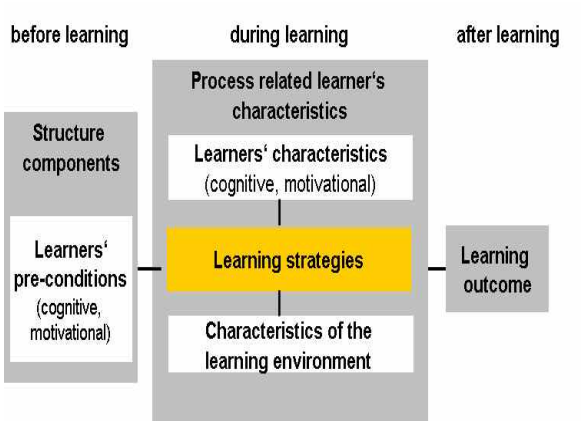

Figure 1: Frameworkmodel for investigation (Germ, 2008)

Context and object of investigation

Context of this study was the online-course "Development and implementation of learning environments". This course addresses master students of education science, educational psychology and various disciplines.

The course consists of eight learning units, each of them dealing with a particular topic. Students' have to work on all units over a period of two months.

The design of the units is problem-oriented: Based on a real-life problem students have to work on contents individually within a given timeframe to prepare on solving a case-based task collaboratively. The contents are presented in hypertext-format enriched with graphics and audio-streams. During the learning process students communicate with the tutor and learners asynchronously.

Focusing on the situation-specific use of learning strategies, within this study one unit of the course was chosen for inquiry in order to analyze the use of learning strategies related to a particual learning situation and topic.

Research questions and dimensions

Four main questions were investigated within this study:

(1) To what extent are cognitive, metacognitive and resource management strategies used by students during SRL in the online course?

(2) To what extent is there a correlation between the learners´ pre-conditions and the use of learning strategies?

(3) To what extent is there a correlation between the learners' situational characteristics and the use of strategies on the one and between the perceived characteristics of the learning environment and the use of learning strategies on the other hand?

(4) To what extent is there a correlation between the use of learning strategies and the learning outcome?

To investigate these questions different essential structural and process-related components of the learning process were regarded, that are assumed to have an influence on students' use of learning strategies (Germ, 2008). These components are summarized in *figure 2* relating to the four main questions.

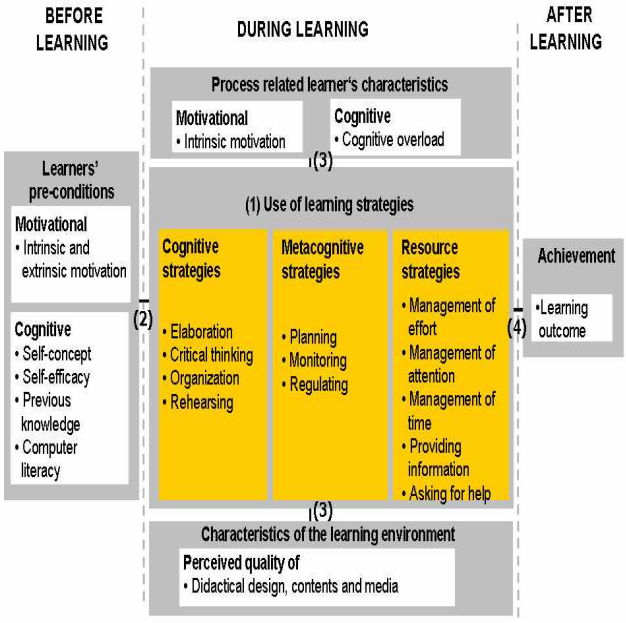

Figure2: Framework model and dimensions of investigation (Germ, 2008)

The following dimensions were considered within this study (figure 2):

(1) According to the first research question cognitive, metacognitive strategies as well as strategies for resource-management were regarded.

(2) According the second question structural components respective learners' pre-conditions were considered: Intrinsic and extrinsic motivation on the level of motivational pre-conditions as well as self-concept, self-efficacy, previous knowledge and computer literacy on the level of cognitive pre-conditions.

(3) According to the third main questions the framework model (figure 2) includes learners' process-related cognitive characteristics respective cognitive overload and students' situational intrinsic motivation while learning.

(4) Learning outcome is the dimension, which was regarded relating to main question 4.

Situation-specific assessment

25 participants of the online course at the University of Munich took part in this assessment. Before starting the self-regulated learning phase an online-questionnaire and test were conducted to assess learners' cognitive and motivational preconditions as well as previous knowledge.

At the end of the learning phase, that took 12days, a questionnaire and test were promptly exerted in order to assesss the use of learning strategies and further process-related components as well as the acquired knowledge. All of the process related components were assessed referring to the specific learning situation. To appropriately assess the use of learning strategies an adapted version of the LIST-questionnaire (Wild & Schiefele, 1994) was used. This adapted version contains items that have been restated in terms of the specific learning situation (*table1*).

Table1: Examples for the adaptation of the items.

Original item (LIST)	*Items adapted fort he study*
Learning new concepts, I imagine practical application possibilities.	Learning new approaches of designing learning environments, I imagined additional apllication possibilities myself.
If anything unclear, I ask my colleagues for advice.	If anything was unclear during the learning phase, I wrote my question in the forum to ask my colleagues for advice. .

RESULTS AND DISCUSSION

Central results of the study are described and discussed referring to the four main questions in the next paragraph.

Use of learning strategies (Question 1)

The results of the study show, that learning strategies were used to a different extent (see figure 3):

Students' reported a *frequent use* of metacognitive strategies for monitoring (M=4.09 on a 5-point-scale) and regulating (M=3.68) the learning process as well as internal resource-oriented strategies for *managing attention* (M=3.84) and *effort* (M=3.99).

Compared to the use of metacognitive and resource-oriented strategies cognitive strategies were not used to a high extent. The results show, that strategies of a surface processing seem to have played a less important role during the self-regulated learning phase compared to strategies of elaboration. Although students contentiously had the opportunity to communicate with tutors and others as well as to provide additional information, these external resource-oriented strategies were hardly used.

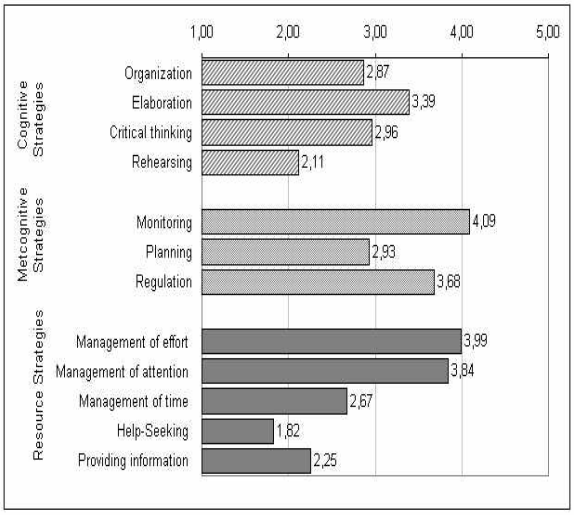

Figure3: Mean values of the use of learning strategies reported by students on a 5point-scale with a range from 1= 'very rare' to 5 = 'very often'

The reported differences in the use of strategies seem to be associated with the specific learning situation: With respect to the various requirements of self-regulated learning in online-courses as mentioned above, the frequent use of metacognitive and internal resource-oriented strategies that students reported during the learning phase of the online-course seems quite plausible.

Considering the learning task there probably was no need for students to deploy cognitive strategies for rehearsing, because they had to prepare on solving a case-based problem and not for a test or examination. Regarding the frequent use of metacognitive and internal resource-orientied strategies the question arises wether coping with the requirements of the self-regulated leaning situation occupy cognitive capacities for elaboration and critical thinking.

Learners' pre-conditions and strategy use (Question 2)

The results of the study show, that learners' pre-conditions were related to the use of learning strategies during the learning phase. In particular, motivational pre-conditions of the learners particularly seem to be notable. The intrinsic motivation at the beginning of the learning process was unexpectedly not associated with the use of strategies within this study.

Students' extrinsic motivation seems to be quite important for the use of cognitive strategies for a deep processing as well as internal resource-oriented strategies (see table 2 and table 3): The extrinsic motivation correlated significantly with the use of cognitive strategies for elaboration and critical thinking and resource-oriented strategies for management of effort and attention.

Table2: Correlations between students' pre-conditions and the use of cognitive strategies

	Organi-zation	*Elabo-ration*	*Critical thinking*	*Re-hearsing*
Intrinsic motivation	-.22	.24	.09	-.28
Extrinsic motivation	.19	.52**	.42*	-.17
Self-efficacy	-.08	-.13	-.07	-.30
Self-concept	-.25	.37*	-.11	-.29
Computer literacy	-.02	.04	.11	-.51**
Previous knowledgle	.18	.40*	.28	.20

Note: ****** $p < .01$; ***** $p < .05$

Table3: Correlations between students' pre-conditions and the use of internal resource-oriented strategies

	Management of effort	*Management of attention*	*Management of time*
Intrinsic motivation	.04	..22	-.17
Extrinsic motivation	.34*	.55**	.15
Self-efficacy	-.13	-.04	-.30
Self-concept	.10	.26	-.04
Computer literacy	-.05	.07	-.12
Previous knowledgle	.23	.17	.25

Note: ****** p < .01; ***** p < .05

These findings seem to be consistent with theoretical assumptions that the impact of extrinsic and intrinsic motivation at the beginning of the learning process have to be regarded relating to specific learning situations (e.g. Schmitz & Wiese, 1999). By reason that students have to solve all case-based learning tasks during the online-course to complete it successfully, the importance of extrinsic motivation for the use of strategies for a deep processing seems plausible.

Process-related components and the use of strategies (Question 3)

The results of the study stress the importance of process-related components of the learning process relating to the use of learning strategies: Both learners' *situational characteristics* as well as *perceived quality* of the learning environment showed significant correlations with the use of several cognitive, metacognitive and resource-oriented strategies:

The situational intrinsic motivation during the learning phase correlated significantly with the use of cognitive strategies for elaboration (r = .57; p < .01, metacognitive strategies for monitoring (r = .43; p<.05) and resource oriented strategies for management of attention (r =.49; p < .05).

Students' cognitive overload and the use of metacognitive strategies for regulation were positively correlated (r =.47; p < .05), whereas cognitive overload and the use of strategies for management of attention correlated negatively (r = -.41*; p < .05).

Furthermore, perceived quality of the learning environment was correlated with several cognitive, metacognitive and internal resource-oriented strategies (see table 4)

Table4: Correlations between perceived quality and the use of cognitive strategies

	Organi-zation	*Elabo-ration*	*Critical thinking*	*Re-hearsing*
Didactical Quality	.35*	.41*	.45*	-.10
Quality of contents	.09	.20	.25	.13

Note: ****** p < .01; ***** p < .05

Table5: Correlations between perceived quality and the use of metacognitive strategies

	Planning	*Monitoring*	*Regulation*
Didactical Quality	.38*	.60**	.36*
Quality of contents	.14	.43*	.30

Note: ****** p < .01; ***** p < .05

Table6: Correlations between perceived quality and the use of internal resource-oriented strategies

	Management of effort	*Management of attention*	*Management of time*
Didactical Quality	.44*	.33	.25
Quality of contents	.02	.09	.37*

Note: ****** p < .01; ***** p < .05

Based on the results, the intrinsic situational motivation and particularly the perceived didactical quality can be assumed as beneficial for using learning strategies.

Strategy use and learning outcomes (Question 4)

Only one correlation seems to be meaningful concerning the use of cognitive, metacognitive and resource-oriented strategies. Regulation strategies and learning outcomes were positively related (r = .37*; p < .05), suggesting that regulation strategies were an important factor concerning the students' learning success.

Given the results concerning the use of strategies and the learning success, the question arises, wether the learning outcomes has been assessed appropriately by a knowledge test. Regarding the knowledge, that has

to be applied during the process of solving a case-based task subsequently to the individual learning phase probably will contribute to assess learning success in more appropriate ways than a test can do.

CONCLUSION

From a situation-specific perspective of research on the use of learning strategies within this explorative field-study it could be highlighted, that different cognitive, metacognitive and resource-related strategy were used by students in association with characteristics and requirements of the specific learning situation in the online course. Metacognitive and internal strategies for managing effort and attention played a major role during the self-regulated learning process.

Furthermore the study indicates that in addition to structural components of self-regulated learning, process-related components are crucial aspects related to the use of learning strategies. It could be shown that process-related cognitive and motivational characteristics as well as perceived didactic quality of the learning environment are meaningful factors for the use of learning strategies. The study suggests several starting points for further research and enhancing self-regulated learning in online courses.

Implications for further research

Further research on the use of learning strategies in technology enhanced learning environments should regard the use of learning strategies from a situation-specific perspective: Learners' pre-conditions and situational characteristics should be focused as well as characteristics of the learning environments.

A situation-specific perspective on the use of learning strategies requires a situation-specific assessment of the use of learning strategies. If learning strategy inventories are applied for assessment, an adaptation to the specific learning-situation seems to be essential.

Certainly there is a need for further replication studies in the context of similar online-course with larger samples. Multiple relations between structural and process-related components of the learning process in association with the use of strategies have to be analyzed within those replication studies.

Educational implications

In order to enhance the use of strategies for a deep processing of information, online-courses should be designed in high didactical quality that supports problem-oriented active learning by students. Thereby learners' motivation can be increased, which seems to be a crucial aspect in enhancing the use of learning strategies.

Finally, elements should be included that support working with hypertext and hypermedia. Such elements are:

- Structuring of hypertext and hypermedia by predefined learning paths and explanatory guided tours;
- Describing and explaining the structure of presented information and relations between information verbally or graphically (e.g. advanced organizers, mind maps or concept-maps);
- Marking of already visited web-pages and functions logging the learners' paths;
- Realizing design criteria for multimedia learning as using complementary pictures and texts and not inconsistent elements, avoiding distracting computer animations or sounds that are not related to the contents;
- Following design criteria for text such as comprehensibility, coherence, structuring, sequencing of contents.

Thus learners' activities to manage their attention and effort may be supported and capacities for information processing can be enhanced.

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WORKSHOP A: SRL IN TELES WITH FOCUS ON TEACHERS AND STUDENTS

LESSONS ON LEARNING: GUIDELINES FOR TEACHERS FOSTERING SELF-REGULATED LEARNING IN A TECHNOLOGY ENHANCED LEARNING ENVIRONMENTS

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INTRODUCTION

It goes without saying that fostering the development of knowledge and skills is different from supporting students to develop self-regulation learning strategies. Schoenfeld (1985) showed the difference describing how he, as a mathematics teacher, asked his college students to design challenging math problems which he subsequently solved thinking aloud in front of the classroom. In this way he not only showed the way he solved the problem but also modeled the use of heuristic strategies to approach the problem and control strategies to regulate the process of solving the math problem. Schoenfeld also coached groups of students independently working on math assignments. He asked the students three questions: (1) What are you doing? (2) Why are you doing this? (3) Why do you think that your strategy will help you to solve the problem? (Brown, Collins, & Duguid, 1989). Schoenfeld coached students to reflect on their approach and created awareness for learning and self-regulation strategies.

Teachers who are able to show how they apply heuristic strategies must have developed appropriate strategies for learning and self-regulation themselves. How do teachers in higher education learn and how do they regulate their learning? This question was addressed by Van Eekelen, Boshuizen, and Vermunt (2005) in a study in which three conceptions of learning (Cochran-Smith & Lytle, 1999) were distinguished: (1) acquiring existing knowledge by studying books or receiving training, (2) acquiring knowledge by reflecting on own teaching practice, (3) acquiring knowledge by studying own teaching practice. These three ways of learning may lead to either accommodation of existing knowledge or assimilation of new knowledge. The authors expected the higher education teachers to learn in a self-directed way on the basis of their own teaching experience (type 2 learning). Teachers were supposed to "independently and consciously direct the process of attaining learning goals" (p. 452). Fifteen experienced teachers from various disciplines (language, teacher education, facility management) were interviewed twice and were asked to keep, during one month, a diary three times a week by answering e-mails sent by the researchers. The data were analyzed according to the phenomenographic framework of Marton (1986). Teachers identified four categories of activities from which they reported to have learned: (1) learning by doing, (2) learning in interaction, (3) learning by reading (a newspaper, a book, an article), (4) learning by thinking. The teachers indicated that most of their learning took place in an unplanned way. Teachers more often

reported to have gained new insights than to have changed their behavior. The authors concluded that teachers' reported learning was less self-regulated and more spontaneous than expected. Also, reflection was not systematically used as an instrument to learn from teaching experiences. The authors proposed to add a fourth category, spontaneous learning at the workplace, to the three types of learning (acquiring existing knowledge by studying books or receiving training, acquiring knowledge by reflecting on own teaching practice, and acquiring knowledge by studying own teaching practice) proposed by Cochran-Smith and Lytle (1999). The conclusion from this study must be that teachers develop strategies for learning and self-regulation in a rather spontaneous, unplanned way.

Moreover, teachers tend to focus on discussing subject matter issues instead of learning strategies. Bolhuis & Voeten (2001) observed 130 upper secondary school Dutch classes taught by 68 teachers and identified three types of teaching: traditional transmission (30%), activating classes, coaching students at work (43%), process oriented teaching, discussing learning and self-regulation strategies (5%). So, Dutch teachers tend to activate their students, without addressing the process of learning itself.

Finally, when teachers coach students at work, they tend to focus on providing solutions, instead of diagnosing the cause of problems. Van de Pol, Volman, and Beishuizen (2011) closely observed three social science teachers working with groups of 12 – 14 years old lower vocational education students, working on assignments like preparing a poster or summarizing a text. Contingent support by diagnosing a problem and using the diagnosis to advise on how to proceed, was rare. Usually, teachers either did not diagnose the problem at all or did not follow up on their diagnosis when offering advice.

So, there is an issue: teachers acquire strategies for learning and self-regulation in a rather haphazard way, teachers prefer discussing subject matter, instead of self-regulation and learning strategies. And when they focus on learning problems, they often jump to advice before adequately diagnosing the problem itself. In this paper, I want to provide guidelines to teachers on how two make use of the opportunities of technology enhanced learning environments (TELEs) in order to foster self-regulated learning (SRL). I address this issue by identifying and discussing examples of *lessons of learning.* In particular I try to find answers to three questions:

1. What is the role of technology enhanced learning environments in fostering the development of learning and self-regulation strategies?
2. What is the role of teachers in fostering the development of learning and self-regulation strategies?
3. How can teachers make use of technology enhanced learning environments to foster the development of learning and self-regulation strategies?

THE ROLE OF TECHNOLOGY ENHANCED LEARNING ENVIRONMENTS IN FOSTERING THE DEVELOPMENT OF LEARNING AND SELF-REGULATION STRATEGIES

Technology enhanced learning environments (TELEs) have three important characteristics which considerably contribute to the depth and breadth of learning processes: complexity, interactivity and authenticity (Beishuizen, 2010). I will first explore the role of complexity of TELEs in fostering self-regulated learning. Swaak, De Jong, and Van Joolingen (2004) tested the performance on various posttests of 112 16-17 years old secondary school participants preparing for university education. Participants were randomly assigned to either a simulation environment or a hypertext environment. Both environments represented the same content and contained a considerable number of assignments. The hypertext environment led to better learning outcomes than the simulation environment in terms of knowledge of definitions and relations between concepts. It turned out that participants in both conditions closely followed the assignments without using the facilities for self-regulated learning. Available self-regulation tools were manipulating the complexity of the model te be studied, exploring the accompanying assignments, and the opportunity to study graphs. Based on the finding that students did not make use of self-regulation tools and the finding that the hypertext environment produced better learning outcomes, the authors concluded that simulation based learning environments should only be developed and implemented when they provide clear advantages to the students, when the domains are really complex, and when students receive considerable amount of freedom to explore and self-regulate their learning process. So, the complexity of

the simulation environment was not necessarily a blessing for the students.

In perhaps one of the most explicit studies into self-regulated learning in TELEs, Manlove, Lazonder, and De Jong (2009) devised a so-called Process Coordinator (PC+) to provide regulative support to upper secondary students inquiring a fluid dynamics problem in a simulation environment called Co-Lab. PC+ provided a goal tree or a representation of goals in an inquiry cycle. This feature was heavily and successfully used by the students. Monitoring tools like a note pad, question prompts, timed cues and hints did not improve students' inquiry behavior. A lab report template clearly helped students to report and evaluate the outcomes of their inquiry. The authors emphasized the influence of domain related knowledge and experience on the efficacy of the regulative tools in PC+. Students were reported to have ample experience with lab experiments which made the goal tree instrument for planning useful. However, due to lack of knowledge about fluid dynamics they could not take advantage of the monitoring tool which was embedded in the problem space. In line with Moreno and Mayer (2005) the authors suggested to pre-train student on subject matter knowledge and skills before admitting them to complex simulation based learning environment. Again, the complexity of the simulation environment was not used by the students to full extent.

Does enhanced interactivity of TELEs lead to better self-regulated learning? Saab, Van Joolingen, and Van Hout-Wolters (2006) developed an instruction for students working in a technology enhanced collaborative learning environment. Four rules were included in the instruction: respect ("everyone will have a chance to talk", "everyone's ideas will be thoroughly considered") , intelligent collaboration ("sharing all relevant information and suggestions", "clarify the information given", "explain the answers given", "give criticisms"), deciding together ("explicit and joint agreement will precede decisions and actions", "accepting that the group, rather than the individual, is responsible for decisions and actions"), and encouraging ("ask for explanations", ask until you understand", "give positive feedback"). Pairs of 76 tenth grade secondary school students (age 15 - 17) were randomly assigned to either an instruction or a control condition. The students had to discover the rules behind a simulation about collisions, implemented in SimQuest (De Jong et al., 1998). The instruction improved the quality of communication (describing and recognizing relations), discovery activities (drawing conclusions) and regulative interaction between the pairs, but the learning outcomes of instruction group and control group did not differ. In this study, students were trained to make proper use of the rich instruments of the learning environment. However, extensive interaction tools in the learning environment did not pay off in better learning outcomes.

What about the influence of authenticity on self-regulated learning? Martens, Bastiaens, and Gulikers (2002) studied competency based computer supported learning environments (CCLEs). The authors varied the degree of authenticity of the learning environments. Psychology students had to discover why in a transport company so many bus drivers often fall ill. Three versions of the environment were compared: an authentic version with full learner control, a text-only version, and an authentic version with restricted learner control. Students' reports were evaluated. Students completed a knowledge test and a questionnaire about the experienced authenticity and clarity of the learning environment. The text-only version turned out to produce the best learning outcomes. Moreover, students did not perceive the authentic learning environments as more authentic or more motivating than the text-only version. The authors concluded that high expectations of the authentic learning environments were not corroborated by the learning outcomes. However, the authors did not advocate a restoration of traditional principles of instruction. Rather, they suggested to further explore the nature of student motivation in learning environments.

Studying the effects of authenticity on the motivation of secondary school students was one of the aims of the FM1550 Project, in which students explored the medieval center of Amsterdam and enacted various historical events. Field teams were guided by colleagues in the headquarters of the game. Akkerman, Admiraal, and Huizenga (2009) collected data about the extent to which authentic context contributed to the acquisition of history knowledge and understanding and to the motivation of the students. The authors observed that the field teams were less able to grasp the story line and, consequently, focused on the practical issues related to locating assignment spots in the city, communicating through cell phones and recording video sequences. Students working the headquarters of the game were better able to create a narrative

organization of all game elements representing the historical context of medieval Amsterdam. Again, complexity was an intrinsic part of the authentic learning environment but did not contribute to better learning outcomes.

All studies conveyed the message: Technology enhanced learning environments can be used to create complex, interactive and authentic learning environments. However, students often make insufficient use of the cognitive and metacognitive controls the environments offer in order to improve learning, self-regulation or learning strategies. Perhaps, a teacher is needed to introduce the student to the rich features of the learning environment.

THE ROLE OF TEACHERS IN FOSTERING THE DEVELOPMENT OF LEARNING AND SELF-REGULATION STRATEGIES

Which teaching strategies are effective means of fostering self-regulated learning by students? In order to answer this question, we need to know which self-regulated learning strategies produce effective learning. Dignath and Büttner (2008) conducted a meta-analysis of 49 studies in primary education and 35 studies in secondary education in which students were trained to self-regulate their learning. The authors made a distinction between cognitive strategies (like elaboration, organization and problem-solving), metacognitive reflection (reasoning, knowledge about strategies, benefits of strategy use), metacognitive strategies (planning, monitoring and evaluation) and motivation strategies (resource management, causal attribution, action control, and feedback). The authors conclude that primary school children benefit from cognitive strategy instruction, whereas for secondary school students instruction of motivational strategies and metacognitive reflection is superior to instruction of cognitive strategies. So, it appears that primary school students should be coached at a more concrete level and secondary school students are best addressed at a more abstract level.

As Van Eekelen, Boshuizen, and Vermunt (2005) found, teachers often develop learning and self-regulation strategies in a haphazard way. Therefore, we need to consider how student teachers, beginning teachers, and experienced teachers can be trained to foster self-regulated learning by students. Kramarski and Michalsky (2010) showed that a hypermedia learning environment proved successful in teaching student teachers to design skills to foster self-regulated learning strategies, like planning and allocating learning resources, monitoring current knowledge and skill levels, and evaluating current learning level at various points during the acquisition process. Perry, Hutchinson, and Thauberger (2008) designed a framework for helping beginning teachers to teach and model self-regulated learning strategies. In this framework, communities of teachers were created in which teachers identified learning goals, designed activities to accomplish these goals and monitored their progress. Beginning students prepared activities like fostering choice, challenge, self-evaluation, peer support, and creating complex tasks. During discussions between beginning teachers and coaches after observation of lessons, the authors noted an increase in self-regulated learning related issues, which indicated that the beginning teachers became more sensitive to these issues. Butler, Novak, Jarvis, and Beckingham (2004) developed a community of learners during a period of two years, in which researchers and teachers collaborated to design new instructional strategies to foster self-regulated learning by students with learning difficulties. Teachers were supported by an experienced mentor on the workplace. After two years of collaboration the authors noticed substantial changes in the practice of the participating teachers which were not dependent upon the presence and support of researchers. Teachers showed signs of deeply rooted conceptual change.

Granberg (2010) asked 57 student teachers, preparing for kindergarten, to use a collective blog to work on assignments, like reading a book are discussing the characteristics of good teachers. Assignments were completed at various levels of abstractness. Deep levels of reflection were only reached after a prolonged period of time. The author concluded that the step from internal dialogue to, external, written dialogue, takes a long time.

Now that we know that teachers can develop SRL strategies themselves, we have to consider the question how they can teach their students to become self-regulated learners. Based on an extensive review of the relevant literature Ley & Young (2001) proposed four instructional strategies to foster self-regulation among students. First, *preparing and structuring the learning environment.* Teachers can help students to remove sources of distraction before or during the learning process. Secondly, teachers can structure learning materials by *providing outlines or*

advance organizers, or they can teach students to improve the physical setting of the learning environment themselves. Thirdly, it has been shown that adequately monitoring the progress of the learning process contributes to the quality of learning. However, in order to be able to monitor progress teachers need to *clearly state learning goals*. Subsequently, they should *provide feedback* on the students' progress towards attaining the goals. Teachers can train students to keep record of their learning processes and evaluate whether learning goals have been achieved. Finally, *models or performance standards* enable students to evaluate their current performance to the standard of the model. For instance, model exams may help students to identify what they have learnt and needs further attention. These four instructional strategies enable teachers to actively foster self-regulated learning.

The evidence discussed in this paragraph provides a positive answer to the question whether and how teachers can support and coach their students to acquire strategies for learning and self-regulation. Yes, they can, provided that they choose self-regulation strategies that match the level of cognitive development of their students (concrete strategies for younger students, abstract strategies for older students), and provided that they develop teaching strategies on the basis of their own experience and in a social environment. Communities of learners, in which teachers simultaneously develop self-regulated learning and teaching strategies, appear to offer an appropriate learning environment for teachers. The availability of a personal coach or mentor appears another critical success factor. The mentor serves as enculturation agent, offering relevant theoretical perspectives which enrich and strengthen the process of developing teaching strategies for fostering self-regulated learning. Teachers can make use of various strategies to foster self-regulated learning: structuring the learning environment, providing outlines, providing feedback on the basis clear learning goals, and providing models or performance standards. Of course, we have to be careful to attribute learning outcomes to critical characteristics of the learning environment (Veenman, 2007), but the message is hopeful: teachers can make a difference when fostering self-regulated learning strategies of their students.

HOW CAN TEACHERS MAKE USE OF EDUCATIONAL TECHNOLOGY TO FOSTER THE DEVELOPMENT OF LEARNING AND SELF-REGULATION STRATEGIES?

Based on the previous findings, it can be expected that the potential advantages of technology enriched learning environments can be made profitable by teachers employing various instructional strategies, tuned to the level of cognitive development of their students. However, the literature on how teachers make use of the facilities of TELEs to educate self-regulated learners is scarce. In a position paper Vovides, Sanchez-Alonso, Mitropolou, and Nickmans (2007) discussed the use of electronic learning environments to support the development of learning strategies and self-regulated learning. The authors emphasized that teachers need to be trained to acquire the new pedagogical role of facilitator and coach, and warned against frustration when teachers want to make use of educational technology but lack the prerequisite knowledge and skills.

Bartolomé & Steffens (in press) identified three requirements for technology enhanced learning environments supporting SRL:
1. Learners should be encouraged to plan their learning activities. In order to be able to plan, students should have the opportunity to develop planning and time management skills. TELEs can help students developing these skills by presentation relevant information in various modes and enabling students to interact (cf. the goal tree instrument developed by Manlove, Lazonder, & De Jong, 2007).
2. Learners should be encouraged to monitor their activities: feedback from the TELE based on record of students' activities (cf. the lab report template developed by Manlove, Lazonder, & De Jong, 2007). Bartolomé and Steffens (in press) refer to communication mechanisms which link the student to fellow students and to his or her teacher.
3. Learners should be encouraged to evaluate learning outcomes with the help performance criteria provided by the TELE. Peer review and feedback may be helpful to meet this third requirement.

Bartolomé and Steffen's recommendations closely resemble the instructional strategies of Ley and Young (2001), particularly the recommendation to provide learning goals and performance standard.

Beishuizen (2010) reviewed recent Dutch studies into the use of TELE's to enhance self-regulated learning.

He arrived at the conclusion that teachers should create an appropriate balance between structure in the learning environment on the one hand, and autonomy for the learner to develop his or her learning strategy on the other hand.

GUIDELINES FOR TEACHERS

Although it has still to be shown that teachers can make use of the opportunities of technology enhanced learning environments to foster the development of strategies for self-regulated learning, many studies (Manlove, Lazonder, & De Jong, 2009; Dignath & Büttner, 2008; Kramarski & Michalsky, 2010; Perry Hutchinson, & Thauberg, 2008; Ley & Young, 2001; Bartolomé & Steffens, in press) provide promising signs. When teachers are offered the chance to develop their own repertoire of learning and self-regulation strategies in long-term communities of learners, they eventually will be able to make use of the tools technology enhanced learning environments contain to foster the development learning and self-regulation strategies and skills. It is difficult, but is possible.

That it is difficult has become clear in studies reviewed by Vovides, Sanchez-Alonso, Mitropolou, and Nickmans (2007) who warned against frustration when teachers want to make use of TELEs but lack the prerequisite knowledge and skills. That it is possible to develop strategies for learning and self-regulation has been shown in experiments, like Manlove, Lazonder, and De Jong (2009) who developed useful tool to support the development of strategies for learning and self-regulation.

We definitely need more research in this area, combining the effects of well structured, authentic and open technology enhanced learning environments, with the contribution of well trained teachers, able to model and coach a variety of learning and self-regulation strategies.

Before we provide some guidelines for teachers we have to explore the reason that teachers do not apply in practice what they have learnt to do in theory (Bolhuis & Voeten, 2001). Korthagen (2010) emphasized “that all knowledge, including scientific knowledge, is originally grounded in personal encounters with concrete situations and influenced by social values, the behavior of others, implicit perspectives, and generative metaphors” (p. 103). This implies that teachers in general develop their teaching strategies, including strategies to foster self-regulated learning, through experience, and through reflection on their teaching practice. Theoretical perspectives are not useless, but are understood and integrated as part of the enculturation process, in which teachers gradually adopt and develop their professional identity (Cobb, 1996). In this view, theoretical perspectives should be introduced through social interaction with experienced colleagues or teacher educators who coach teachers and explain the value of various strategies.

Based on the literature discussed above we can make some claims as to *what* and *how* teachers should aim at when fostering self-regulated learning. As far as the *what* is concerned teachers might focus on providing clear learning goals (Ley & Young, 2001; Bartolomé & Steffens, in press) to enable students to develop planning and monitoring strategies and skills, and on providing performance standards (Ley & Young, 2001; Bartolomé & Steffens, in press) which students can use to evaluate the quality of their work. These two components of learning environments are often mentioned as useful tools to foster self-regulated learning. Technology enhanced learning environments may be adapted to provide support to the realization of these two characteristics.

As far as the *how* concerned, it is clear that the context of communities of learners (Brown, 1997; Brown & Campione, 1996) provides a good opportunity for teachers to foster stable strategies for self-regulated learning. Wong (2004) summarized the characteristics of successful induction environments for young teachers:
“Successful induction programs:

- Have networks that create learning communities
- Treat every colleague as a potential valuable contributor
- Turn ownership of learning over to the learners in study groups
- Create learning communities where everyone, new teachers as well as veteran teachers, gains knowledge
- Demonstrate that quality teaching becomes not just an individual responsibility, but a group responsibility as well" (Wong, 2004, p. 51).

These characteristics are not only meaningful for young teachers in their induction phase, but also for students in general working in the development of strategies for learning and self-regulation. Beishuizen (2008) summarized the way communities of learners should be arranged:

1. Students are considered as *serious partners* in a process of knowledge building.
2. Students and teachers collaborate in order to answer questions according to the method of *inquiry learning.*
3. The research questions clarify *big ideas* in the domain of research.
4. Students are immersed in a culture of scientific research, in which they learn to work with *research methods, rules for collaboration* and *scientific communication.*
5. Students learn to *reflect* on methods and rules, on principles and schemas on the basis of concrete experience and on the value of their work for science and society.
6. Students get access to *resources and equipment* for research.

These six crucial characteristics meet the requirements Wong (2004) identified for successful induction programs. It should be added that the gradual development of strategies for self-regulated learning requires a prolonged period of working in a community of learners (Butler, Novak, Jarvis, & Beckingham, 2004; Granberg, 2010). Under these conditions, teachers should establish an appropriate balance between structure and autonomy (Beishuizen, 2010), and, in this way, create optimal conditions in technology enhance learning environments to foster the development of strategies for learning and self-regulation.

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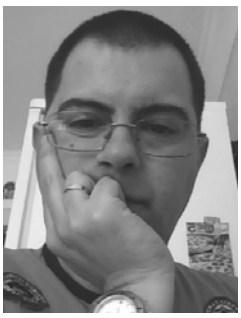
Building proactive teachers: A workshop to provide for self-regulated learning experiences in teacher education



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KEY WORDS

Community of practice, Higher Education, moodle, self-regulated learning, social network analysis, teachers' training, technological tools.

ABSTRACT

This paper addresses the rationale and structure of a teachers' training workshop which was held at an institution of Higher Education in Portugal during the academic year of 2010/2011 based on self-regulated learning and e-learning using *moodle*. We will begin presenting the background and institutional context of the workshop and its theoretical framework, drawing on *Connectivism*, *self-regulated learning* and *communities of practice*. After that, we will explain the structure of the workshop and suggest strategies to assess its success and conclude with some final thoughts.

INTRODUCTION

The Bologna Process has brought new challenges to Higher Education in Portugal; it has also provided us with the characteristics of a new type of student: more

interventionist, proactive and master of his own learning process. The challenge for teachers is the redefinition of pedagogic and didactics processes, closer to the reality of scientific research, relegating, without neglecting, the transmission of knowledge to a more secondary role. Based on this fact, Higher Education institutions feel the need to train their teachers on theories and methodologies where issues such as problem based learning, self-regulated learning and e-learning and tools like *Learning Management Systems*, *Personal Learning Environments* and *Networks* must prevail even if it means going out of the walls of the institution.

Training Higher Education teachers in the use of technological tools and Learning Management systems must not be reduced to learning technical and technological skills. They must learn how to use them with pedagogical support. Having in mind that we should give an example of how not to teach in a directive way we designed a workshop based on the concepts of self-regulated learning (Wolters, 2010; Bentivoglio et al, 2010) sharing some traits of the *massive online open courses* (MOOC) designed by Siemens, Downes, Cormier and Kop (Siemens, 2010). Downes (2009) proposed autonomy, diversity, openness and connectedness and interactivity as the principles of a connectivist dynamics. Being restricted to teachers of the institution the dimension of openness is the only one not completely assured. Nevertheless it might be called a *massive online closed course* (MOCC).

For the design of the workshop we had to take in account some considerations and theoretical concerns involving pedagogy and didactics in Higher Education, intending to go further than technological tools use issues as mentioned by Steffens (2001):

> While self-regulatory activities are controlled cognitively, they encompass more than the monitoring of cognitive activities.
> Motivational and emotional processes are also important in learning and they too need to be regulated. At the same time, multimedia computer programs and the Internet have come to play an important role in present day's learning environments. The question therefore arises as to what extent these new technologies facilitate the acquisition and improvement of self-regulated learning strategies. (p. 77)

We wanted teachers participating in the workshop to be proactive and build their own path of learning, with the possibility to work collaboratively throughout the workshop or grouped at specific times, either online, face-to-face or both.

BACKGROUND

The increasing integration of Information and Communication Technology (ICT) in Higher Education has been a challenge and a research area in constant growth. The progress of technology along with the great evolution of the Internet and the invention of a plethora of devices have brought significant challenges to teachers and students.

Among the technologies to support technology enhanced learning there are *Learning Management Systems* (LMS) that have been adopted by many institutions of Higher Education, either as support in the classroom learning or in full distance learning. In Portugal, these institutions have started to adopt the use of LMSs due the increasing use of ICT and due the Bologna Process and the creation of a *European Higher Education Area* (EHEA).

The integration of ICT in the Portuguese education system has been constant since the 80's culminating in 2007 with the approval of the *Technological Plan for Education* which gave computers and internet access to almost all students, creating challenges and opportunities for Higher Education.

In this line, Lencastre and Monteiro (2008) conducted a study involving teachers from an institution of Higher Education in Portugal which aimed at evaluating new concepts, attitudes and approaches to the learning process using Moodle. The same study emphasizes the importance of research on teaching and learning with LMS.

THE INSTITUTION

Higher Education in Portugal is engaged in a large set of transformations due to the Bologna Declaration which aims to standardize and ensure a high transfer of skills and mobility of teachers and students in Europe (European Commission, 2010).

Having that in mind, the Institution has made an effort to modernize its technological infrastructure to implement a training model able to answer 21th century learning challenges, where the presence of

moodle is a constant, as support of face-to-face teaching, or in blended courses where the teaching has a strong online presence. To this effect teachers must be trained on how to use the technological tools and how to use them in a pedagogically sound way.

In December 2007 the Institution started the *Online Education Project*. Having selected the LMS Moodle, given its dissemination in the Portuguese Higher Education institutions (as in primary and secondary schools), the technical aspects were arranged in conjunction with the Technology Division of the Institution assuring good conditions for the use of the Institution internal network, and a Help Desk was designed to offer specialized support. In terms of pedagogical implementation pivots of the project were appointed on each campus and selected teachers called pioneers or precursors, responsible for promoting and repeating the instruction processes with their colleagues and the academic community (Lencastre & Monteiro, 2008).

Implementing a physical pivot on each *campus* served two objectives: first, to have a local reference point for potential users, and second to take into account the local realities of the various *campi* (Lencastre & Monteiro, 2008). The pivots and pioneers received internal training on technical and pedagogical use of the Moodle LMS . These *pioneers* sought through a viral network to extend the use of the technological tools available to other teachers (Lencastre & Monteiro, 2008, 2009). In 2009, the project was renamed *Online Project*, and in 2010 the *Online Education and Training Unit* was made formally responsible for assuring access to and availability of the Moodle LMS and the training of students and teachers on each campus.

As in all processes of change - and this was significant - there was resistance, some of which had been studied in the literature as non-immediate acceptance by teachers and students, e.g. the fear of technology. The Portuguese education system itself was reluctant to change although we were witnessing some changes in Higher Education, which are only now being followed up in primary and secondary schools, creating a gap between current objectives of Bologna process and the previous training of students who were not provided with the tools essential for being integrated in their jobs smoothly (Lencastre & Monteiro, 2009)

However, the aspect to which we should pay more attention is that teachers tend to offer some resistance to the process because they feel they are more exposed, both in terms of knowledge, or in terms of digital literacy level, to the challenges of a networked world. Teachers feel pressured and recognize that they are not prepared for this challenge. It is therefore evident that the training of teachers will have to move from technical to pedagogical and didactic training and that training has to be as inclusive as possible.

Having implemented local teams, the next step was to promote and create a culture of technology use based on educational principles. In order to achive this, the team of one *campus Online Education and Training Unit* designed this training workshop.

We took in account some of the aspects indicated by Attwell (2010) as factors of success in continuing personal development:

- *Peer learning*; the exchange of experiences is a key factor in the creation of a community among teachers;
- *The shift from large group to small groups*, throughout the process, teachers are encouraged to join interest groups, regardless of the main group, thereby allowing learning in context and personalized pathways;
- *Informal learning* will be stimulated and taken in account in the structure of this workshop as "Informal learning, by definition, cannot be planned but can be facilitated by creating time and space for networking, inclusive leadership styles, democratic staff relationships and the development of staff as a learning community." (Attwell, 2010, para. 6)
- *A clear definition of artefacts and their link to practice*, the artefacts created or presented during the workshop must have immediate practical application in the classroom so that teachers see the advantage to learn how to build them;
- *A reflective pedagogy and didactic basis*. Moments of reflection on pedagogy and didactics related to the practice must be propitiated. These moments are planned sessions for debating the implications of the use of tools and artefacts in learning;
- *Time management*. Time is always a factor to consider in any model of training. Hence, in designing the structure of the workshop we decided to keep all modules open and

available throughout the training so that teachers themselves decide on their time management of the learning activities;
- *Observation of practice*. All experiences and their sharing will be encouraged. These feedback will also enrich the training and practice of colleagues.

THEORETICAL FRAMEWORK OF THE WORKSHOP

Connectivism

Connectivism, according to de Waard (2010), is a concept that fits perfectly into contemporary learning. The field of learning is advancing at great speed like a major ecosystem, being designated as organic learning.

The framework that Siemens (2004) used to support the theory of Connectivism is based on the need to adapt/rearrange the theories commonly used in the creation of learning environments - Behaviourism, Cognitivism and Constructivism. It takes into account the impacts of the use of technology in learning, as Pappert and others who have been advocating since the 60's changes in education through technology, especially computers. These authors (Siemens, 2004) also point to the actual changes in our society that increasingly requires rapid adaptation to various environments, making the traditional learning methods obsolete because they cannot or will not encourage those digital skills.

George Siemens states that "Connectivism is the integration of principles explored by chaos, network, and Complexity and self-organization theories" (Siemens, 2004, p.21) supported by eight fundamental principles. He argues that it is important to be able to separate and distinguish information that is or not important depending on the contexts. To better understand this, Siemens (2009) organized a table showing how Connectivism differs from other theories:

- Learning occurs based on the recognition and interpretation of various patterns in distributed networks enhanced by technology;
- Factors that influence learning are the diversity of networks, the strength of the nodes and context;
- The role of memory based on adaptive pattern is representative of a particular state;
- The transfer of learning is generated by the addition of nodes and network expansion;
- Learning becomes complex with a quick change at its core, based on various sources of knowledge.

Verhagen (2006) argues that Siemens brings up issues not on the level of learning, but on the level of the curriculum because Connectivism is being geared more towards a pedagogical approach rather than to a learning theory. This author also emphasizes that learning is defined as a result and not as a process. In response to these criticisms, Siemens (2006) contends that "Connectivism is strongly focused on the linking to knowledge sources... not simply trying to explain how knowledge is formed in our heads" (p.37) and concludes that it is irrelevant whether Connectivism assumes a predominant role in school change. The most important is: "(...) that educators are reflecting on how learning has changed and the accompanying implications to how we design the spaces and structures of learning today." (Siemens, 2006, p.39)

Self-regulated learning (SRL)

According to Turing and Yang (2009), SRL describes the repertoire of strategies to overcome the challenges that have been posed to Higher Education by the Bologna process and lifelong learning issues. We hope that through SRL participants will become more proactive and seize opportunities to carry out new teaching strategies and didactics in Higher Education. We define SRL as a person's ability to remain focused on the progress of his/her learning. This workshop aims to involve all teachers from Almada *campus* in a meaningful set of activities.

Assuming that teachers can be described by the SRL model suggested by Pintrich and colleagues (Wolters, 2010) as constructive and active participants, we will ensure that they follow the four phases of SRL:

- *Forethought*. Planning, goal setting and prior knowledge activation;
- *Monitoring*. Keeping track of on-going progress and performance;
- *Management or regulation*. Use and management of several learning strategies to complete the tasks;
- *Reflection.* Generation of meta-level knowledge about their activities.

During and after the workshop teachers are supposed to design and construct the courses they will deliver

on moodle so they can enhance interaction and learning of their students through this LMS.

Community of Practice (CoP)

One of the goals of the project will be the development of a CoP, which will grant the trainees a support for skills development through sharing of practices, experiences and resources, collectively constructed knowledge and mutual aid during the training.

What defines CoPs? Wenger defines them as "groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly." (Wenger, 2006, p. 4). CoPs have three defining characteristics:

- A *domain of knowledge***,** that corresponds to a shared group interest that ensures the group identity.
- A *community***,** as members engage in joint activities: they share information, discuss, help each other, and learn from each other while pursuing their common interest within the community. The community is not closed; it allows the integration of newcomers in an apprenticeship process.
- A *practice***,** as a "shared repertoire of resources" (Wenger, 2006, para. 8) for their practice is created beyond the community of interest, which can be embodied in a knowledge base, but in most cases is only evident in members' practices and interactions.

In a CoP, learning occurs mainly in an informal way (Wenger, 1998, 2006). This workshop although apparently a formal training will allow for informal learning; it is an internal training without grading and evaluation aspects typical of formal learning. Since the trainees are not geographically distant (all of them work in a Higher Education institution with a good informal climate) the interactions will take place both in the virtual environment and face-to-face, contributing to the emergence of informal learning.

Another important factor in a CoP is that learning is more distributed and not so focused on the expert (teacher), something explicitly provided in this training setting (enabling peer-to-peer professional development activities). The temporal persistence of the CoP beyond the strict duration of the course will be a sign of the CoP maturity, with the community showing increasingly greater independence from the experts and new member integration capabilities.

In the development of Cop the following elements are paramount: defining the area of shared inquiry and the key issues (domain), developing relationships and sense of belonging (community) and developing the body of knowledge (methods, tools, documents and practice) (Wenger, 2002) and must be taken in consideration.

Nevertheless, some conditions must be assured to enable a successful CoP. Fontainha and Gannon-Leary (2007) present as critical success factors for building a CoP; according to these authors technology must be mastered and accepted as a means of communication and a user-friendly language (netiquette) should be used to foster communication as support for development of trust and sense of community. Members should have a sense of belonging, effective shared understanding and a sense of purpose and time to allow the trust and consequently the sense of community to grow.

Structure of the workshop

This workshop is designed for teachers to outline their own learning, with no predefined paths or a proper sequence of learning. It is intended that teachers improve their experiences, their knowledge and their technical skills from the information provided during the workshop.

The structure of the workshop addresses the main activities of the LMS Moodle and its pedagogical use as presented in figure 1. Participants can build their personalised pathway.

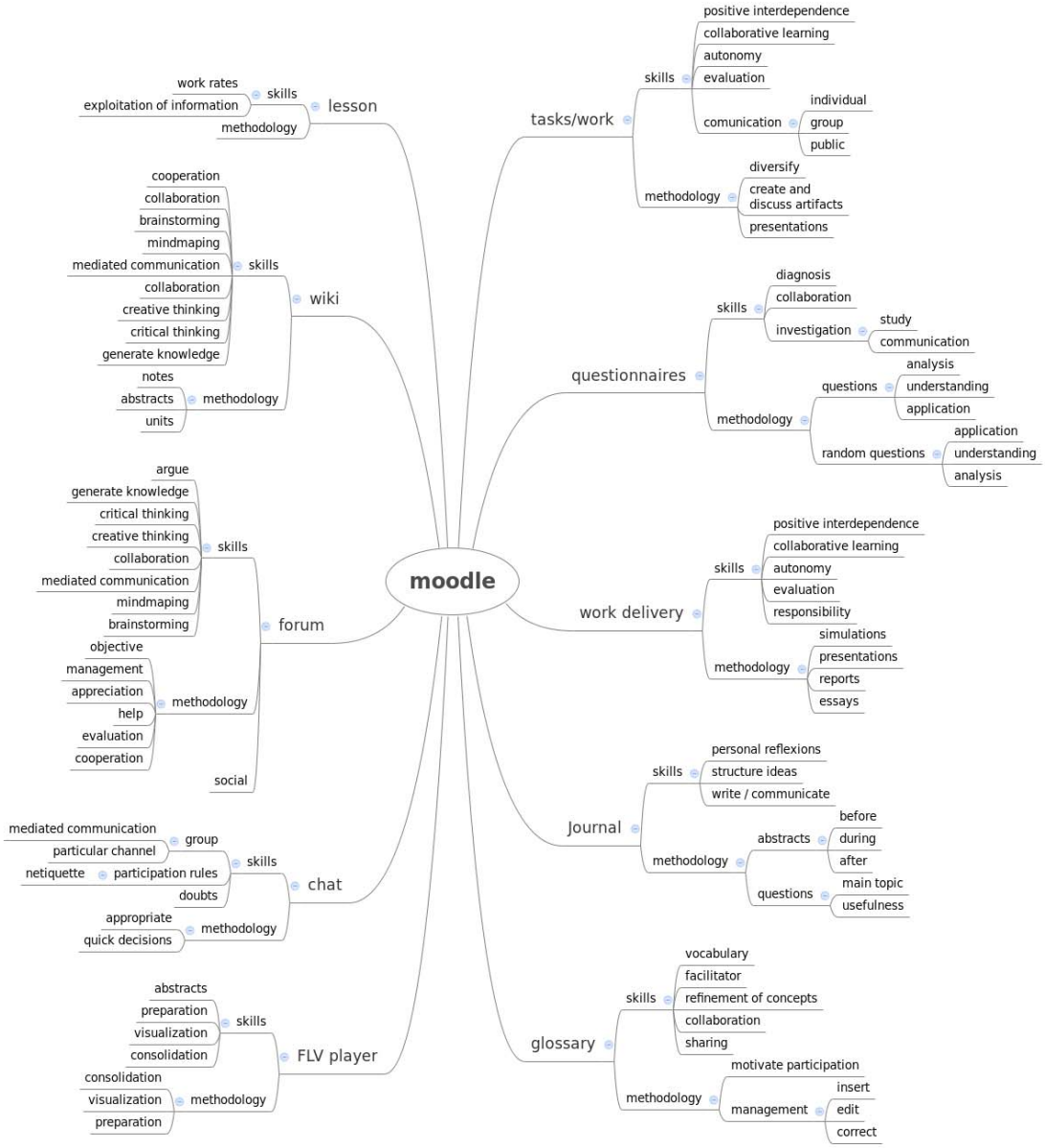

Figure 1. Workshop structure based on Andrade (2006)

The transformation of information into knowledge occurs when participants establish interactions between themselves and the artefacts available in asynchronous discussion forums, synchronous forums and even in face-to-face communication.

The exchange of experiences can occur spontaneously or through the moderation of the workshop instructors who will assume the role of facilitators, avoiding direct instruction.

Based on these ideas, the workshop's objective is that the participants will develop pedagogical, didactical and technological elearning skills in a community of practice, with open dialogue, learning actively in flexible pathways, at a personalised rate and being able to reflect on processes and products of their learning.

Each module is independent of the others and can be done without prior knowledge, as the modules are

offered throughout the year. Participants may attend only some of the modules (or even only one).

ASSESSMENT

We will use Grounded Theory (GT), Community of Practice assessment (CoP) and Social Network Analysis (SNA)in order to answer the following general questions:

- What perceptions did the participants gather from the workshop?
- To what extent was a Community of Practice (CoP) built and developed?
- Which networks arose from the interactions between participants?

Grounded Theory (GT)

GT originated in the 60's with Glaser and Strauss (2006); it was suggested as an alternative method for qualitative research. The collection and analysis of data are to give rise to a theory grounded in data, supported by three types of coding: open, axial and selective.

The three structural elements of the GT are:

- *Concepts*, basic units built from the conceptualization of data;
- *Categories*, the highest level because they are more abstract giving us a means to integrate concepts into a theory;
- *Prepositions*, generalized relations between a category and a concept associated with it.

Community of Practice (CoP)

To identify the presence of CoP we will use some of the indicators presented by Wenger (1998):

- Sharing a common purpose;
- Easy flow of communication;
- Shared ways of doing things together;
- Knowledge of what others do, know and how may contribute;
- Shared repertoire (tools, representations and other artefacts;
- Shared private (group) codes and jargon;
- Overlapping of recognition of belonging to group among participants.

Wenger also lists as typical activities in a CoP problem solving, requesting information, seeking experience from others, reusing assets, coordination and synergy processes, discussions, documentation projects, mapping group knowledge and gaps (Wenger, 2006).

We will draw from these indicators and the community assessment tool developed by Andriessen & Verburg (2004) to assess the presence and development of the CoP.

Social Network Analysis (SNA)

The increasingly frequent adoption of LMS by Educational Institutions and the need for more knowledge about the users and the use made of these systems led us to adopt the method for SNA evaluation of our workshop. “The visualisation of online student engagement/effort is shown to afford instructors with early opportunities for providing additional student learning assistance and intervention – when and where it is required” (Dawson, McWilliam, & Tan, 2008, p.221). As one of the main objectives of our project is to stimulate collaborative work among participants1 , we assume that the type of analysis provided by SNA will meet the needs of assessment that we foresee for this workshop.

The SNA can be defined as “the disciplined inquiry into the patterning of relations among social actors, as well as the patterning of relationships among actors at different levels of analysis (such as persons and groups).” (Scott, 2000, p.2) In this sense, the SNA describes relational patterns and examines how involvement in social networks helps explain the behaviour and attitudes of members of the networks (Wasserman & Faust, 1994).

The learning network that will be created in the context of this workshop will be reviewed by us in order to assess what relationship patterns are created by the actors among themselves in this network and how these may create and/or influence learning opportunities. “By obtaining information, producing insight, undertaking analysis and collaboration in the course of knowledge building and by way of an instructed learning process, these networks create all manners of interpersonal associations and learning opportunities.” (Wang, 2010, p.4)

[1] Hereafter referred as actors according to the terminology of social network analysis.

Our purpose is to analyze the interactions established between the network actors (and sub networks) to assess the following:

- Generic characteristics of the network that develops during the workshop (size and type);
- Participants, their types of action and participation in groups;
- Function, distribution and representativeness of participants;
- Groups and subgroups created in the network;
- Participants and subgroups activity within the network;
- Degree of stakeholder participation;
- Relationship patterns;
- Communication channels used and types of transfers and resource flows.

We believe that this kind of research provides an opportunity to better manage the education process either by the trainers/facilitators or by the students/trainees.

FINAL THOUGHTS

The advantage of using technological tools in education, especially in Higher Education, lies in the easy access to information and media at the disposal of teachers and students. With this workshop we aim to increase the participants' proficiency in the use of these tools and to contribute to their scientific, pedagogical and didactic use.

The workshop structure will allow participants not only to identify their own learning needs but also to choose their own learning pathways and to ajust those pathways so the workshop can meet their expectations.

The changes observed in the education system for the last decade presented challenges that must be overcome with new processes that adapt to the new technological and pedagogical reality that affect all educational institutions and forces us to rethink the whole learning process.

In this context of exchanges we hope to contribute to the quality of teacher's education process and we expect to improve the quality of future workshops on the basis of the quantitative and qualitative data gathered throughout this first experience in order to contribute to quality teachers' training that meets the needs of Higher Education in this new millennium.

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AN ANALYSIS OF SELF-REGULATED LEARNING FROM THE PERSPECTIVE OF SELF-DIDACTICS

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INTRODUCTION

As current transformations in the context of *Social Web* exemplify, navigation emerges as media-supported, communicative and participative practice. At the same time, educational cultures evolve based on cooperation in informal learning communities. As there is no teacher predefining content and acquisitional processes in these communities, the learner is on his own with regard to being motivated, staying focused, solving learning related problems and evaluating results of his learning process. In this regard, the learner can be conceptualized as a *self-didactic learner* (see Iske & Meder, 2011) who is organizing and regulating his learning processes on his own, but in cooperation with others and in interaction with specific environments.

The concept of *self-didactics* is related to the concept of *self-regulated learning* and located within the discourse on *lifelong education* (Lengrand, 1972), *lifelong learning* (Delors, 1998), *informal learning* (Watkins & Marsick, 1990) and *self-directed learning* (Dohmen, 1998). Like in these discourses, the perspective of *self-didactics* implies a shift to increasing freedom of learners and changing demands on learning (and on teaching). In educational and psychological contexts, for instance, this transformation is described and discussed as a transition from teaching to learning; from teacher-oriented to learner-oriented instruction; from externally-directed to self-directed learning; from school-based to lifelong learning; from reactive to active learning; from the didactic triangle to learning arrangements (topology) and from formal to informal learning.

In a broad sense, the term “self-didactic learning” refers to different degrees of freedom concerning learning (Fig. 1). Key points are decisions on goals (for what?), content (what?), learning path (how?), evaluation (how successful?), forms of cooperation (with whom?), forms of support (which resources?), time (when? how long?) and place (where?).

These transitions have in common that the learner and the process of learning becomes the focus of teaching and learning efforts. For learners, this implies an increased level of activity and responsibility. During the last decades these transformations were subject of fierce debates – especially their relation to transformations within the field of Information and Communication Technology (ICT). In Germany, for instance, a federal initiative “Connecting Schools to the Net” (*Schulen ans Netz*) was established in 1996 in order to provide public schools with computer hardware and Internet access. While the initiative tries to improve media literacy, it also explicitly aims at the advancement of the school as an institution for learning and at the advancement of an academic learning culture. Currently, the potential and the

implications of ICT are discussed as the potential of *New Media* and *Social Web* for fostering self-regulated learning.

To acquire strategies for self-didactic learning is a challenging and complex task. We cannot expect that every learner already is endowed with this competence, it needs to be developed and nourished. Concerning learning situations and processes, externally-regulated and self-regulated learning constitute the end points of a continuum of hybrid forms of learning, they may be considered as ideal types in the sense of Max Weber. From an educational perspective, the relation of externally- and self-regulated learning can be interpreted as the relation of control / guidance and giving space (Litt, 1965).

Fig. 1: From externally-regulated learning to self-regulated learning

Based on the results of a European research project, Steffens (2008, p. 221) argued that there is some evidence that complex Technology Enhanced Learning Environments (TELEs) have a potential to foster self-regulated learning, but that there is only little empirical research on the question whether and to which extent this potential is actually perceived and realised.

In the following paragraphs, I will focus on this open question by presenting an approach to analyse *processes* of self-regulated learning from the perspective of self-didactics and by presenting empirical results of its application: (1) By outlining the *concept of self-didactics*, the theoretical background of this approach will be described; (2) then, *methodological aspects* of this approach and the *analysed dataset* will be characterised; (3) main *empirical results* of an empirical analysis of learning processes (self-didactics) within a hypertext learning environment will be outlined, focusing on reflexivity and acquisition of content as well as structure. (4) Finally, an *outlook* will be presented.

THEORETICAL BACKGROUND: SELF-DIDACTICS

In this paragraph, I will focus on processes of self-regulated learning from an explicit educational perspective. Taking into account the above mentioned transformations from teaching to learning, navigation in hypertext environments is conceptualized from a learners perspective as *self-didactics* (see Meder, 1997). Characterised by the absence of a teacher (who is animating, guiding and controlling, supporting and evaluating learning processes), a self-didactic learner is in charge of being involved in a topic, staying focused, facing learning related problems and barriers and integrating results of these processes into experience (see Iske & Meder, 2011).

From the perspective of self-didactics, navigational *processes* in online environments can be interpreted as the linear unfolding of a non-linear environment. In discussions of learning with ICT, its potential is often globally attributed to spatial and temporal aspects ("anywhere" and "anytime"), whereas the characteristic of navigating as the temporal process of this *unfolding* is usually neglected.

The term *didactics*[1] refers to a long-standing pedagogical tradition of teaching and, to questions of *content* (what to teach) as well as questions of *structure* (how to teach) and emphasises *temporal processes* of teaching and learning (for instance as a "scheme of articulation", see Herbart, 1806; or "articulation" as the main topic of didactic communication, see Prange, 1995). In the following paragraphs, I will focus on the temporal process of navigating online environments, describing it as the *succession* of web pages which are selected by a learner and which constitute a navigational path or sequence. Finally, I will consider reflections of learners on their specific selections.

The underlying conceptualization of *didactics* refers to the work of Richard Hönigswald (1927) who defines it from a systematic-philosophical perspective as the *transformation of meaning into time* (Fig. 2): meaning is understood in a multi-relational, non-linear way and does not posses any specific temporal structure in itself. But for the purpose of teaching, meaning is in need to be transformed into a temporal structure, into the process of teaching and learning, into the temporal structure of acting in general. Obviously, this transformation is in need of a medium: meaning is transformed *into time and space*, into the *process* of teaching and learning by means of a specific medium (this is the fundamental reference points of media education and instructional media).

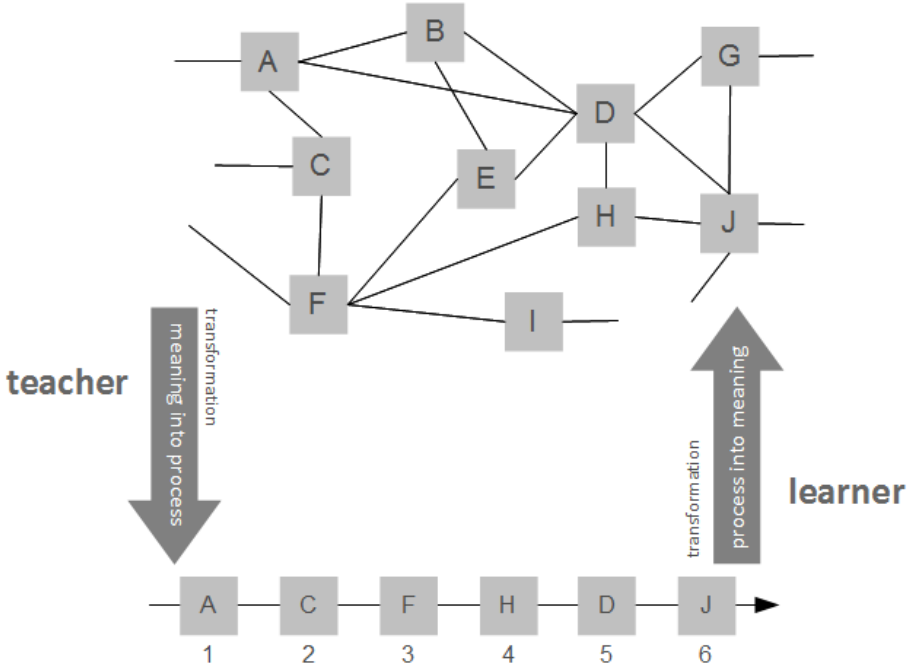

Fig. 2: Didactics

This understanding of *didactics* - as the process of transforming meaning into time - can be illustrated by the *scheduling of a lesson* (left side of Fig. 2): First a teacher acts *issue-oriented* and conducts an analysis of the specific topic (i.e. meaning), its structure and its relations. The result of this analysis is symbolised at the top of Fig. 2 as a semantic network consisting of concepts (nodes) and their relations (links). Second

[1] In this article the term *didactic* is used without any connotation of disapproving or any connotation of teaching a moral (see „didactic", Cambridge Advanced Learner's Dictionary (2008), <http://dictionary.cambridge.org/dictionary/british/didactic>).

in a following *process analysis* the teacher creates a precise lesson plan as a sequence of teaching activities: How to start, what to do then, how to go on... how to end. In doing so, he decides on content (didactical reduction), on media type and on social form. As a result, at the bottom of Fig. 2, this teaching process is symbolised as a temporal succession of concepts (nodes) as content of a lesson.

Adapting the approach of Hönigswald, the process opposite to that of *didactics* can be conceptualized as *self-didactics* (Fig. 3): Whereas the term *didactics* stresses the teacher perspective and the process of teaching, the term *self-didactics* stresses the perspective of a learner and the process of learning *without* processes of teaching. Concerning navigation in online environments, *self-didactics* implies that a

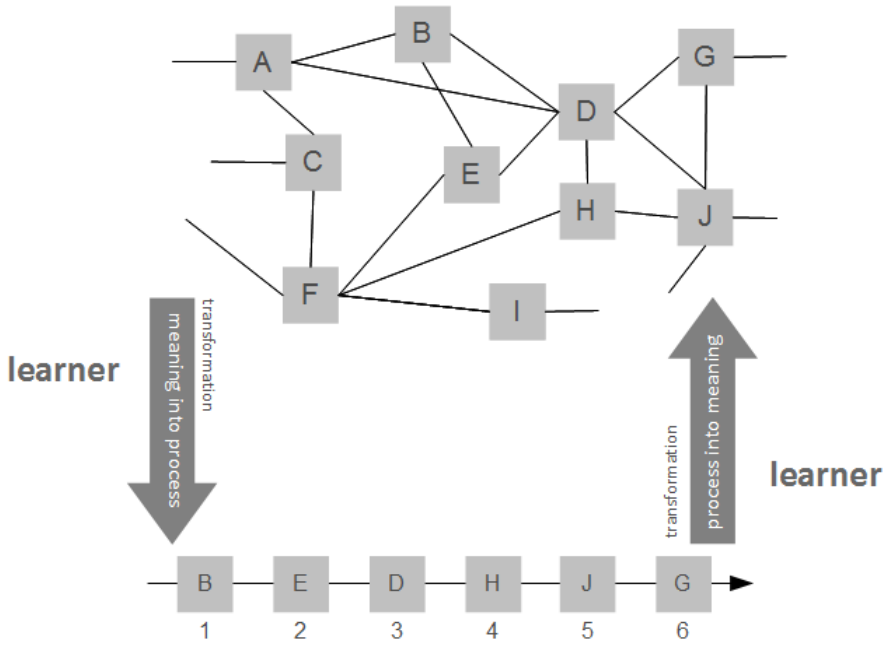

Fig. 3 Self-Didactics

Traditionally, this modularisation is a fundamental educational task and refers to the question of how learning should take place (in what time period, what content, with what tasks and in what social form).

This concrete succession within the lesson is always structured temporally i.e. in a linear manner. It aims at the most adequate and suitable succession as a way of teaching a subject-matter to a group of learners. In short, the focus of *didactics* as a theory of action is on the transformation of spatial figures into temporal figures.

So far, within the concept of didactics, *teaching* and decisions of a teacher are focused upon (left side of Fig. 2): Complementary, *learning* corresponds to the transformation of a linear teaching process („a lesson“) into non-linear mental model („knowledge“) of a specific subject-matter (right side of Fig. 3).

learner is in charge of both transformations: (1) the transformation of *meaning into time*, and (2) the transformation of *time into meaning*. The learner is in charge of navigating the online environment. In doing so, he takes decisions within a *didactic* setting provided by a teacher (1) and at the same time he is in charge of an appropriate learning result (developing an appropriate mental model) based on his navigational path.

Therefore, specific knowledge of one's own learning processes and learning strategies is required. This process of *self-didactic* practice constitutes a challenging and complex task and varies from incidental learning to the application of sophisticated strategies. However, its execution should be supported by an appropriate arrangement of the learning environment.

From a pedagogical perspective, the crucial questions of *self-didactics* are: (1) How do *learners* actually translate spatial figures (meaning) into temporal figures (their linear learning path): Which criteria and strategies do they employ for navigation? (2) How do *learners* actually create spatial figures (a mental model of a topic) based on temporal figures: What kind of knowledge do they create based on their navigational path?

In general, this approach of analyzing processes of *self-didactics* relies on the assumptions that navigation in online environments (a) is *not contingent*, but contains specific patterns, structures and regularities within the action of learners (behavioural patterns); (b) is an *index* for -implicit and explicit- strategies of learners, which reflect the learners' decisions on goals, content, path, evaluation etc. (see Fig. 1). In this respect, navigational paths reflect a specific „habitus" which according to Bourdieu (1982) can be characterised as structured structures predisposed to function as structuring structures. Finally, it is assumed that navigation in online environments (c) refers to the *context* of a specific online environment and therefore expresses a specific relation between the structure of the online environment on the one hand and empirical navigational paths on the other hand.

METHODOLOGY AND DATASET

As the analysis of *self-didactic learning* is a complex and challenging task, the following approach aims at analysing *self-didactics* in online environments based on triangulation of the following methods and data (Fig. 4): (1) Log file data analysis, (2) thinking-aloud protocols and (3) retrospective focused interviews.

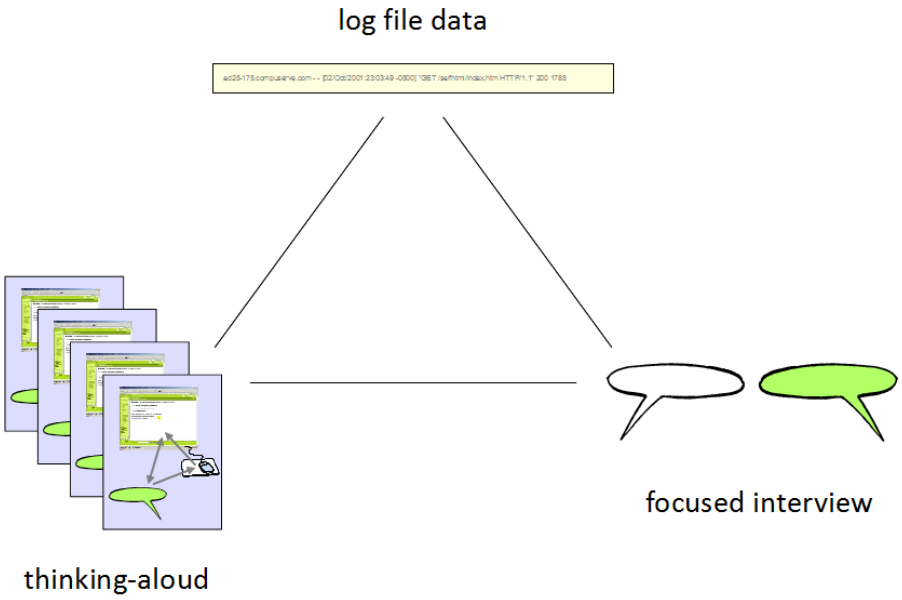

Fig. 4: Research Design: Triangulation

From a methodological perspective, central analytical questions are: How can the processes of *self-didactic* practice appropriately be analysed? How do learners empirically realise the potential of increased degrees of freedom? Based on which processes do they acquire knowledge? Which criteria and strategies do learners employ to regulate their learning processes?

The data analysed in this article originate from a research project where navigational paths within an online learning environment were analysed (Iske, 2007). The learning environment was structured according to the didactical ontology of *Web Didactics* (Meder, 2006); i.e. content as well as links were classified by didactical meta-data. A subject matter (e.g. descriptive statistics) is de-contextualised in *learning units* (e.g. "measures of central tendencies", "mode", "median" or "arithmetic mean"). These learning units are re-contextualised by links to form a

semantic network. In general, a learning unit is a container for *knowledge units*, which characterise the learning unit among others by means of different *knowledge types.* For instance, the learning unit "median" contains the following knowledge types:

- *orientation knowledge*, which provides, for example, an overview or a summary in order to help learners to find their way around a subject ('know that');
- *exlanation knowledge*, which provides learners with arguments to explain why something is the way it is ('know that'),
- *action knowledge* helps learners to appropriate subject-specific practices, methods, techniques or strategies ('know how')
- and *source knowledge*, which shows learners where they can find additional or more detailed information on a specific subject ('know where').

Following the concept of Web-Didactics, each page of the learning environment was created to contain exactly one type of knowledge. This is important for further analysis as it allows us to trace and interpret the type of knowledge users selected while navigating in the online environment. Based on these didactical meta-data, for instance, strategies can be deduced from the succession of selected knowledge types (web pages).

LOG FILE ANALYSIS

On the one hand, server-based log file data documenting the usage of the online learning environment were analysed. Users accessed the learning environment over the Internet, so this data represent actions of users in authentic situations. From this perspective, log file data represent a specific form of transcription of the user – online environment interaction. For this reason, log file data collection can be characterised as *unobtrusive, detailed, objective* and *non-reactive* (see Web, Campbell, Schwartz, Sechrest, 1966). In contrast to forms of retrospective data collection (i.e. interview, questionnaire) it is characterised as *process-generated* data (see Bergmann & Meier, 2000).

The overall data set consists of about 1500 navigational paths (sequences) containing about 4700 elements (web pages) and is based on data of how the hypertext online learning environment was used over the period of about one year (06/2005 – 06/2006).

Two different approaches were used to analyse this log file data set. First, log file data were aggregated and analysed by quantitative descriptive statistics: Frequencies of sequences, frequencies of elements as well as frequencies of identical sequences were calculated. Second, navigational paths where analysed heuristically in order to identify patterns, structures and regularities within paths as well as in order to identify similar paths. Furthermore, navigational paths were analysed confirmatively in order to compare identified empirical patterns and regularities with known theoretical patterns (i.e. „explanation-oriented" or „task-oriented" strategies). This approach of analysing navigational paths is based on the quantitative approach to sequence analysis called Optimal-Matching (Abbott & Forrest, 1986) with subsequent cluster analysis.[2]

CONCURRENT THINKING-ALOUD INTERVIEWS

On the other hand, data on the process of navigating in online environments were collected using the method of thinking-aloud. In reference to the framework of Ericsson and Simon (1984, "Protocol Analysis: Verbal Protocols as Data"), "thinking-aloud" is conceptualized as verbalizing one's own thoughts while carrying out a task: The learner is focusing on a specific task (primary task) and is asked to verbalise his actual thoughts (secondary task). In this article, we will not go into the controversial discussion of thinking-aloud protocols (e.g. effect-of-verbalisation; incompleteness-argument; epiphenomenality or irrelevance argument, see Ericsson & Simon, 1984, 61).

Using thinking-aloud interviews within the field of e-Learning basically aims at coming as close as possible to the actual processes of navigation. In contrast to retrospective forms of data collection, these verbalisation are related to actual behaviour within the learning environment: the interviewee was coping with a task and thinking-aloud while navigating in an online-learning environment (concurrency of verbalising and acting). In doing so, his verbalisation as well as his interaction with the learning environment were documented by screen-recording software for further analysis.

[2] The application of sequence analysis by means of Optimal-Matching in the field of e-learning is described in more detail in Iske (2007, 2008).

But in contrast to the framework of Ericsson and Simon (1984), these recordings were analysed in terms of structure as well as content in order to identify the subjective relevance and the strategies of the learners (in addition to the formal analysis of navigational process by means of sequenced log file analysis).

Overall, nineteen thinking-aloud interviews were conducted with students of the natural sciences and the humanities which were based on the prior instruction to think-aloud (in order to avoid social communication) and related to a specific task within the field of descriptive statistics.

> Example: “Please imagine the following situation: you are attending a seminar at your university. You are given a statistical data set which you are to analyse with regard to measures of central tendencies. As you do not know how to accomplish this analysis, you are navigating in this online environment in order learn about (a) which measures of central tendencies exist and (b) how they are calculated.”

In addition, log file data resulting from these thinking-aloud interviews became part of the overall log file data set. The triangulation of data and methods as described above allowed us to compare navigational sequences resulting from thinking-aloud interviews with navigational sequences performed via the Internet. We were therefore able to estimate the influence of thinking-aloud on the sequence of coping with the task.

RETROSPECTIVE FOCUSED INTERVIEWS

In addition to formal and process-focused analysis, retrospective focused interviews (Merton & Kendall, 1979) were conducted with our nineteen interviewees after their thinking-aloud protocols had been taken.

The main focus of the interview was put on the navigational sequence and the navigational strategies employed while carrying out the preceding task. In contrast to the thinking-aloud interviews, these focused interviews aimed at the retrospective and meta-cognitive interpretation and evaluation of the task-oriented navigational process (e.g. first impression of the online environment; its relevance for learning; positive and negative aspects of the online environment; most helpful node to accomplish the task; evaluation of the navigational process; evaluation of the employed strategies; influence of thinking-aloud on navigation). In addition, sociodemographic data of the interviewees were collected.

RESULTS

In this paragraph, the main results of the triangulation of log file data, thinking-aloud data and retrospective focused interviews will be outlined.

The most important conclusion from the analysis is the *diversity and plurality* of the navigational paths taken by the learners: There is no single 'golden' navigational path. Quite to the contrary, sequenced log file data revealed that there are hardly any identical sequences concerning micro-navigation (navigation *within a learning unit* like “measures of central tendencies”, “mode”, “median” or “arithmetic mean”) containing more than five elements. This plurality and diversity holds especially true for macro-navigation, i.e. navigation between learning units (e.g. between “measures of central tendencies”, “mode”, “median” or “arithmetic mean”).

Furthermore, this diversity and plurality can be interpreted as a *quality indicator* of the analysed learning environment: From a conceptional and pragmatic point of view, the analysed environment provides a multiplicity of different navigational sequences and therefore provides *self-didactic plurality*. These various possibilities to navigate in the learning environment and to employ different navigational strategies were judged in the focused interviews to represent a specific potential of the analysed online environment and to be beneficial for learning.

There were, however, *groups of similar sequences* based on the typical succession of pages (knowledge types) within the navigational path (corresponding to sequence analysis by means of optimal-matching). In accordance with this overall diversity and plurality, the empirical data based on the formal analysis of sequenced log files as well as on thinking-aloud verbalization and on retrospective focused interviews revealed a *multitude of navigational strategies*. As a result specific *navigational strategies* were identified, which can be differentiated at a general level as *linear strategies* depending on the layout and the navigation bars of the online environment and *non-linear strategies* of direct and selective navigation like

"examination" and "exploration". Based on the data from focused interviews, *explanation-oriented* strategies as a form of direct and selective strategies can be characterised as follows: A user picks a module representing a specific kind of knowledge (in this case the knowledge type "explanation") and skips all the others. Comparable to using a lexicon, this procedure is characterised as "looking-up". In a similar way, *test-oriented* strategies can be characterised as follows: A user tries to find out if he can pass a test on a specific subject-matter. In case he can not pass it, he will further navigate in corresponding modules to get the needed information. In addition, it should be stated that there are various navigational sequences which can not be related to plausible strategies.[3] This is especially true for very long and complex sequences.

As a specific aspect of this diversity and plurality, log file analysis, thinking-aloud protocols and focused interviews exposed a *high interpersonal variance* of navigational strategies. Users employed various strategies depending on factors like previous knowledge, topic, intention and situation: they choose between different strategies, reflect and evaluate their use and change strategy if necessary.

Particularly the *layout-oriented* strategy is a good example of what we found in the analysis of self-didactic learning: users navigated following the interface design of the online environment (e.g. navigation bar from *left to right* or *top-down*). From the analysis of thinking-aloud protocols and focused interviews we can see that this strategy was often employed in order to get acquainted with the structure of the online environment. Based on the analysis of transformations within this strategy, it is possible to differentiate between two processes of acquisition and to analyse their transition: the acquisition of the meta-cognitive representation of the online environment and the acquisition of content. For example, while getting acquainted with the structure of the learning environment, users often make use of browser-integrated navigational functionality (back / forward; history). After getting acquainted, users increasingly employ functionality for navigation integrated in the learning environment as restrospective interviews reveal in accordance with thinking-aloud protocols and log file analysis.

Furthermore, navigational strategies were analysed with respect to *faculty cultures* (humanities and natural sciences). Based on the analysis of sequenced log file data, thinking-aloud protocols and focused interviews it can be stated that learners' understanding depends on different pages (e.g. different knowledge types) of the online environment. In the area of descriptive statistics, students of the natural sciences (mathematics) perceive understanding as being first and foremost related to the knowledge type of „formula": As mentioned in the focused interviews, the formula is „all you need to know". To paraphrase a student: "I do not need any further information, I can deduce everything important from the formula". In contrast, for students of the humanities (educational sciences), understanding is not at all related to the knowledge type of „formula". As mentioned in focused interviews, a formula is regarded as something like an abstract painting. With these students, understanding is foremost related to the knowledge type "example", which illustrates the important characteristics of the corresponding topic. But although understanding is related to different knowledge types and to different strategies of navigation, the result in both cases is quite similar: Most students of the thinking-aloud interviews solved the task correctly, but based on different periods of time and on different navigational strategies.

Although, in the first instance, the described analysis did not aim at evaluating the employed methodological approach, empirical data revealed insight into the relation of log file analysis and thinking-aloud protocols. In the context of thinking-aloud protocols, it is often argued that the concurrency of coping with a task and verbalising influences the subsequent sequence of navigation (see above, *effect-of-verbalisation*). and consequently the scientific interpretability of thinking-aloud data in general. However, concerning the analysed data set and based on sequenced log file analysis, it can be stated that the navigational sequences resulting from thinking-aloud does not differ recognisably from navigational sequence resulting from access through the Internet: Within 28 empirically identified strategies based on cluster analysis, there were no clusters which exclusively contain navigational sequences of the thinking-aloud condition. In contrast, a corresponding preliminary study revealed a serious influence of concurrent acting and verbalising on subsequent navigational paths in a modified procedure of „thinking-aloud": while navigating, the learner was asked for explanatory statements of his

[3] As these complex and long sequences originate from log file analysis, there is no complementary data from thinking-aloud or focused interview to further analyse these processes.

navigational decisions. As cluster analysis showed these navigational sequences differed from navigational sequences resulting from access through the Internet and did not correspond to the above mentioned empirically identified strategies. These methodological aspect will be subject of future research.

In addition, it should be emphasized that the approach presented here enables us to perform a detailed content-related analysis of the respective online environment, for instance with respect to learning barriers like lack of understanding or ambiguity of information. In this respect, the approach of thinking-aloud yielded specific insights, in particular when two subjects were carrying out the task cooperatively.

CONCLUCSIONS AND OUTLOOK

The described methodological approach of triangulation is highly efficient in analysing self-regulated learning in online environments from the perspective of self-didactics. First of all, self-didactic practice can be analysed by taking into account the fundamental temporality of navigation. Consequently, hypotheses about navigational strategies and their effects can be made objectives of empirical educational research (for instance of research in cultural dependent navigation, processes of informal learning, cognitive load, or serendipity).

Moreover, the currently dominant focus on results of e-learning can be put into perspective. Focusing on the outcome of navigational processes is unsatisfactory from a pedagogical point of view because processes of learning and training are a fundamental topic of pedagogy. Knowledge about these processes allows for a multitude of pedagogical practices and interventions, i.e. the pedagogical design of an online learning environment and the support of learners. In general, hypertext environments represent a space of possibilities. But it is extremely difficult to infer empirical practice from structure alone: a space of possibilities is neither a perceived nor a realised space. It remains an empirical question how (specific) learners interact with the structure and content of (specific) learning environments and how this interaction can be characterised (for instance as self-regulated learning).

The methodological approach presented here is an effective extension to a structural analysis of online environments with respect to its potential to foster self-regulated learning because it allows for analysing navigational processes as indicators of underlying navigational strategies. In doing so, it makes a substantial contribution to the analysis and understanding of self-regulated navigation in hypertext online environments.

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INFORMAL LEARNING AS A LEVERAGE FOR DIGITAL AWARENESS AND SRL

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INTRODUCTION

This study focuses on the relation among formal learning, informal learning and Self-Regulated Learning (SRL) and provides some provisional considerations on this subject based on the results of a survey addressed to a community consisting of the students of a large Italian lower secondary school, their teachers and their parents.

The study was originated by the need for dealing adequately with some episodes of cyberbullying happened among students. Although this problem had arisen outside the school context and was reported by the parents, the headmaster and the teachers agreed on the point that the school should be concerned about it. Our claim is that schools can restrain and control the problem of cyberbullying by addressing it within a wider framework of actions concerning media literacy with all the students. These actions should aim to reinforce the students' awareness and control of the technological instruments they use every day, from a conceptual rather than technical point of view. This can be done by deliberately cross-contaminating formal, informal and non formal learning contexts, and specifically, by recognizing the technological competences acquired through informal learning processes and building on them to develop better media awareness and control of one's own learning.

CYBERBULLYING

According to the literature cyberbullying is an aggressive, intentional act against others carried out using electronic forms of contact, repeatedly and over time (Willard, 2007; Smith, Mahdavi, Carvalho & Tippett, 2006; Li, 2005). Many authors studied the relations among bullying and cyberbullying and pointed out the different ways they manifest themselves in different contexts (for a comparison,

see, Hanewald, 2008). Cyberbullying can be interpreted as simply bullying in another territory (Li, 2004) or as an addition to traditional bullying (Shariff, 2005). Other authors (e.g., Ybarra & Mitchell, 2004) suggest that the victims of real-life bullying often turn into perpetrators online. In any case, the phenomenon is increasing (Aoyama & Talbert, 2010) and adults in charge of the education of the youngest are required to confront with the growth of the problem. In particular, we claim that teachers should not overlook the problem even if the cyberbullying events take place outside the school context, because this issue is only a component of a wider picture that has to do with learning to live in a digital world and develop skills for digital citizenship.

DIGITAL AWARENESS

The mastery in using digital tools, not just from the point of view of the technical skills, but also from the point of view of the control on and awareness of the implications of their use, is among the needs recognized as crucial in the information society. Awareness in the use of digital tools implies recognition of the cognitive, cultural and social aspects of digital media and is connected to the development of different competences (e.g., questioning the sources of information and their reliability, reflecting on the effects of our public and private communications). This awareness is an important component of the SRL abilities needed to become autonomous lifelong learners of the digital age, able to exploit the potential of technology without yielding in front of its critical aspects and risks.

In the literature, this broad knowledge of the world of media has taken different labels that emphasize different aspects. For example, Buckingham (2006) uses the expression "digital literacy" to identify a "broader *critical understanding*, which addresses the textual characteristics of media alongside their social, economic and cultural implications" (pp. 272, italics in the original). Prensky (2009) emphasizes the distinction among *digital cleverness* and *digital wisdom*, claiming that "there is no wisdom, digital or otherwise, in merely creating programs or in being a digital criminal—only digital cleverness. Digital wisdom comes only when digital tools are used to enhance thinking in a positive way" (definition 3221). Other authors prefer to talk about *cybercitizenship* and explain the relations among technologies and citizenship, thus pointing out the duties and the rights, the social and the political effects of a responsible behaviour enacted when using the new forms of communication (Sujon, 2007).

FORMAL AND INFORMAL LEARNING

The increasing importance of life-long learning, together with the rapid evolution of technological tools and associated methods have brought about the need to redefine the skills and competences required to the citizens of the digital age. In turn, this re-definition has concurred to the acknowledgement and validation of all those situations in which learning takes place, being them formal or not (Eraut, 2000; Bjornavold, 2001; Colardyn & Bjornavold, 2004).

Generally, in the literature on this theme, a distinction is made among formal, non-formal and informal learning (European Commission, 2001). Some years ago, CEDEFOP, the European Agency to promote the development of vocational education and training in the European Union, proposed the following definitions of *formal*, *non formal* and *informal* learning (Tissot, 2004):

- formal learning: "Learning that occurs in an organised and structured environment (in a school/training centre or on the job) and is explicitly designated as learning (in terms of objectives, time or resources). Formal learning is intentional from the learner's point of view. It typically leads to certification" (p. 70);
- non formal learning: "Learning which is embedded in planned activities not explicitly designated as learning (in terms of learning objectives, learning time or learning support), but which contain an important learning element. Non-formal learning is intentional from the learner's point of view. It normally does not lead to certification" (p. 112);
- informal learning: "Learning resulting from daily activities related to work, family or leisure. It is not organised or structured (in terms of objectives, time or learning support). Informal learning is in most cases unintentional from the learner's perspective. It typically does not lead to certification" (p. 76).

There has been an intense debate on the definition and description of these expressions (Colley, Hodkinson & Malcolm, 2002; CEDEFOP, 2007). Establishing precise borders is not so easy, because the definitions involve elements such as an explicit

and structured learning design (characteristic of formal learning), intentionality (both of the learner and of the institution/learning context), the presence of a certification and its guarantee of a learning value. For the purposes of this paper, the distinction between non formal learning and informal learning is not so important, while we will regard these two forms of learning as the opposite to formal learning. Even though it is clear that formal learning often includes episodes of informal and non formal learning and vice versa, we will use the expressions *formal learning* to denote learning that occurs in the school context or as a consequence of activities designed by teachers, and *informal learning* to denote learning occurring outside this formalized context.

While discussing the interplay of formal learning with informal learning for the students of an Italian secondary school, we will focus on the role played by technology (and specifically, the Internet) both inside and outside school, for at least two reasons. The first is that it was through the use of the internet outside school that the problem of cyberbullying originated. The second is that technological development is speeding up the innovation rate of learning dynamics and challenging the ability to cope of all learners. To tackle this problem, the need was perceived for understanding better not only the kind of informal learning processes and skills involved when the students are at home and use technology on their own or under the supervision of their parents, but also the opinions and beliefs of the parents and teachers concerning such processes.

SRL was not among the explicit aims of the survey, but the information gathered provide interesting hints on the way SRL intertwines with formal and informal learning.

RESEARCH STUDY
OBJECTIVE AND METHOD

The research study conducted can be regarded as action research, as a form of inquiry committed "to bring about change as part of the research act. Fundamental to action research is the idea that the social world can only be understood by trying to change it" (McTaggart quoted by Brydon-Miller, Greenwood & Maguire, 2003, p. 15).

Aim of the survey was to obtain information about the digital habits of the target population. These information are necessary to identify suitable approaches for dealing with the phenomenon of cyberbullying and, more generally, to develop media literacy competences among the students to make them less undefended when confronted with some of the risks of the digital world and better prepared to take advantage of their potential.
This study is focused on some results of the survey and its objective is to highlight, in particular:

- the use of technology among the students of an Italian lower secondary school, their teachers and their parents;
- their awareness in the use of digital technologies;
- their knowledge and beliefs on the theme of cyberbullying.

In order to explore the above aspects, three different questionnaires were used, addressing respectively students, parents and teachers. The three questionnaires had a common structure and were articulated in different sections intended to achieve similar data regarding:

- the digital equipment possessed by the respondents (e.g., mobile phone, personal computer, Internet connection, personal e-mail);
- the familiarity, purposes and frequency of use of specific instruments and tools (e.g., the frequency of use of Internet for specific purposes, such as videoconferences, social networking, listening to music, downloading music);
- the attitudes, beliefs and wishes towards the use of digital technologies in the learning context; the thoughts and convictions on the problem of cyberbullying.

The surveys were delivered in two different ways: parents and teachers had a paper copy of their questionnaires, while students had the chance to fill them either online or on paper: this decision was left to the teachers who were in charge of the compilation. As a matter of fact, all the six classes of one of the three locations chose the online form, while the other two locations opted for the paper option.

After the compilation of the paper questionnaires, all the data were inserted in a digital spreadsheet (realized with the function Module of Google Documents) by the students of one of the classes, guided by their teacher during the after school; and then analyzed.

The data derived from the questionnaires were used as a basis of a series of initiatives organized by the school: as reported in the section devoted to the meetings outcomes, these were events involving the teachers and their students, except for one which addressed teachers and parents together.

Nine meetings were organized with the students during the school-time, one for each grade per school location. More than lessons, the meetings were designed as a conversation with an expert teacher on the different ways to use digital technologies.

The objective of the meeting with parents and teachers was a reflection on the educational and cultural challenges imposed by the diffusion of technology in the students' lives and the best strategies to join forces to achieve the common goal of equipping the youngest in using technologies. The questions raised, the remarks made during the meetings, and all the private conversations held after the meetings were noted down by the researchers.

CONTEXT

The research was conducted among the 27 classes of an Italian lower secondary school – a three year mandatory school, covering grades six, seven and eight – during the 2009/2010 academic year.

The school – that gathers students from families belonging to the upper-middle class - has three different locations throughout the municipality of Genova and in each location there is a computer laboratory with about a dozen of computers. Given the high number of students per class (the average was 25) and the restrictions recently imposed by the Italian ministry of education (only one teacher per class), there was no chance to split the classes into subgroups. Furthermore, media education is not part of the Italian school curriculum and, in actual facts, the schools organization doesn't favour the integration of ICT in the curricula. For this reasons, in most cases students did not use computers in the school time.

PARTICIPANTS

High percentages of Students, Teachers and Parents (henceforth in the tables S, T and P, respectively) of the school answered the questionnaires.Among the students, 626 of them out of 673 (93.0%) filled in the questionnaires during school hours. Among the teachers, 54 out of 61 (88.6%) returned the completed questionnaires.
Regarding the families, three different sets of data must be considered. The questionnaire was meant to be filled in by both the parents of each pupil and for this reason a family with three children enrolled in the school, should return three different questionnaires (and 579 questionnaires out of 673, 86.0%, were returned, compiled by 554 families). However, since the questionnaire was organized in sections some of which addressed to the parents as a whole (regardless of their gender), some others with questions posed to the individuals (mothers vs. fathers), we have data collected from mothers and data coming from fathers (respectively, 546 mothers and 515 fathers, for a total of 1061 individuals).
Table **1** shows a synthesis of the respondents to the questionnaires.

Table 1 - Respondents to the questionnaires (579 questionnaires filled in)

Respondents	**S**	**T**	**P**
Average age	13 years	52 years	48 years (fathers) 45 years (mothers)
Male	317 (48.1%)	9 (16.7%)	515 (48.5%)
Female	301 (50.6%)	43 (79.6%)	546 (51.5%)
No answer	8 (1.3%)	2 (3.7%)	-
Total	626 (100%)	54 (100%)	1061 (100%)

OUTCOMES FROM THE QUESTIONNAIRES

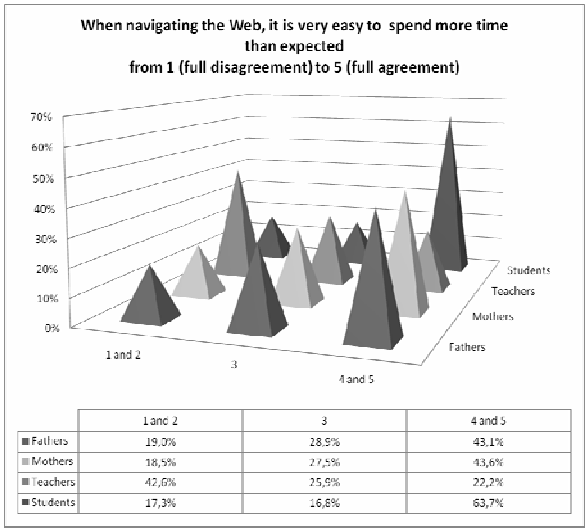
In the following, the main outcomes of the survey relevant for our discussion are described. Not surprisingly, according to these data, technology use is quite common among all the respondents while their familiarity and skills with technologies are diversified. All in all, the adults' perception of the students' ability with technology is quite positive, in that both parents and teachers recognize their cleverness. However, awareness in using technology is perceived in a different way by the parents and teachers, a fact that might have some effects on the educational aspects related to the use of the Web.

USE OF TECHNOLOGY

The ownership of mobile phones and personal computers is widespread among the respondents.
As Table 2 shows, the majority of students, teachers and parents have a mobile phone and/or a computer. Furthermore, the use of these devices is quite customary, especially among the adults. The Internet, however, seems to be used more by students that by adults.

Table 2 – Ownership and personal use of mobile phones and personal computers

Respondents	**S**	**T**	**P**	
			Mothers	**Fathers**
Have a personal mobile phone	93.5%	100.0%	99.3%	96.3%
Have a computer at home	98.3%	98.2%	96.7%	
Use the computer more than once a week	66.1%	81.5%	67.9%	82.9%
Have a personal e-mail account	63.7%	85.2%	74.5%	82.1%
Use Internet	88.7% (without specifying how often)	72.2% (more than once a week)	61.9%	79.4%



	1 and 2	3	4 and 5
Fathers	19,0%	28,9%	43,1%
Mothers	18,5%	27,5%	43,6%
Teachers	42,6%	25,9%	22,2%
Students	17,3%	16,8%	63,7%

Figure 1 - Time control during Web navigation

Even though the use of Internet is rather diffused among adults (72.2% of the teachers, 61.9% of the mothers and 79.4% of the fathers declare to use it more than once a week), it seems that the connection habits of parents and teachers are quite different. For example, the teachers' claim to be in control of their time when navigating the Web is rather surprising and in contrast with the parents assertion of finding themselves often spending more time than expected on this activity.

Students' allegations show how difficult it is, for teenagers, to forecast and manage their time when navigating the Web (Figure 1). This is possibly due to the fact that a high percentage of students (81.0%) declare to navigate the Web without adults supervision and/or that their main activities online involve the interactions with others (e.g., chatting, social networking).

Despite the high frequency of use of digital technologies among teachers and students, technology has not yet assumed an important role in formal learning. Teachers use computers and the Web at home, but they do not make much use of it at school (Table 3).

Table 3 – Teachers' professional use of the Web

On a scale from 1 (never) to 5 (very often), how frequently do you:		**Mean (s.d.)**	**% answers**		
			1-2	**3**	**4-5**
Use the Web to prepare your lessons	T	2.4 (1.2)	53.7%	27.8%	16.7%
Use the Web during your lessons	T	1.9 (1.0)	72.2%	11.1%	11.1%
Receive questions from your students on information they found on the Web	T	2.3 (1.0)	51.9%	35.2%	9.3%
Encourage your students to retrieve information on the Web	T	2.8 (1.2)	44.4%	24.1%	27.8%

Interestingly, while parents regard a major role of technology in schools as desirable, teachers are more cautious about this. In particular, teachers seem to be less keen than parents on increasing the technological devices in the school context (Table 4).

FAMILIARITIES AND SKILLS WITH TECHNOLOGIES

When asked to compare their use of digital technologies with that of their students, in terms of both quantity of time and quality, high percentages of teachers say they believe that they use technology less and worse than their students (respectively 74.1% and 59.3%). Almost half of the parents (44.6%) are convinced that their sons and daughters use technologies better than them.

Table 4 - Teachers' (T) and parents' (P) opinions about the introduction of technologies in the school context

On a scale from 1 (not at all) to 5 (very much), how much would you like that:		**Mean (sd)**	**% answers**		
			1-2	**3**	**4-5**
In the classrooms there were a computer, Internet connection and a projector [i.e., IWB]	T	3.4 (1.5	25.9%	24.1%	48.2%
	P	3.54 (1.3)	21.7%	20.6%	52.9%
Each student at school had his/her own computer	T	3.0 (1.5)	38.9%	22.2%	35.2%
	P	3.4 (1.4)	28.5%	20.7%	47.2%
Traditional text-books were complemented by e-books	T	2.8 (1.4)	46.3%	22.2%	29.6%
	P	3.3 (1.4)	28.8%	22.1%	45.4%

Table 5 – Teachers' (T) and parents' (P) beliefs on the students' familiarity and skills with technology

On a scale from 1 (disagreement) to 5 (agreement), how much do you agree with the claims: our students/sons use technologies...		**Mean (s.d.)**	**% answers**		
			1-2	**3**	**4-5**
... more than us	T	4.1 (1.1)	9.3%	14.8%	74.1%
	P	3.0 (1.4)	35.9%	23.3%	37.3%
... better than us	T	3.8 (1.2)	13.0%	22.2%	59.3%
	P	3.3 (1.4)	29.4%	23.3%	44.6%
... methodically and knowingly	T	2.3 (0.8)	53.7%	35.2%	3.7%
	P	3.5 (1.0)	16.1%	33.9%	46.5%

The main disagreement between parents and teachers concerns what we initially named *digital awareness*: while parents fully agree on the fact that their sons and daughters use technologies methodically and knowingly, the teachers sensibly doubt it (respectively 46.5% and 3.7%; for more details, see Table 5).

Furthermore, teachers believe that their students lack some important cognitive skills (long term and in depth concentration power and other learning abilities) and put down these problems to their intensive use of the web (Table 6).

Table 6 – Students using the web: beliefs expressed by Teachers

On a scale from 1 (disagreement) to 5 (agreement), how much do you agree with the following claims?	**Mean (s.d.)**	**% answers**		
		1-2	**3**	**4-5**
The intensive use of the Web is limiting the students' cognitive and learning skills (e.g., long term and in-depth concentration power)	3.7 (1.2)	16.7 %	24.1 %	53.7%
Students are passive and uncritical towards information found on the Web	3.5 (1.2)	22.2 %	24.1 %	48.2%

Table 7 – Education to use technology as part of the curriculum from the Teachers' point of view

Education to use technologies methodically and knowingly:	**#**	**%**
Should not enter the school curriculum	2	3.7%
Should be introduced in the curriculum as an autonomous discipline	24	44.4%
Should be part of a specific discipline (specify which)	5	9.3%
Should be integrated in the disciplines that are already part of the actual curriculum	22	40.7%
No answer	1	1.9%
Total	54	100.0%

EDUCATING STUDENTS TO USE THE WEB

A high percentage of the parents (72.0%) and a very high percentage of the teachers (94.5%) believe that the use of technology should be part of the school curriculum. However, as shown by the data in Table 7, there is no agreement among the teachers on how to deal with this subject (e.g., as an autonomous discipline or not).

Parents and teachers' points of view on the adequacy of school infrastructure to educate students in using the Web are quite similar, since both the categories agree on the fact that schools lack of equipment. Nevertheless, they disagree on the competences possessed by teachers to educate students in using the Web: while only one fourth of the parents believe teachers do not have these competences, more than half of the teachers express the same belief (Table 8).

Table 8 – Teachers' (T) and Parents' (P) beliefs on the adequacy of the competences and infrastructure to educate students to use the Web

On a scale from 1 (disagreement) to 5 (agreement), how much do you agree with the following claims?		**Mean (s.d.)**	**% answers**		
			1-2	**3**	**4-5**
Schools have adequate infrastructures to educate students in using the Web	T	2.7 (1.1)	42.6%	25.9%	22.2%
	P	2.4 (1.2)	54.1%	23.6%	16.4%
Teachers have the right competences to educate students in using the Web	T	2.8 (1.2)	55.6%	25.9%	14.8%
	P	3.2 (1.2)	25.9%	31.1%	34.9%

It stands to reason that, on this matter, teachers probably have a clearer view and are better aware of the competences needed. In fact, not only do these include autonomy in the use of technological devices but they also comprise the ability to use them in a wise way, especially in teaching.

OUTCOMES FROM THE MEETINGS

MEETINGS WITH STUDENTS

As mentioned above, the students also participated to ad hoc sessions organized by the school to reflect together on the problem of cyberbullying and, more generally, on opportunities and threats involved in technology use.

The data from the students' questionnaires were presented as an introduction to reflect on the time they spend using technologies and to give some advice on how to use mobile phones and Internet in a safe way, in order to protect themselves from the risks related to an (unaware) use and to understand when it is the case to ask for help from adults.

In order to make the students feel at ease during the discussion, no opinion was sentenced, but became object of discussion. The students actively participated to the discussion and let emerge their doubts. Despite their frequent access and use of technology, they expressed many uncertainties that can be ascribed to lack of knowledge and competence in different fields. For example, many of the students did not know that online activities can be traced and – as a consequence - that online invisibility is not always guaranteed. Similarly, many underestimated the potential pitfalls of computer mediated communication.

During the meetings students were lead to realize, through the analysis of real excerpts of online text-based conversation, how many different meanings could be associated to the same sentence when two people talk at a distance without the support of nonverbal cues, etc.

Very interestingly, after the meetings many students felt encouraged to talk in their classes and with their teachers about the use of ICT in general and their own use of it, in particular.

The initiatives organized by the school encouraged them to introduce it as a new topic of conversation in the formal learning situations. In other words, they started to regard it as part of the school activities.

MEETINGS WITH ADULTS (PARENTS AND TEACHERS)

About 100 people participated to the meeting with teachers and parents (approximately 8% of the target population of adults). The meeting was started up by showing participants an excerpt of the data from the three questionnaires. Teachers and parents talked about their common goal as educators and had the

chance to compare their different roles and their competences.

While parents expressed their difficulties in understanding, controlling and monitoring their sons and daughters (not only while they use technology), teachers expressed worries regarding their skills in educating the students and equipping them from a technological point of view. The parents' needs could be ascribed to a more general request not to be left alone in the (digital?) debate with their sons and daughters. What they actually asked teachers was a major commitment from the institution on the themes connected with sensible and reflective use of technology, despite the allegedly insufficient competences owned by teachers. For this reason, parents interpreted favourably the fact that teachers intended to discuss with students about sound and unsound online behaviours, an important first step to bring in the school context the theme of digital awareness.

CONCLUSIONS

The effectiveness of the approach adopted to face the problem of frequent cyberbullying episodes in an Italian school is difficult to assess. While it is true that in 2010/2011, that is the scholastic year following the study described in this paper, as yet, no cyberbullying events have taken place, it is also true that this cannot be regarded as scientific evidence of the success of the initiatives undertaken, especially if we consider that one third of the students involved in these initiatives is not attending that school any more. However, it is reasonable to hope that, thanks to the reflections carried out on the strengths and pitfalls of technology use, at least those students who took part (or simply didn't react) to the cyberbullying episodes out of sheer unawareness, underestimating its effects, would not do it again.

As discussed in the paper, aim of the study was not just to address the problem of cyberbullying alone, but also to extend the discussion to the larger problem of education on digital media in Italy, on the reasons why it is not carried out (at least systematically) and on the issue of how it could be carried out. The picture emerged points to a perceived need, on the side of the teachers, for more solid competence in the field, a competence that should include not only digital wisdom, but also skills in the pedagogical use of technology.

Besides this need, the study also suggests that teachers' attitudes towards the use of technology in the educational context do not seem to take into consideration the fact that technology has actually entered their students' and their own households and has consequently changed the practice of learning, at least in informal contexts. Students spend a lot of their time using technology, on their own or in connection with their peers.

Underestimating this factor prevents teachers from activating a dialogue between their students' digital cleverness and their own (digital?) wisdom which is likely to lead to two positive outcomes. The first is improving the integration of technology in formal learning contexts and strengthening the self-regulation of the learners in technology enhanced environments. The second outcome is an increase of the opportunities to enrich the students' digital cleverness with pills of wisdom concerning, for example, the importance of questioning information found on the web and of adopting sensible behaviours in computer mediated communication. In other words, the answer to the question on how to carry out media education might lie in a positive contamination between formal and informal learning.

The above consideration does not contradict Boekaerts and Minnaert's (1999) claim that learners, left alone in their digital practice in informal learning contexts, are likely to refine their learning strategies so to let self-regulation emerge in a natural way. It just points out that, especially for young learners whose critical judgement skills are not fully developed, it is greatly advantageous to find the right balance between autonomous use of technology in informal learning and reflective practice on sensible online behaviours in the class context.

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WORKSHOP B: SRL IN TELES WITH FOCUS ON LEARNING IN CLASS

“I hope you don’t mind… I’ve done the next three pieces of homework that you’ve set and I’ve also worked two or thee pages ahead. Is that alright?” Changing patterns of self-regulated learning in nine high ICT schools in England

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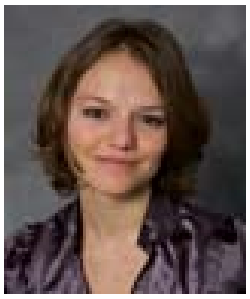

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INTRODUCTION

This chapter will report findings related to self-directed learning from Impact 09, an evaluation project carried out in England during 2009-10 (Crook, et al., 2010) whose goal was to report on the nature of learning in nine high-performing high-ICT (information and communications technology) secondary schools. We shall argue that self-regulation was a distinctive feature of the teaching and learning in these schools. The Impact’09 project proposed a broader perspective on the notion of impact than has been generally used in earlier studies (see, for example, Johnson, Cox and Watson, 1994 and Harrison et al., 2004), and argued that many previous studies of impact have been limited in that they have either focused on a single innovation or have reported

solely on institutional factors, and have paid too little attention to the contexts of learning. In the Impact 09 project, the focus was on the learning practices of the students and on the contexts of ICT-supported learning. The learning practices that the project identified as mediating ICT for learning are presented within a taxonomy of nineteen elements (including, for example, exposition, reflection, and construction), and this taxonomy was used to classify the lesson activity reported in teachers' lesson logs. We argue that ICT reconfigured classroom practice in the project schools in important ways, that self-regulation was a distinctive element in this practice. We also argue that self-regulation was facilitated and directly encouraged in three ways. First, there were changes in the authority structure of learning: students were invited to participate in learning in ways that reconfigured their position as learners, with their peers and the teachers as resource persons, from whom feedback could be elicited on a just-in-time basis, in school or out of school, day or night. Second, there were changes in the topological dynamics of learning: the teachers reconfigured learning spaces, from traditional to flexible, in ways that permitted instant switching between individual, small group and whole-class activity. Thirdly there were changes in the information architecture of learning: instead of passively receiving information from the teacher, students became dynamic users of the teachers' and schools' information systems, which included online lesson plans and tasks for the whole semester, the school's assessment data, and all the teachers' online resources.

SELF-DIRECTED LEARNING AND THE IMPACT09 PROJECT

As Jerome Bruner has argued, learning through play is an important aspect of social behaviour in humans, in infancy, childhood and beyond. Play is the arena in which children can not only learn important social and cognitive skills, but also 'test limits with relative impunity' (Bruner, 1974, p. 22). The challenge for schools and teachers is to produce greater congruence between the activity goals of the child, which prioritize play, inquisitiveness, rapid change, immediate reinforcement, freedom and socialisation, and those of the school, which prioritize work, focus on predetermined goals, extended concentration, delayed reinforcement, coercion and individualization. In many respects, one could argue that the self-directed learning movement in education represents one of the most systematic and serious attempts to bring about that congruence. This chapter will not attempt a synoptic review of the literature on self-directed learning, but it will draw upon the perspectives of two scholars who have produced such reviews, Abdullah (2000) and Steffens (2006). It is necessary at this point to give at least some attention to the previous literature on self-directed learning (SDL), partly because different definitions of SDL emphasize very different aspects of learning, and partly because, as Steffens has pointed out, the definitions themselves mean little unless they are connected to a reasonably explicit account of three things- the learner model, the management model and the feedback model that underpins them. In this section, therefore, we shall attempt to outline how an SDL perspective can be applied to our research, and shall then go on to relate it to interview and case study data from the Impact'09 project.

The Impact 09 project was funded by Becta, the government-funded British Educational Communications and Technology Agency, whose closure was announced by the new Conservative Secretary of State for Education, two days after the general election in May 2010. The remit of the Impact 09 project was to provide explanatory case studies of the impact of technology enhanced learning (TEL) within nine secondary schools in England in which ICT for learning was already well embedded. The project team began by carrying out a 'deep audit' of ICT activity in each school, and simultaneously worked to design new tools for researching the TEL environment. These tools were needed for two reasons: first, it was clear that ICT made possible new forms of classroom practice as a result of reconfigurations of space, new ways of orchestrating class activities and new possibilities of representation; second, ICT created the possibility of a wide variety of learning practices such as exposition with multimedia facilities, independent research and construction with ICT tools. In order to more fully explore the new forms of classroom practice and to more carefully map the nature of the learning practices, the research tools that were developed were (a) an online lesson log that was completed by teachers, in which they were invited to record their use of space and digital technologies, and their reflections in relation to student engagement and learning, and (b) a taxonomy of learning practices, which aimed to capture some of the ways in which

ICT was mediating the learning that took place within and beyond the lesson that was recorded in the log.

Before describing these two research tools, however, we want to offer our thoughts on some of the ways in which we believe the research ideology of the Impact 09 project harmonises with an SDL perspective. Traditionally, educational research into the transactions of learning has tended to focus on a single lesson as the unit of analysis. Stake's matrix (1967, p.528), with its focus on antecedents, transactions and outcomes, was perhaps the archetype of such an approach, and it has served educational research well, but it is based on two assumptions that do not hold for TEL: first, that the teacher's intentionality rather than the learner's should be the pedagogical focus, and second, that 'a lesson' rather than a spatially and temporally elastic learning space should be the transactional focus. As Abdullah (2001) pointed out, in SDL, control gradually shifts from teachers to learners, who exercise a great deal of independence in setting goals and deciding what is worthwhile learning as well as how to approach the learning task within a given framework. It was precisely this shift of emphasis that the Impact 09 project wanted to capture, and thus, although we certainly aimed to elicit from teachers their goals and intentions, we also wanted to capture evidence of the impact of ICT not just on learning, but rather on the learning practices that led to or facilitated that learning, wherever they occurred and whoever initiated them.

The Impact 09 project team's interest in capturing the learning practices also harmonises with the emphasis that Steffens (2006) places on the value of articulating in some detail the models of learning, management and feedback that underpin any attempt to introduce SDL. Figure 1 shows our suggested components of these models, as informed by the data gathered from the Impact 09 project. First, our learner model places a great deal of emphasis on student autonomy in learning, not just in relation to learning goals, but also in relation to the choice of learning environment and the pathways that could lead to learning. Second, the management model privileges freedom for the learner within time and space; this was a crucial component of the educational philosophy in some of the schools that were the most successful in integrating ICT into learning. Third, some of the innovative schools which the team visited had totally redefined the feedback models that underpinned learning. Instead of the traditional two-element feedback model consisting of in-class praise and delayed feedback through grades on coursework, innovating schools encouraged multiple feedback systems that made use of peer feedback, formative teacher and student feedback, 24/7 access to the school's own management and information systems for parents and students, as well as external feedback mechanisms involving parents and industrial partners.

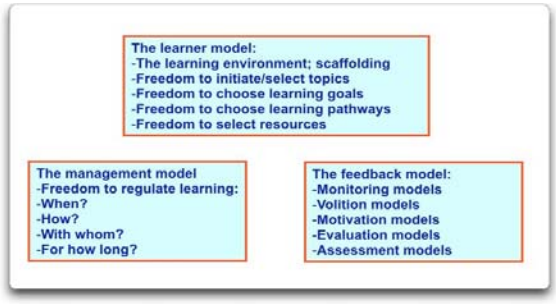

Figure 1 The Learner, Management and Feedback Models underpinning SDL

In these ways, therefore, we would suggest that there was a high degree of overlap between the Impact 09 project's research perspective and the ideology of SDL.

THE IMPACT09 TEACHER LOG AND LEARNING PRACTICES TAXONOMY

In essence, the Impact 09 report argued that many previous studies of impact have paid too little attention to the contexts of learning, and that what was needed was a focus on the learning practices of the classroom, and the contexts of ICT-supported learning.

The study reported an analysis of 85 lesson logs collected from nine nationally recognised high-ICT schools in which teachers recorded their use of space, digital technology, and student outcomes in relation to student engagement and learning. A screenshot of the web-based version of the teacher log is shown in Figure 2. The teachers who filled in the logs and senior managers in their schools had been interviewed as part of a 'deep audit' of ICT provision conducted over two days, and one-hour follow-up interviews with the teachers were carried out after the teacher's log activity, on order to obtain a broader contextualisation of their teaching.

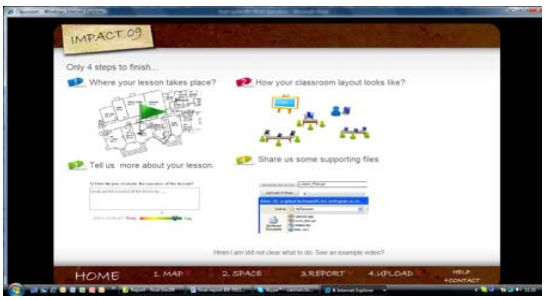

Figure 2 Introductory page to the web-based version of the teacher log

The learning practices that we identified as mediating ICT for learning are presented in Table 1 as a taxonomy of nineteen elements (including, for example, exposition, reflection, and construction) and these were used to classify the lesson activity reported in the logs. The taxonomy proposes nineteen forms of interaction that a learner might take part in, where the objects of interaction are material things, symbols, or other people. Detailed descriptions of the categories can be found in the full report (Crook, et al., 2010). Such "interactions-for-learning" offer a variety of ways in which a learner's knowledge could be elaborated. It is proposed that a taxonomy of this sort suits a context where interest centres on the impact of technology on learning. This is because of the meditational role of technologies - the coming between ourselves and the world (i.e., between ourselves and things, symbols or people). Thus in situations where technology is being used we can ask: "what learning practices is it mediating?" Then asking, perhaps, how efficiently, economically or convivially is it doing so? Or whether its involvement with that interaction enriches the experience? A related question would be "does the availability of technologies shift the profile of learning interactions that are chosen or cultivated in some place of learning?"

The leftmost column in the table is an attempt to group and organise the nineteen forms of interaction. Instrumental items are interactions that are not necessarily involving other people in direct relationship. Dialogic items are interactions that are more one-to-one. Social items involve people in a more diffuse or distributed sense. Scenarioed items are those within more formally constructed configurations of a setting for learning.

Table 1. Taxonomy of learning practices (from Crook et al, 2010)

	Learning Practice	Learners mediated interaction
Instrumental	Searching	A directed or improvised exploration of subject materials
	Annotation	Record elaborating commentary on subject materials
	Rehearsal	Recall and exercise relevant domain elements and processes
	Representing	Design and manipulate symbolic formats of subject matter
	Ludic	Un-directedly explore materials to generate positive affect
	Construction	Build artefacts, knowledge, or representations relevant to some subject domain
	Reflection	Consciously systematise one's own evolving learning
Dialogic	Exposition	Implicit dialogue with authorial voice
	Tutorial	Engage in dialogue with more knowledgeable other
	Assessing	React to feedback from an authoritative other
Communal	Performative	Publically present a domain-relevant construction
	Networked	Distributed and intermittent exchange of subject-related understandings
	Participative	Integrate with a community of learners who share knowledge-building ambitions
	Collaborative	Exchange to deliberately create shared knowledge
Scenarios	Cross-Contextual	Integrate and manage activities over multiple contexts
	Case-based	Engage with the components of a subject-relevant case
	Simulation	Manipulate a functional reproduction of subject-relevant system
	Problem-focused	Solve a specific problem defined as subject relevant
	Scripted inquiry	Execute a scaffold of investigation or articulation

In our report we argue that ICT reconfigured classroom practice in the project schools in important ways, amongst which we would highlight the following:

- ICT can make possible new forms of classroom practice. This was apparent in three particular respects : (1) the reconfiguration of space such that new patterns of mobility, flexible working, and activity management can occur, (2) new ways in which class activities can be triggered, orchestrated and monitored, (3) new experiences associated with the virtualisation of established and routine practices – such as using multiple documents in parallel, or manipulating spatial representations.
- ICT creates the possibility of a wide variety of learning practices. Overarching this variety are three central activities which are significantly enriched by the ubiquitous availability of technologies: (1) exposition which is animated by the opportunity to invoke rich shared images, video and plans,

(2) independent research which is extended by the availability of internet search opportunities explored and utilised within time-frames that are not predicated on school timetables or locations, and (3) construction which is made possible by ICT-based tools.

'EMERGING THEMES' FROM THE IMPACT09 DATA, AND HOW THESE RELATE TO SDL

Impact 09 report we identify six 'emerging themes' that surfaced from the interview data, and relate these to the findings of the teacher log exercise. We identified as Emerging Themes:

- vision and leadership
- the goals and structures of out-of-school learning
- the importance and multifaceted nature of staff development
- the redefinition of learning spaces
- the impact of ICT on learning was noted in four particular areas: differentiation, inspiration, coherence and engagement
- exploiting the affordances of new media

The emerging themes focused particularly on a system-level analysis of the conditions under which ICT impacts learning, but they echoed many of the issues that surfaced as important in the lesson log analysis: the use of space, and new ways of using space (including virtual spaces) to improve learning, and the ways in which ICT was used to inform a wide variety of learning practices, a number of which involved the students in new forms of activity.

Many of the key emerging themes that were identified in the Impact 09 data resonate with the issues and concerns that are associated with self-directed learning. First, while we were clear that the vision and leadership of the head teacher in a school was a key factor in facilitating the effective use of ICT for learning, many of the interviews made it clear that what a school needed to use technology effectively was not simply a vision of technological innovation, but a vision of transformed learning and an elaborated vision of the autonomy and authority of learning. As one head teacher put it:

... you know, children are in school for 15% of their time and we can control that by and large, but for me the real learning gains [relate to the] totally almost untapped potential to use ICT to affect the other 85% of children's lives ... it's just a fascinating way to engage children and parents. (Head teacher, School 3)

This head teacher understood that technology had the power to make learning available on demand, whenever or wherever the child needed to access it:

... the power of mobile technology is immense and I have a view about podcasting and vodcasting lessons, ... we determine on the timetable that a child will learn French at half past two on a Thursday; well, if the child doesn't learn at half past two on a Thursday, for whatever reason, they ought to have the facility to be able to revisit that lesson in their own time and at their own pace. And lots of children won't put their hands up in class just to ask questions because they think they look a bit stupid and most people don't get everything first time, do they? So I believe that we can make major gains from the gains that we've already made by podcasting, vodcasting, [and the] use of mobile technology. (Head teacher, School 3)

This head teacher's vision neatly encapsulates key aspects of the SDL learner model relating to the authority of learning, and the management model relating to the ubiquity of learning. He also was very clear about the enhanced possibilities of the feedback that ICT could offer:

... Kids need that feedback, immediate feedback, and they also need to have no parameters in terms of, well, you know, the sky is the limit sort of idea. You know, you can go wherever you want to go with this stuff. And our job really is to enable in terms of hardware, software and bright ideas, enable the kids to have ... no restrictions on how much or how far they can go with their learning. (Head teacher, School 3)

This vision was also shared by the teachers in School 3. A number of them described how their own philosophy of teaching and learning had changed, with a new emphasis on student autonomy in learning:

I kind of came to the realisation that in effect I'm not actually ... just teaching them geography. ... I'm teaching them ... skills they can use wherever they want. I make the material available for them to take responsibility for their learning. At the end of the day, I can't make you learn something, but if you choose not to, because it's your responsibility, then you have to deal with the consequences ... Instead of me standing at the front teaching ... the onus is on the

pupils to find, investigate, learn. I'm giving them the opportunity always for them to do it. (Geography teacher, School 3)

An encouraging aspect of our team's visits to School 3 was that every teacher and student was making use of the autonomy that was envisioned by the head teacher, and supported by the technology provided by the school. This teacher's comments also emphasise our second emerging theme: enhancing out-of-school learning:

... It's got to be with our independent learning, it's got to be ... what the kids do at home. When I first came in, the kids would not work at home, you'd get next to nothing off them.... But now, they know they've got this constant access to the school. (School 3, Teacher 1)

Similarly, the students themselves saw accessing school files from home as a crucial aspect of their learning. Students in Schools 3 and 5 commented on this:

... So if you are at home it is just like at school, our parents love it... There is a system like an online timetable and teachers upload documents from the lesson and you can see the lesson – you can see that from anytime or anywhere. (Year 10 student in School 3)

... In IT last year you could find all the information, everyone can access that information. You can access it from home. You can save documents ... on the school drive remotely. (Student in Year 10 at School 5)

Access to technology redefined the time and space parameters for learning in other schools, too. In Schools 5 and 6 where there was a one laptop per student scheme which established continuity of learning between school and home. Having all the information on their laptop made it easier to access learning opportunities:

It is in your laptop and you can carry working on it from home and also through the online database for independent learning (Year 8 student, School 6)

At home we do most of our homework on the school laptops (Year 7 Student in personal laptop pilot scheme School 5)

These changes did not come about purely through the introduction of new technology and because the head teacher had vision; our third emerging theme of staff development was also crucial. Initially, teachers had been required to integrate technology into their teaching, but in the most successful schools, teachers themselves were gradually offered more autonomy and individualised support. In the main, staff development opportunities in the project schools placed a major emphasis on in-service training days and one-to-one support, but most of all, on the sharing of good practice in the school with other colleagues via more or less formal channels of communication. The excerpt below from School 3 illustrates an approach that was effective in spreading and sustaining good practice: there was a good deal of formalized support, but from the start the provision took account of the fact that individual teachers were at very different stages in terms of their personal development:

I think we differentiated it at the outset in terms of training for people. There were very few mass briefings, you know, it was very much individualised. We ran sessions for less confident people, we ran sessions for more confident people. We got more confident people to train less confident people. The sense of feeling that 'we're all in this together', I think the sense that I managed to convey to staff that 'OK, I'm no expert. We're going to take this at a pretty slow pace. It is going to be very interesting, it's going to be fascinating for the teacher, fascinating for the kids, but we're not expecting you to be a genius by Christmas, you know'. (Head teacher, School 3)

The interviews with teaching staff revealed additional sources of development that were less visible or even unintended. Some opportunities emerged from the alliance between teacher, student and technology that was perceived by some teachers to open additional channels of not only teacher development but also of learning opportunities. These were often described as organic and spontaneous. The example below reveals an interesting interaction whereby the teacher learned from the students, which in turn gave space for more student participation in the classroom:

How' has [technology] changed my teaching? Drastically. We teach one another now. I mean, you put a child on Photoshop. That software normally has five or six different ways to bring about a solution. They'll find them all. They'll teach me new ways. I'll teach them the way that I know, and they'll come up with different solutions all the time. So it's absolutely fascinating. They'll learn from me, I'll learn from them. (Art and design teacher, School 3)

A similar pattern of teachers being confident enough to learn from their students was noted in School 4, where a teacher talked about the use of a film and moving image editing package to teach poetry with a Special Education Needs (SEN) group of 12-year-olds:

... I didn't know how to use it. And I had the SEN group last year, the Year 10s, I just said to one of the boys 'Does anyone here know how to use MovieMaker?' and he said 'Yes, I do. I'll show you.' And he taught me. ... So he taught me how to do it and he taught the other boys in the class. I didn't know what I was doing. I kept saying 'What do I do now?' and he would say 'Do this and do that.' And then because he taught me, I taught Year 9 this year. But a lot of the kids already, you say to them 'Who doesn't know how to do it?' and they'll go 'Oh no, I know.' They all know." (School 4, Deputy Head)

Such an openness to learning from students can have an exponential effect on learning across a whole school:

...So a student may well find a new way of doing something or make a discovery that they've never come across before and what I would do then would be to use our [screen monitoring] system so that the child can then take control of my interactive white board and speak through the process and show everyone else in the room what they'd done. That can then be passed over to the rest and they can attempt something similar.... I've been teaching now for 30 years and of course I was the person at the front of the room who more or less told children what to do. That is no longer the case. I quite often like sitting back and watching people working with the software intuitively. I love the way that a problem may arise and I do encourage them now not just to ask me what the solution is, but to find someone else in the room who has worked through that problem, so they can tutor one another.... (Art and design teacher, School 3)

The fourth emerging theme from the Impact 09 study related to the redefinition of learning spaces, and to the ways in which this was redefining learning and the opportunities for learning. The use of space was largely determined by infrastructural and subject demands, but, as we saw in the teachers' lesson log accounts, space was an issue that was at the forefront of many teachers' minds as they discussed their pedagogy with us. Most of the schools with which we worked had started to incorporate flexible learning spaces, and these are perceived to accelerate the pace of learning. Often such areas were used for both ICT and non-ICT work, and to promote differentiation and student-led learning. In School 2, for example, teachers preferred a diverse layout within the classroom that provided both dedicated space for computer work and a non-ICT supported discussion. This allowed movement within the room and increased the range of activities (e.g. using flip videos and presentations). Figure 3, below, shows such a classroom, in which there is one computer for every two students, to encourage peer teaching and interaction at the computer, an area for non-computer group work, and a large-screen data projector with Internet access to facilitate whole-class teaching.

Figure 3 Classroom in School 2, in which a computer-student ratio of 1:2 was augmented by tables for small-group work and a data projector for whole-class teaching.

As this interview segment shows, classroom flexibility and student autonomy also were high on the agenda for this teacher as she described her classroom of the future, in which the teacher is a facilitator rather than a pedagogue:

... I'd have fold down tables on the walls so that if you wanted to have just as an object or a piece of information, [that] could be over there. Or if they were doing an activity where they had to look at something, go back to the group and draw a piece, then take turns to build the picture up as a group, then you could have it spread around the room. If I had laptops then you could pop them on there so they could walk over, and type up, rather than their being dependent on me to find the answers. [It's important]

for them to realise that I'm a facilitator to provide for them, and then they go and find the answers. I've done my work when I walk in; I keep reminding them 'your lesson's prepared, it's time for you to work'. And to have the flexibility of where things are would be brilliant. (Geography teacher, School 3)

Our fifth emerging theme related to how ICT was impacting learning, and a key point to emphasise is that ICT was a source of individual difference, as well as a solution, as this teacher noted:
The variation between the groups was huge... it wasn't my intention to develop their use of those particular two programmes. I was mainly interested in their research, how they used it and how they put the information across and how usable it was and the content. But their variation in the end made a massive difference. What you don't know when you divide them up is that even though I arranged it you don't know how good their knowledge is... so I had done mixed groups but some groups were just so much more ICT literate. They were just much more able to access it and know what they were doing more quickly while for others it was a very slow process... and therefore it slowed them down. (School 2 Teacher 6)

However, ICT was more commonly identified as a support for managing learning in a way that effectively responded to different student needs. This support was sometimes related to the ease with which individual progress can be monitored in certain arrangements of networked technology:
Some will want to get on quickly and some will wait for guidance and when you do stop them you are able with the monitoring software to blank the screen and you can do it straight away. You are not waiting for them to stop tapping or whatever (School 2 Teacher 3)

In this case, ICT made available to the teacher the computer screen of all students in the class. This speeded up the teacher's access to information on each student's progress, and offered richer openings for intervention. The computer also offers students a choice of learning pathways- a key element in SDL. In this case the curriculum area was writing:
I think [ICT] supports the students that are less able literacy-wise. In terms of a child who has poor handwriting or really struggles, the child that can access the keyboard, suddenly they feel so much more confident… right now I have a much lower ability group and they just seem more confident. You put a pen in their hand and they say I can't do this. You sit them in front of a computer and their whole confidence level changes... for them it's being able to feel they can do a good job... (School 2 Teacher 6)

A similar view was expressed by this teacher of Music:
I can pre-set up five different versions of the same piece of music and they can chose which level they are going to work on. So in terms of differentiation it's really helped. That has helped with the engagement and the behaviour, while before I was giving out the whole range and telling some of them they only had to work on this easy bit. Some saw that as rubbish and others would say "oh no, I can't do that can I". So I say to them all now, start at level 1 - and then they can close that down and go on to the next level. (School 2 Teacher 4)

Perhaps the final point to make about how ICT is fundamentally transforming learning in some schools relates to how the affordances of a range of technologies are now being combined to radically change how teachers teach and how learners learn. The title of this chapter was taken from an interview with a teacher in his final decade of service who over five years had totally changed how he had taught compared with the previous thirty years. First, all his teaching resources were now online. Second, all his lesson plans were accessible to every student, and visible from any computer, at home or at school. Third, he encouraged the students to do much of the teaching and much of the assessment, while he took the role of facilitator and manager of learning. We asked him who gained from this approach, and his answer was to refer to a lesson that he had just taught, in which five different students had presented their Photoshop design work to the rest of the class electronically, to be critiqued by their peers:
There's benefit for everyone in the room. If I talk about myself first, it means that what I've been trying to put over has been accepted, and that they're able to work with those techniques but if there's other students who are struggling with that particular technique then it's a reinforcement. I think for the person who's doing that it's a reward for them to show that they've been able to follow the instructions, do it and do it to a high standard. I think there's more than one thing going on there. It's the exchange of ideas. I like the students to be involved, not only in the learning but also in the teaching and I think a lot

comes out of this particular system in that respect. It allows them to experiment and even if we are using the same techniques, they will discover different ways of doing it and that's what we want to see because it might just spark off an idea in another child. I think it works particularly well in that respect. (Art and design teacher, School 3)

It is clear, then that the authority of learning is distributed in this teacher's classroom. But so are the pathways to learning. In the interview segment from which we chose the title of this chapter, the teacher was emphasising that he was no longer threatened by the thought that a student might have worked three weeks ahead of his planned timetable:

[The students have] got access to my lesson presentations. One lovely little instance was a Year 7 girl who saw me on Wednesday and said 'I hope you don't mind Mr [Name], I've been looking at your resources, I've done the next three pieces of homework that you've set and I've also worked two or three pages ahead. Is that alright?'. That is why it's there. That's fantastic. And she printed the work off at home and brought it in in a file, which was just lovely. And we can flag that up as good practice. (Art and design teacher 2, School 3)

This teacher, in common with many that we interviewed as part of the Impact 09 project, and in common with his students, was looking ahead, and planning how new technologies would continue to extend the opportunities for learning. His perspective leads us neatly to the sixth and final emerging theme, which was the use of new media for enhancing learning. Here again we encountered many teachers whose technological vision was allied with an evolving educational philosophy. Two concepts related to new media in particular that we thought were of particular significance in relation to SDL were ownership and production: learners becoming owners of the technologies that will enhance their learning, and becoming producers rather than simply consumers of information.

Three examples will have to suffice in this chapter to give a flavour of what we found. The vision of informed teachers is important in this area, because individual teachers often have ideas about the tools that they want to use that will be part of the infrastructure of the learning platform, and they know how they want them to be used, as this teacher's comment demonstrates:

I would like to store more things other than it being more PowerPoint's, notebook, word documents or links. I would like it to have more things like film clips; I would like to get the students to de producing more things like podcasts, actually it becoming more of a social network site. I've encourage the use of a forum for recording ideas about improvements in teaching and learning in English, which did get some response last year (in 2008). But you really have to push it and really drive that forward. Also, getting them (the students) discussing things like the papers for the exam outside of the classroom, and record some of those conversations to show understanding.... (English teacher, School 1)

The teachers in School 1 placed an emphasis on developing work related to the end of year exams by using technology to increase reflection, production and critique. They wanted the learning platform to be a vital and developing repository within which students could record ideas and evaluations throughout the progress of their projects, and visualised podcasts and blogging as part of this function. The introduction of video for assessment in the class was also described as enhancing the student learning. In School 7, a modern languages teacher videoed students in a foreign language assessment project performing a comedy that they had scripted in French. Students commented on their experience of this as positive and motivating, as this focus group comment shows:

It was like last year in Yr7 we did the Olympics and we had to do it with dolls, and we had to make a play, it was good and it was tested on your pronunciation, the teacher filmed it and put it on the IWB, so she would film it and we were under pressure to get it right, it was the end of year test – she records it...You have to try and get it right – you have to speak in a French accent, then you listen to it so you are under pressure" (Year 8 Student, School 7)

Finally, a number of the maths teachers that we met were making increasing use of multimedia for teaching concepts and procedures, and accepted that a slightly different explanation from a teacher on a YouTube video might not only be helpful, but would be accessible to the student at home:

I think stuff like watching the videos of 'Maths Watch', they enjoy it because I'll run the video through once and it gives me a break and I can sit down and wander round the class, see how they're doing, keep an eye and then I can go through it again

and they're hearing two different voices- I know it's the same thing that's being said but it really does help, hearing it a second time from a different voice." ..."Slightly different, yes. Even though I'll be talking through the same example there- they don't talk about the thinking they go through, whereas when I go through I say 'I'm thinking through this, what do I need to do next?' try and put that in. I think it helps having both ways and that's always there for them to go back to. (Maths teacher, School 3)

This teacher, in common with many in his school, envisioned the use of podcast video clips, tailored to the learning needs of individuals, being available on students phones in the near future, and called up on demand.

CONCLUSION

In the sections above, we have tried to demonstrate through a number of examples the many ways in which SDL was a feature of the innovative practice that was recorded in the Impact 09 project. Was that practice exemplary? The question is not one that we can answer, since the answer relates to the values and beliefs of the individual educator or educational system. In one presentation that we gave on the Impact 09 project, some colleagues from Germany suggested that there was nothing particularly innovative in having traditional transmissional teaching delivered in 5-minute video clips on someone's phone. Traditional pedagogy is traditional pedagogy, they argued, whether it's delivered in a lecture theatre or on a mobile phone. The presentation was interrupted for 20 minutes, as colleagues from all over Europe took up the argument, and the counter-argument presented was that if a student can call up the teaching they need, from the teacher they choose, delivered at the level they need, any time, day or night, then something very significant has changed in the pedagogical model.

Our team thoroughly enjoyed the European debate on pedagogy that the Impact 09 had precipitated. The question of whether at a deep level the pedagogical model had changed remained unresolved. But what was perhaps uncontestable was that many of the students whom we met in the project were demonstrating autonomy in relation to choosing learning, managing learning and accessing feedback that fully exemplified the principles of self-directed learning.

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PROMOTING CO- AND SELF- REGULATION AMONG YOUNG SCIENCE LEARNERS IN A COMPUTER SUPPORTED COLLABORATIVE LEARNING (CSCL) ENVIRONMENT

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INTRODUCTION

Self-regulated learning (SRL) is an active and constructive process whereby learners set goals for their learning, monitor, regulate, and control their cognition and motivation behaviours as well as the contextual features of the learning environment. Self-regulated learning (SRL) helps learners to choose what to learn, determine how long they want to learn, determine how to learn, access relevant instructional materials effectively, as well as assessing their level of comprehension of learning materials (Zimmerman, 1989). Several studies have revealed that self-regulated learning (SRL) variables such as goal setting, monitoring and help seeking have been shown to have significant impact on the learners' academic performance (Paris & Paris, 2001, Narciss *et al*. 2007). According to Pintrich & Zusho, (2002), if students regulate their learning effectively, they will definitely achieve their academic goals. Reaching these goals successfully during science learning will lead to greater understanding of the scientific concepts being taught; however, students are not always effective at regulating their learning (Paris & Paris, 2001). Research has shown that students may fail to use self-regulatory skills for many reasons; for example, students may not have prior knowledge or know when to apply certain regulatory strategies during learning processes in order to meet their set goals. Students may also not engage in planning their learning through goals setting as well as monitoring their progress toward the set goals within the learning context. Students may not even know when to seek help from a peer or teacher and finally they may not be motivated about their learning tasks (Azevedo *et al*., 2003, Narciss *et al*. 2007). The context of the learning situation within the classroom plays an important role in how students self-regulate their learning behaviours, when they use technology learning tools such as computer supported collaborative learning (CSCL) environment.

Co-regulated learning (CRL) means two or more students or students and teachers engaging in aspects of planning, monitoring, evaluating and reflecting on the learners' cognition, motivation behaviour, and context as they work towards investigating a problem (Volet *et al*, 2009).

Moreover, CRL also involves a transitional process in a learner's acquisition of SRL, within which experts and learners share a common problem solving space and SRL is gradually appropriated by the individual learner through interpersonal interactions. In CRL, according to McCaslin (2004), social environments support individual participation and learning. CRL is based on the idea that learning is a naturally social act in which the participants talk among themselves and involve one another in the learning process. McCaslin (McCaslin, 2004) argues that a co-regulated learning approach includes inter-personal processes of motivation (including prior self-knowledge and future expectations), enactment (including overt and covert goal-coordination strategies), and evaluation. These processes are considered in the context of relationships with other participants, structural supports, and affording opportunities in the social environment. Although the ultimate goal of co-regulated learning is to enable learners to become self-regulated, during co-regulation an individual learner establishes relationships with teacher, peers and their social environment. CRL engages students in challenging tasks and enables them to develop higher order reasoning and problem solving skills (Volet *et al.*, 2009).

Because research about co-regulation focuses on interactions that are taking place when students are learning together as a group, therefore the analysis involves looking at the group as a whole rather than individual cognition, behaviour, motivation, or metacognition (Hadwin, et al., 2005). The individual is not absent from analysis, but the social aspect is very crucial. Looking at it from this perspective, proper understanding of the appropriation of self-regulated learning means investigating how interactions and exchanges of knowledge take place during collaborative learning.

In order to measure students' co-regulated learning behaviours during collaborative learning, an instrument to measure co-regulated learning was developed. Therefore in the first part of the preliminary study, a co-regulated strategies for learning questionnaire (CRSLQ) for measuring co-regulated learning behaviour of young science learners was developed and validated. In developing the instrument, it was ensured that (1) it was based on models of SRL theoretical framework, (2) it was detailed enough to capture the complexity of the topic, (3) it was able to distinguish different dimensions of co-regulated learning, (4) it

emphasised the behaviours that are carried out by students as they learn science collaboratively in their groups, and finally (5) it has good psychometric properties. This questionnaire which has four subscales with high reliabilities of all α =.820 on each subscales had been successfully used to measure co-regulated learning behaviour in a collaborative learning setting in this present study.

COMPUTER SUPPORTED COLLABORATIVE LEARNING (CSCL) ENVIRONMENT AND SCIENCE LEARNING

Research has shown that advances in new technology offer opportunities to explore new ideas for ways of carrying out teaching and learning (Wang & Lin 2007, Gress, *et al.* 2010). Collaborative technologies offer a range of new ways of supporting learning by enabling learners to share and exchange their learning experiences with one another (Wang & Lin 2007, Gress, et al. 2010). Computer-supported collaborative learning (CSCL) presents a powerful way to take advantage of computer technology to provide new forms of learning. CSCL is intimately concerned with education; it cuts across all levels of formal education from kindergarten through graduate study as well as informal education. It is a branch of learning science that is concerned with studying how people can learn together when using computers. The idea of encouraging students to learn together in small groups has been increasingly emphasised in the broader field of learning science. It is envisaged that further advancement in developing necessary resources to full capacity could provide effective learning environments to broad audiences of students. In doing so, they would even make it possible for students to collaborate across national borders, preparing them for increasingly globalised educational institutions. However, CSCL environments have often not fulfilled expectations as researchers and educational practitioners have failed to provide the regulatory prompts that groups need to succeed (Kreijns *et al.*, 2002). The ability to combine computer support and collaborative learning or technology and education in order to successfully enhance learning remains a challenge that the CSCL environment is designed to address in this study.

In order to get engaged in collaborative activities for effective learning in a CSCL situation, it is important that students are intuitively able to control their own pace of learning. Unlike traditional learning, CSCL is considered a highly learner-centred and self regulated learning environment where learners must take responsibility for what and how to learn due to the nature of the setting. High demand of self regulated learning is required in technology learning environments (Mayer & Mereno, 2002) and learners are obliged to independently manage their own learning in accordance with their goals. In order to cope with this demand, learners basically develop self-regulatory skills by applying meta-cognitive strategies to monitor and regulate the learning process (Pintrich, 2004). In order to encourage active collaboration among students, research has shown that it is necessary to impose external structures including individual accountability and positive interdependence (Mayer & Mereno, 2002; Volet *et al.* 2009). These structures ensure that each student knows that he or she is responsible for his/her own learning within a group and that he or she is also responsible for the learning of others (Abrami 2010). Moreover, empirical research has shown that much attention had been paid to different individual aspects of the learning process such as metacognition, planning, and reflection with analysis only addressing learning gains from pre-test to post-test. However a thorough consideration has not been given to the complex nature of the dynamics between the phases of SRL and the way this complexity may affect how students regulate their learning of science concepts in student-centred classrooms using CSCL environments (Abrami 2009).

Therefore, this present study employed co-regulated learning as a theoretical framework in providing a more comprehensive analysis of the processes which may lead to understanding the difficulties students encounter when using CSCL to learn in the complex context of a science classroom. It is also important to understand how students working collaboratively regulate their own learning as well as how CRL facilitate students' SRL by using different co-and self-regulated learning (CRL and SRL) prompts in a CSCL learning environment. This study adopts and extends existing models of SRL (Zimmerman, 1989 and Zimmerman, 2000) and has used them as a lens to examine the complex interactions between students' CRL and SRL behaviours when prompted with CRL and SRL instructions when learning simple circuits collaboratively using a CSCL environment. Not surprisingly, verbal interaction has played a central role in research about co-regulation. In this present study, co-regulated learning process is investigated within a collaborative science classroom with a CSCL environment. Specifically this study examined the

effectiveness of a CSCL environment with co- and self-regulated learning (CRL/SRL) prompts on students' self- and co-regulated learning behaviour and academic performance as compared to a CSCL environment with SRL prompts only.

Following these general expectations highlighted above, the following hypotheses about the use of co-regulated learning prompts to support students' learning in a CSCL are formulated:
(1) Supporting students with CRL/SRL behaviours will increase co-regulatory behaviour during collaborative learning.
(2) Students' scores on SRL measures in both experimental and control group are expected to increase.
(3) Students in the experimental condition will improve in their academic performance as measured by knowledge test more than students in the control group.

THE STUDY METHODOLOGY

Participants

This study took place in a high school based in the United Kingdom. The participants were year 7 students (11-12years olds). Forty students (two classes) participated in this study. Students were randomly assigned to either the experimental group or the control group. Each group consisted of twenty students. The students in the experimental group were prompted with CRL/SRL prompts during the computer supported collaborative learning (CSCL) while the students in the control group were prompted with SRL prompts only.

Procedure

Data were collected for this study using the following instruments:
(a) The co-regulated strategies for learning questionnaire (CRSLQ).
(b) The self-regulated strategy for learning questionnaire (SRSLQ).
(c) A knowledge test (KT) on a simple circuit (SC).
(d) Learning activity sheets.
(e) Observation through audio/video recordings and observation of students' participation (undertaken by one of the authors and a science teacher)

The study was carried out in three separate 50-minute lessons during the spring term of 2010. During the first lesson, CRSLQ, SRSLQ, and pre- knowledge test on simple circuit (SC) were handed out to the participating students. They were given 15 minutes to complete each questionnaire and the knowledge test about simple circuits (SC).

Figure 1: Picture showing students in CRL/SRL group engaging in collaborative science learning using CSCL environment.

The second lesson took place in the computer suites in the school during which students were introduced to the Sunflower science simulation programme teaching the simple circuit (SC). Students sat in sub-groups of five, each with his or her computer and were encouraged to discuss the given task together as a group (see Figure 1). Learning activity sheets with either CRL/SRL prompts or SRL prompts only were designed for the study and students were instructed to work collaboratively using a science simulation on simple circuits. Thereafter, they were asked to discuss their learning with other members in their group. Two versions of learning activity sheets designed for use by students in both groups are described below.

Instruments

The leaning activity sheets incorporated into the computer supported collaborative learning (CSCL) environment for students in the experimental (CRL/SRL prompted) group consisted of CRL/SRL prompts such as: *Can you all skim through whole activity before starting, to see how they are organised? Please set three learning goals for this activity. Please try and comment on goals of others in your group. It will also be good if you can all agree on three goals here. Can you all agree on the time you would like to spend on each goal? Note that you*

have 50 minutes for the whole activity. However, the learning activity sheets incorporated into the CSCL environment of students working in the control (SRL prompted) group consisted of SRL prompts only. These included the following: *Would you like to skim through the whole activity before you start? Please set three specific learning goals that you want to achieve after learning this topic. Indicate how much time you intend to spend on each goal? Note that you have just only 50 minutes for the whole activity.*

Participants in both groups were observed by one of the authors and the science teacher as they learnt about simple circuits in a CSCL environment. The third lesson was used to administer post- CRSLQ, post-SRSLQ and post-KT on the SC. Thereafter, measurements of scores obtained by the participants in each of the instruments (CRSLQ, SRSLQ, and KT) before and after exposing them to the CSCL environment incorporated with either CRL/SRL or SRL prompts were reported. Content analysis was also carried out on the audio and video recordings, and observation notes, to investigate the process of students' co-regulation in the groups.

Coding

A coding scheme was used to identify the CRL behaviours demonstrated by students in both the experimental and the control groups as they interacted whilst learning about simple circuits. The development of the coding scheme was based on an approach adopted by Azevedo *et al*., (2003); Dettori and Persico (2008); and Pifarre and Cobos (2010) to assess the metacognitive skills that students deployed; a schema used extensively to analyse students' regulatory behaviour in collaborative processes. The coding scheme analysed the regulation of collaborative learning processes by establishing whether or not the participants in each of the experimental and the control groups demonstrated any of the these five main categories of co-regulatory learning behaviours (namely planning, monitoring, task difficulty and demands, help seeking and, and motivation) during learning in a CSCL environment. The coding process consisted of two steps namely: (a) dividing the transcribed students' interaction into main categories (planning, monitoring, task difficulty and demands, help seeking and motivation) and (b) assigning a code to each unit in each of the sub-categories (Table 1) (Chi 1997; Creswell, 1998; Laat and Lally 2003; Pifarre and Cobos, 2010).

Table 1: Categories and Sub-categories of the Coded CRL Behaviours

Categories/*Sub-categories*
Planning:
Goal setting
Prior knowledge activation
Time planning
Monitoring:
Self-questioning
Feeling of knowing
Content evaluation
Monitoring progress toward goals.
Monitoring time
Task Difficulty and Demands (Evaluating/ Efforts regulation):
Task difficulty
Effort regulation
Evaluating the learning process
Evaluating the learning context
Help seeking and giving during collaborative learning:
Affective help seeking
Cognitive help seeking
Motivation: ***Interest statement***

To ensure reliability in the coding process, two coders (one of the authors and another researcher with experience in this type of coding) participated in the segmentation and the categorisation processes. The coders separately searched for spoken interactions containing examples of CRL indicators and then compared and discussed their selections. After coding, the inter-rater reliability calculated (Cohen's Kappa coefficient) for both coders was 0.95 for each group (Lombard *et al.,* 2005, Pifarre and Cobos, 2010)..

After the computation of the inter-rater reliability, the coders discussed the controversial cases until they reached 100% agreement. The data reported in this study refer to the agreed coding. The value of the inter-rater reliability obtained for this study indicates the replicability of this approach.

RESULTS

Quantitative Results

A double-multivariate analysis of variance (MANOVA) was performed on the three dependent variables (Table 2) before and after exposure to the intervention for each of the two types of learning conditions (Table 2) which formed the between-

subject independent variable. The mean (M) scores and standard deviations (SD) of the dependent variables are reported in Table 3.

Table 2: Dependent and Between-Subject Independent Variables for this Study.

Dependent Variables	Between-subject independent variable
Scores on the CRSLQ,	CRL + SRL prompted condition
Scores on the SRSLQ	SRL + prompted condition
Scores on the simple circuit knowledge test (SC).	

Looking at the CRSLQ scores, it is evident that there are significant differences in means between the control group (M = 87.10) and the experimental group (M = 100.30) on their post-test scores. Turning to the SRSLQ scores, there is no significant difference in the means of the control group (M = 122.75) and the experimental group (M = 129.95). Finally, knowledge test scores reveal significant differences between the means of the control group (M = 10.25) and the experimental group (M = 11.30).

Table 3: Descriptive Statistics

Table 4 reports the multivariate tests of significance for the effect of the studied independent variables on the dependent variables. Results from the Pillai's Trace shown in Table 4 indicate significant effects of the two learning conditions (CRL/SRL and SRL prompted conditions) and this is found to be p = 0.01 < .05 on the combined dependent variables.

Table 6: Average Scores and Frequency/percentage of students' activity sheets' scores categorised by the learning context

Univariate analyses, shown in Table 5, reveal that the dependent variables (scores on CRSLQ, SRSLQ, and KT on simple circuit) had significant main effects on the independent variables (CRL/SRL and SRL prompted conditions) in all tests except for the SRSLQ on the treatment groups. Moreover, univariate analysis results (Table 5) for CRSLQ score show that significant differences between the two learning groups exist (F = 4.33, p = 0.04 < .05).

Table 4: Results of multivariate tests

Source	Dependent Variables	Type III Sum of Squares	df	Mean Square	F	Sig.
Learning condition	CRSLQ	1117.51	1	1117.51	4.33	0.04
	SRSLQ	180.00	1	180.00	.66	0.42
	KT (SC)	13.61	1	13.61	8.18	0.01

Table 5: Tests of Between-Subjects Effects

Measures	Learning Conditions	Pre-Test Post-test			
		M	SD	M	SD
CRSLQ	CRL+SRL Group	73.80	16.73	100.30	8.16
	SRL Group	72.05	13.34	87.10	12.66
SRSLQ	CRL+SRL Group	102.10	14.56	129.95	17.04
	SRL Group	103.30	13.41	122.75	12.99
KT (SC)	CRL+SRL Group	8.10	1.21	11.30	1.13
	SRL Group	7.50	1.10	10.25	1.29

	Pillai's Trace	F	P
Intercept	1.00	2977.99(b)	0.00
Learning conditions	0.26	4.18(b)	0.01

Learning contexts	Group's Average Scores M	(SD)	Low activity scores (0-7 marks)	Intermediate activity scores (8-12 marks)	High activity scores (13-17 marks)
CRL/SRL prompted	12.05	(2.69)	2(20%)	6 (40%)	12 (50%)
SRL-prompted	9.00	(3.46)	6 (30%)	9 (45%)	5 (25%)

Analysis of the results shows that the experimental group, on average, had a higher post-CRSLQ score (Table 3). The result of the post-SRSLQ score shows no significant difference (Table 5) between the CRL/SRL and SRL prompted groups on their usage of SRL behaviour whilst learning the simple circuit in a CSCL environment ($F = 0.66$, $p = 0.42 > .05$).

Students' Verbal Interactions

The outcomes of the content analysis of the verbal interactions of students in both the experimental and the control groups are reported in Figures 2, and 3. The number of verbal interactions containing CRL indicators in each of the groups' interactions are presented in Figure 2. It is evident from Figure 2 that the total number of verbal interactions of students in the experimental group (268) is more than those of the control group (177). Moreover, there are more verbal interactions in the experimental group (217) containing CRL indicators than in the control group (105). It is pertinent to note that the CRL/SRL-prompted and SRL-prompted groups worked on their SC activity for the same duration, thus, making comparison of the raw data meaningful.

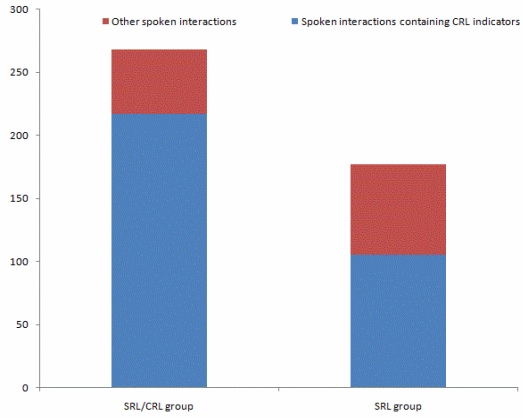

Figure 2: Number of total spoken interactions by the SRL/CRL-prompted group and SRL-prompted group and the number of spoken interaction containing CRL indicators.

The difference between the CRL/SRL- and the SRL-prompts introduced into the activity sheets of each group may also elucidate the data in Figure 3, which confirm that the frequency of CRL indicators of planning, monitoring, help seeking and giving, and motivation obtained for the CRL/SRL group are much higher than those obtained for the SRL-prompted group.

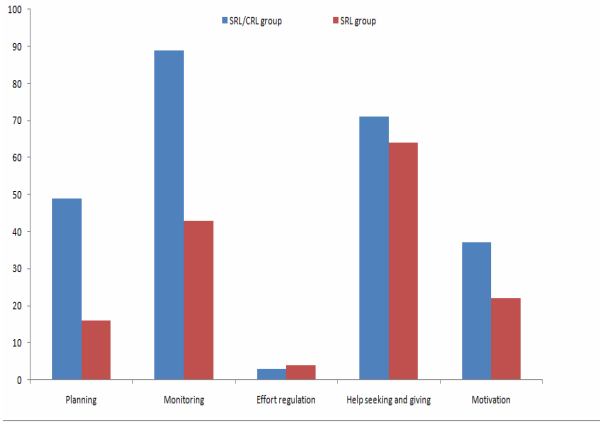

Figure 3: Coding results along the categories of CRL indicators which highlight the planning, monitoring, task difficulty and demands, help seeking and giving, and motivation.

Further analysis detailing how the CRL/SRL- and the SRL- prompts introduced into the CSCL environment shaped the demonstration of each of the main categories of the co-regulatory behaviours of the groups (in terms of frequency of occurrence and quality) is presented below.

Planning

Based on the results obtained from Table 7 which presents the frequencies of usage of categories of the learners' co-regulatory behaviours in a CSCL environment, students' behaviours (from both groups)

associated with the category of planning accounted for just over 16.00 % (65/398) of all the coded spoken interactions.

Looking through the sub-categories of planning in more detail, it is also evident that the CRL/SRL-prompted group predominantly engaged in goal setting (27/65), followed by prior knowledge activation (13/65), and time planning (9/65) whereas the SRL-prompted group members regulated their learning in the following order of ranking by planning the time spent on the group activity (7/65), activating the prior knowledge (5/65) and goal setting (4/65). Below are two example interactions about goal setting from the intervention and the control groups.

Example 1: Goal setting from CRL/SRL-prompted group 1

Student CRLA1: *Alright let's do this. Please set three learning goals....*
Student CRLA1: *I want to learn more about parallel circuit*
Student CRLA1: *What is your target?*
Student CRLB1*: My target; to know how many cells are needed to light up a bulb.....*
Student CRLA1: *Let's aim to make more complex circuits*
Student CRLA1: *We should also aim to understand how cells produce electric current that gives us electricity.*
Student CRLB1: *That is a good one. Make more complex circuits Is really a good one.*
Student CRLA1: *I want to know how to use voltage meters and ammeters*
Student CRLB1: *I think our goals should be to know more about parallel circuit, to make more complex circuits, and understand how cells produce electric current that gives us electricity.*
Student CRLA1: *Yeah, I agree with you.*

Example 2 on goal setting from SRL-prompted group 1
Student SRLA1: *What are our learning goals?*
Student SRLB1: *I want to know how to draw a simple circuit*

It is clear from the spoken interaction of CRL/SRL-prompted group (Example 1) that the CRL-prompt introduced into their activity sheets enabled the group members CRLA1 and CRLB1 to progress from setting individuals goals such as *I want to learn more about parallel circuit* (*student CRLA1*) and *my target; to know how many cells are needed to light up a bulb* (*student CRLB1*) to developing group goals such as "*I think our goals should be to know more about parallel circuit, to make more complex circuits, and understand how cells produce electric current that gives us electricity (student CRLB1)*".

Analysis of the spoken interaction on planning-related events obtained from SRL-prompted group 1 (see Example 2) suggests that students only set their goals at the individual level; they could not progress to the stage of merging individual goals into group goals. Eventually, none of the students in SRL-prompted.

Table 7: Frequencies of usage of categories of the learners' co-supported collaborative learning environment.

Monitoring

	Categories/*Sub-categories*	SRL/CRL	SRL	Total
I	Planning: *Goal setting*	27	4	31
II	*Prior knowledge activation*	13	5	18
III	*Time planning*	9	7	16
	Sub-Total	49	16	65
IV	Monitoring: *Self-questioning*	1	7	8
V	*Feeling of knowing*	0	0	0
VI	*Content evaluation*	25	0	25
VII	*Monitoring progress toward goals.*	45	21	66
VIII	*Monitoring time*	18	15	33
	Sub-Total	89	43	132
IX	Task Difficulty and Demands (Evaluating/ Efforts regulation):*Task difficulty*	1	1	2
X	*Effort regulation*	1	1	2
XI	*Evaluating the learning process*	2	1	3
XII	*Evaluating the learning context*	0	0	0
	Sub-Total	4	3	7
XIII	Help seeking and giving during collaborative learning: *Affective help seeking*	39	20	59
XIV	*Cognitive help seeking*	32	44	76
	Sub-Total	71	64	135
XV	Motivation: *Interest statement*	37	22	59
	Sub-Total	37	22	59
	Total	249	149	398

Students' verbal interactions associated with the category of monitoring accounted for 33.00 % (132/398) of all the coded spoken interactions (see Table 7). It can be seen in Table 7 that both groups contributed fairly equally to the *monitoring time* sub-category. Students in the control group did not engage in content evaluation and, none of the groups' utterances were classified as indicating a feeling of knowing. With regards to monitoring progress toward goals during the collaborative learning activity on simple circuits, there are twice as many utterances from students in the experimental group in this sub-category as from the control group. However, the control group contributed more than the experimental group to self-questioning. Overall, the frequency self-questioning in both groups could be considered to be quite low in comparison to their frequencies of interactions in monitoring progress towards goals and monitoring time (see Table 7).

Example 3 from CRL/SRL group 4

Student CRLB4*: How much time have we left?*
Student CRLA4*: Fourteen minutes to go*

Student SRLA2*: How are you getting on?*
Student SRLB2*: 4 minutes spent on goal setting already*
Student SRLB2*: Need to spend eight minutes on lighting up the bulb*
Student SRLA2*: Just have only twenty four minutes to go*

Example 4 from SRL group 2

Analysis of verbal interactions from the experimental group 4 and the control group 2 shows members of the intervention group (CRL/SRL) checked the time once and reminded one another of the time remaining to complete the task (Example 3), whereas Example 4 illustrates that time monitoring was demonstrated by the control group members but no evidence to show that SRL-prompted group members reminded one another. While student SRLA2 in Example 4 inquired about the progress of student SRLB2 with regard to the learning activity, the responses of student SRLB2 suggests that he is only reporting his own time monitoring strategies to the inquirer SRLA2 while the response of student SRLA2 indicates that the twenty-four minutes remaining is just for him to complete his own work. This is contrary to Example 3 in which student CRLB4 asked about the time left for the

whole group to which student CRLB4 replied appropriately. This attribute reveals a marked difference in the usage of time monitoring sub-strategy between the experimental and control groups.

Task difficulty and demands

Table 7 shows that students both the experimental and the control groups were least engaged with the main category of task difficulty and demands. Frequencies of occurrence of the demonstrated CRL indicators under this category were fairly equally distributed for both groups. Moreover, none of the students in either group demonstrated the co-regulatory behaviour associated with the sub-category of evaluating the learning process under the category of task difficulty and demands (evaluating/efforts' regulation).

Help seeking and giving

Help seeking and giving category of CRL behaviour accounted for 33.90% (135/398) of all the coded spoken interactions (see Table 7). CRL/SRL group has displayed twice as much as the control group with respect to the affective help seeking/giving sub-category while the control group showed a greater proportion of the coded interactions associated with the cognitive help seeking (Table 7).

Example 5 from CRL/SRL group 4

Student CRLC4*: See! it is becoming dimmer*
Student CRLA4*: But why is it like that?*
Student CRLB4*: It's like the two bulbs are now sharing the same energy for one bulb before*
Student CRLC4*: Is that so (Harry)?*
Student CRLB4*: Yes.*
Student CRLC4*: I think you explanation is correct (Harry)*

Example 6 from SRL group 1

Student SRLA1: *Miss, what can I do to get ---*
Teacher*: Look at your left side on the computer window*
Student SRLB1: *Click on the play button ---*
Student SRLA1: *See there are more electrons*
Student SRLA1: *What is the electric current in the circuit Craig?*

It is evident that the experimental group CRL4 members (Example 5) demonstrated affective and cognitive help seeking behaviours respectively by asking for help from one another. However, the demonstration of affective and cognitive help seeking behaviours by the control group SRL1 respectively (see Example 6) suggests that help was requested mainly from the science teacher in accordance with the prompt they received in their activity sheets. It is also clear that students in the control group requested help from one another.

Motivation

Students also engaged in behaviours related to their motivation during the task, accounting for 14.80% (59/398) of all the coded spoken interactions. CRL/SRL- prompted students engaged proportionally in more spoken interactions than the SRL-prompted students (37 versus 22 respectively). Typical examples of demonstration of motivation by both the experimental and the control groups are depicted below.

Example 7 from the experimental group CRL/SRL3

Student CRLA3*: See! it is glowing brighter*

Student CRLB3*: This is really really fun*

Student CRLC3*: I'm loving it*

Student CRLA3*: That's interesting*

Example 8 from the control group SRL4

Student SRLA4*: We need to work it more by putting one bulb, two more,*
Student SRLB4*: Yes, I've put it*
Student SRLA4*: It glows again*
Student SRLB4*: Ehh!! That's good.*
Student SRLA4*: Well done*

It is evident from the spoken interactions of both groups that whenever something of interest occurred (e.g. *the glowing of bulbs*) when carrying out their learning activities, other students complemented the action taking place with statements such as ("*This is really fun" and "I'm loving it"*) as reported for experimental group CRL/SRL3 and ("*That is good.*" and "*Well done*") as seen in the spoken interactions of the control group SRL4. In the next section, further evidences are provided from the observation notes developed from the classroom observation and video recording in support of the hypothesis 1 of this research.

OBSERVATIONAL FINDINGS

The emerging categories of CRL behaviours demonstrated by the students in both the experimental

and the control groups obtained from the observational data are presented as follows:
The first category (students' cognitive behaviours) reveals that prompting students with CRL/SRL might help more in improving the task and the team processes than prompting them with the SRL-prompts only. It was observed that students in the CRL/SRL-prompted condition used CRL/SRL- prompts introduced into their learning activity sheets to develop shared understanding of the team process and the task by asking other group members to clarify ideas they do not understand at every stage of the learning processes. This happened more often than students in the SRL- prompted condition asking their teacher to clarify their ideas. The students in the experimental condition, for example, did try to agree on their planning behaviour in terms of goal setting, prior knowledge activation and time management skills before writing on their activity sheet. By contrast, students in the SRL prompted group did not really come to an agreement through discussions with other students in their group before writing on their activity sheets.

The second category (students' metacognitive behaviours) shows that by prompting the group with CRL/SRL behaviours, students gradually took responsibility for their own group. Prompts can be provided to groups in order for them to plan how the group will go about solving the given problem, monitor the group's progress towards a solution and finally evaluate the effectiveness of their group learning processes Student in the CRL/SRL-prompted condition were observed to have settled down faster for their learning activity than did the SRL-prompted condition. Most of the students in the experimental group read the prompts on their activity sheet and deemed it necessary to carry others students along with their planning in carrying out the task, monitoring and evaluating the learning goals. A lot of students in the SRL-prompted condition just read the prompts on their activity sheets and interpreted it for individual regulation rather than group-regulation.

DISCUSSION

Students' self-regulatory behaviour in a computer supported collaborative learning (SCL) environment with SRL/CRL prompts and SRL prompts

The results of the study suggest that students in the CRL/SRL-prompted group engaged in a deeper level of collaborative activity, and in more metacognitive in activities within the learning environment compared to students in the same learning environment supported with SRL-prompted instructions only (Tables 3 and 5). However, no significant difference between the CRL/SRL and SRL prompted groups was found in regard to their usage of SRL behaviours during learning of simple circuit in a CSCL environment (Tables 3 and 5).

Figures 2 and 3 and Table 7 provide support for the claim that students in the CRL/SRL-prompted CSCL environment made use of key co-regulatory processes more frequently during learning as a consequence of the intervention of the CRL/SRL-prompted instructions. The extensive process data obtained from the students' verbal interaction detailing the quality of CRL indicators (planning, effort regulation, help seeking and giving, and motivational processes) used by students in both groups explains why SRL-prompted students demonstrated fewer and less effective co-regulatory behaviours as they learnt simple circuit in a CSCL environment in comparison to the experimental group (see Examples 1, 3, 5, 6, and 7, Tables 3 and 6). For example, the process data reveals that SRL-prompted students were using SRL strategies such as setting individual goals but they did not progress into merging their individual goals into group goals (Example 2). Moreover, the pedagogical use of CRL-prompts embedded in the learning activity sheets of the experimental group as a tool to support students' regulatory behaviour in planning, monitoring, help seeking and giving, and motivation has been crucial in developing the students' co-regulatory skills. For example, students in the experimental group encouraged one another to give direct assistance to improve each other's work as seen in Examples 5. and 7.

These results are in agreement with other studies that explored the deployment of CRL processes used by students interacting with technological learning environments (Dettori and Persico, 2008; Volet *et al.,* 2009; Kirschner *et al*. 2009; Pifarre and Cobos, 2010). The findings by these CRL researchers suggest that students who are not prompted with CRL behaviours in a CSCL environment are at the risk of being unable to use CRL strategies effectively. The benefit of deploying CRL prompts into a CSCL environment teaching simple circuits is reinforced with the resultant improvement in the construction of

social knowledge by students (Kreijns *et al.,* 2003). It is also pertinent to note that the success of the incorporation of CRL/SRL-instructional-prompts into a CSCL environment for enhancing co-regulation could be ascribed to the fact that the designed CRL-prompts did not impose the burden of additional information processing that may interfere with the students' aim of concentrating on the to-be-learned information. Furthermore, because the designed CRL-prompted instructions were pedagogically integrated into the learning resources, it assisted the students to work towards achieving their target goals within the allocated time.

Computer supported collaborative learning (CSCL) environment and academic performance

The results presented in Table 3 showed that all students improved in their test scores after learning about simple circuit using the CSCL environment. This lends credence to the fact that all students (in both conditions) would gain some conceptual understanding when learning in a CSCL environment. This result agrees with the outcomes from Azevedo *et al*., (2005) and Olakanmi (2008) whose works focussed on the use of technology enhanced learning environment to learn about the circulatory system in biology and rates of chemical reactions respectively. Their research findings showed that students' learning about a challenging science topic with a technology enhanced learning environment irrespective of whether they are prompted with CRL- prompts or not tends to gain declarative knowledge from pre-test to post-tests. The findings by Azevedo *et al*. (2005) and Olakanmi (2008) agree with the result of this present study in the sense that all students who participated in this study gained some conceptual understanding of the simple circuits as measured by the overall knowledge test scores.

Differences in academic performance of students working in a computer supported collaborative learning (CSCL) environment with SRL/CRL prompts or SRL prompts

This study investigated whether there are differences in the students' academic performances when learning in a CSCL environment with CRL/SRL- or SRL-prompts. The results show that there was a greater shift in the pre- and post- means of the simple circuit knowledge test scores of the CRL/SRL-prompted group (3.20) in comparison to that of SRL-prompted group (2.75) as shown in Table 3. Moreover, it is also exemplified by the multivariate analysis of variance (MANOVA) (Table 5) that the hypothesis 3 was supported by a significance value ($p = 0.007$). This finding implies that there is a significant difference between the shift in the means of the test scores of the CRL/SRL-prompted group and SRL-prompted group. This finding is supported by previous research outcomes on metacognitive behaviours during solo and collaborative learning processes which suggest that students who are provided CRL-prompted instructions display significant learning gains in different domains and scientific tasks (Dettori and Persico 2008; Volet *et al.,* 2009; Pifarre and Cobos 2010). This outcome contributes to the literature on the usage of CSCL environment in the teaching of scientific concepts (e.g. simple circuits) to key stage three students by illustrating that CRL/SRL-prompted instructions aimed at facilitating students' ability to co-regulate their learning processes is associated with improved test score attainment during learning with CSCL environment.

Furthermore, students in the CSCL environment with CRL/SRL-prompts were found to have attained higher marks in their activity sheets' scores than students in the SRL-prompted group (Table 6). The significant difference in the scores of students in both learning contexts suggests that most students in the CRL/SRL-prompted group gave correct answers on their activity sheets while in SRL-prompted group, fewer students gave correct answers (Table 6). This might be associated with the presence of SCRL/SRL-prompts on the experimental group's activity sheets. This finding suggests that supporting learners' co-regulatory behaviours in the technology enhanced learning environment will have positive effect on the students' academic performance (Azevedo *et al*., 2005).

Implications of the findings from this study

The results of this study have implications and pose several challenges for the design of learning activities for enhancing students' CRL behaviours and academic performance in technology-rich dynamic science classrooms. As noted earlier on, findings from this study suggest that students working with learning activity sheets containing CRL-prompted behaviours typically use more effective CRL behaviours such as planning, monitoring, and motivation when compared to students prompted with SRL behaviours only. These outcomes establish the need for further

investigation on how a CRL model can influence the usage of CRL behaviours and academic performance over a period of time in a CSCL environment incorporated with either CRL/SRL or SRL only prompts.

Furthermore, it is important that insight is gained into how group collaborative learning influence the nature and dynamics of co-regulatory behaviours over a period of time in a CSCL environment incorporated with either CRL/SRL or SRL only prompts. For instance, how does a group of key stage three students with high academic performance but low CRL behaviours compare with a group of students who has low academic performance but has expressed a high level of co-regulatory behaviours?

CONCLUSIONS

The outcome of this study shows that both CRL and SRL prompts were needed in enabling students to engage in useful interaction and improve academic performance during collaborative learning. Students need to be aware of one another, about shared elements and about the group learning whenever they are engaging in collaborative learning. The findings from this study confirm the suggestions by Njoo & de Jong (1993), de Jong & Joolingen 1998), that technology-enhanced learning can be improved through the incorporation of CRL/SRL-instructional prompts into a technological environment.

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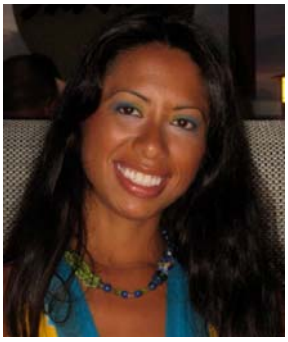
DEVELOPING, TRANSFERRING & ADAPTING SELF-REGULATED LEARNING PROCESSES



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INTRODUCTION

As children progress through each grade in school, they are increasingly asked to think for themselves, allocate their time effectively, stay on task, and spontaneously utilize effective strategies for studying and processing complex materials. In other words, they are increasingly asked to be *self-regulated* as they make the transition from elementary school to the upper grades (Rudolph, Lambert, Clark, & Kurlakowsky, 2001). By the time students are in college, they are essentially left to their own devices to engage in the kinds of behaviors that will help them succeed. Given the important role that self-regulation plays in academic success, it is not surprising that a number of researchers have examined this construct from a variety of perspectives (Boekaerts, Pintrich, & Zeidner, 2000; Byrnes & Miller, 2001; Graham, Harris, & Mason, 2006; Winne, 1998; Zimmerman, 2001). However, the majority of the studies in this area examine the linkages between self-regulatory processes and some aspect of academic performance. Moreover, most of recent work examines online regulation of researcher-constructed tasks (Zimmerman, 2008). Relatively few studies have examined the relationship between contextualized (in situ) instructional practices of actual classroom teachers and the acquisition of self-regulatory strategies over time. The present study was conducted to help fill this void.

As we describe later in this article, the targeted age group was 5th graders who would be making the transition to middle school the following year. Before these students reached 5th grade, the teacher in the focal school reported in an interview that students were infrequently asked to be self-regulated in the sense of expecting them to plan ahead, use strategies, and so on with little prompting by the teachers. Instead, students' academic lives were largely managed by their teachers and parents. However, in the middle school that these students would attend, the teacher reported in an interview that middle school teachers often did require students to be self-regulated. Given the likelihood that the transition from other-regulation to self-regulation would be difficult for these students, the goal of the present intervention was to increase their level of self-regulation during 5th grade. As well, we aimed to generalize the strategies students learned in the focal subject to other areas because teachers of all academic domains reported that they required their middle schoolers to be self-regulated.

More specifically, we attempted to increase students' tendency to engage in self-regulated learning (SRL) strategies when they worked on actual social studies classroom assignments and examinations. The second aim of this study was for the students to transfer and/ or adapt the SRL strategies taught in the social studies context to another academic context such as reading,

writing, math, or science. The intervention itself has six components that involve all phases of SRL, but emphasizes self-reflection because this aspect has not been addressed much in the literature, and we believe self-reflection is a key component. As we describe more fully later in this article, the six components are: self-consequating for strategy use, study skills instruction, math quizzes, challenging writing and math tasks, strategy transfer chart, and modeling and facilitation of SRL processes. In what follows, we briefly describe the theoretical models that informed our approach and then describe prior intervention efforts that provided insight into how to proceed.

THEORETICAL MODELS OF SRL

Our review of the literature revealed that it can be difficult to draw straightforward conclusions about the nature of SRL because of the number of partially overlapping theoretical models that have been proposed to date (Boekaerts & Cascallar, 2006). Moreover, when we attempted to apply any one of these models to the classroom tasks that our participants faced, we saw that each model only accounted for some of the phenomena that we observed. As a result, we created a synthetic account that combined the key constructs from the models of Zimmerman (1986), Boekaerts (1995), Winne (1982), and Byrnes (2008). Our consensus definition describes SRL as the cyclical process of using self-generated feelings, thoughts and actions to modify knowledge structures in order to meet adaptive goals (Zimmerman, 2001). The cyclical process is comprised of three main phases:

Forethought phase. Here, the learner sets goals and plans tactic(s) to meet these goals based upon the learner's appraisal of the task, which is informed by: motivation (the desire to complete a valued task in order to reach a goal), self-efficacy (one's beliefs about learning or performing effectively), value (how important doing well is), expectations, goal orientation, affect, and domain-specific knowledge including metacognitive knowledge (Boekaerts, 1992; Winne, 1996; Zimmerman, 2001).

Performance/ volition phase. The learner will actually carry out the planned strategies such as note taking or memorization techniques while engaging in volitional processes and self-observation to ensure that the current problem solving approach is effective. The utility of self-observations during learning depends upon the following: how selective the learner was in tracking information, use of process goals to facilitate monitoring at each step of the process rather than the product only, the amount of time between a student's action and feedback, accuracy of self-observation, informativeness, and amount of positive versus negative self-observations.

Self-reflection phase. The learner engages in self-evaluation, causal attributions, self-reaction, and inferencing. Self-evaluation is comparing self-monitored information with a goal using criteria to ascertain if the goal has been attained. The complimentary component to self-evaluation is causal attribution (i.e., assigning a cause of an outcome such as good grades to some preceding factor such as studying). Causal attribution to controllable factors fosters a strategically adaptive course of action whereas linking causes to uncontrollable factors discourages self-regulation (Zimmerman & Kitsantas, 1996). Once self-evaluation and causal attributions are formed, an individual engages in self-reaction (Zimmerman & Martinez-Pons, 1992). Self-reaction can result in self-satisfaction or self-dissatisfaction. According to Zimmerman's (1986) SRL theory, self-satisfaction occurs when the person experiences positive emotions (joy, pride) when reflecting on his or her performance; self-dissatisfaction occurs when the person experiences negative emotions. This claim is based on hundreds of studies within the causal attribution and emotion literature (see Weiner, 1986 or Frijda, 1994 for reviews). It is important to note that self-dissatisfaction only occurs when tasks are highly valued. There are two implications of this reaction: adaptive inference or defensive inference (Zimmerman & Martinez-Pons, 1992). Adaptive inferences direct individuals to feelings and actions that are conducive to learning such as increasing effort whereas defensive inference directs individuals toward feelings and actions that impede learning such as withdrawing effort.

PRIOR INTERVENTION STUDIES

In addition to drawing inspiration from theoretical models, the present intervention was also informed by two approaches to intervention: Zimmerman's approach and Butler's approach.

Zimmerman's intervention model. Grounded in his three-phase Triadic Determinism Model for SRL (1989), Zimmerman's intervention for study skill instruction is considered cyclical because the phases interact. In the first phase, learners engage in self-monitoring and self-evaluation of their current performance and repertoire of skills. This part of the

intervention can be conducted in five weeks through using homework review time for the activities stated below. First, self-evaluation and monitoring of their current study skills occurs so a student's strengths and weaknesses can be identified. The deficiencies identified inform the next phase—goal setting and strategic planning. To guide students through this phase, teachers focus student's attention to the causal link between strategy use and outcome. Recall that SRL is characterized by self-generated actions; therefore, teachers only coach students through constructing or selecting a strategy. This process is contingent upon student's self-evaluations, which depends on the student's repertoire of strategies and discriminative knowledge (Zimmerman, 1998).

Once the study skill is selected, strategy implementation and monitoring occurs. Learners must focus on accurately implementing the strategy; in fact, novice learners require feedback and support as they implement the strategy. Here, students are asked about the effectiveness in using the strategy and how strategies could be modified to reach their goals. Also, teachers should continue providing graded opportunities such as quizzes or other assessments with clear rubrics. How closely the outcome aligns with the goal is contingent upon one's routinization of the strategy, goal specificity, and causal attributions (Zimmerman & Kitsantas, 1997).

Of the five academic skills that Zimmerman (1996) discussed in his program, i.e., time management, text comprehension, note taking, test preparation, and writing, empirical work has shown that this cyclical model does improve the academic skill of writing in high school students. Research appears to be lacking on the effect of the intervention on the other four academic skills. In the present study, we target two of these other skills: text comprehension and note taking.

Butler's Strategic Content Learning (SCL) Approach. Butler's SCL approach (Butler, 1995) drew its inspiration from Zimmerman's principles of teaching and learning self-regulation. Her intervention had two goals. The instructor guides the students in planning, monitoring of strategy performance, use of feedback in tasks so students learn to manage motivational and volitional processes (such as self-rewarding) and learning to focus their attention in helpful ways ("attentional control"). Next, instructors support students to construct knowledge in particular domains ("domain specific knowledge"), knowledge of themselves as learners ("metacognitive knowledge"), and motivational beliefs that promote self-regulation (e.g., that they are capable of succeeding). The approach has been successfully applied to adults with learning disabilities and has shown strong effects in areas such as performance gains in reading and math, metacognitive improvements, and increases in self-efficacy.

Further, this approach is characterized by five features. SCL instructors work with students to flow through the phases of SRL by providing support and feedback during the tasks (Butler, 1995). The learning tasks used to promote SCL must be aligned with the curriculum and reflect various domains (math, social studies, etc.) so the student will consider the process meaningful and so that the issues of transfer is addressed. The third feature is the collaborative effort of both the teacher and student in interpreting tasks, setting goals, strategy planning, strategy selection, strategy implementation, and reflection. Another key feature is the structured and explicit nature of the lessons. The social interaction between the teacher and student targets the metacognitive processes required to self-regulate. Here, students are prompted through strategic questioning to articulate their task interpretations, expectations, goal setting, and strategy planning An example of strategic questioning is *What is the problem asking you to do and what steps will you take to figure it out?* It is important to note that explicit modeling of strategies is not part of the SCL approach as it contradicts the goals. In cases where teachers are modeling strategies, agency is removed from the students as the teachers are going through the task analysis while the students passively observe. When students are generating their own strategies, then they are the ones who are actively learning to analyze a task. The fourth feature of self-recording is conducted to promote self-monitoring so students can see the link between their strategies and outcomes. Last, special attention is drawn to the strategy implementation and the outcome (Butler, 1995). Eventually, through discourse with the teacher and fellow students, the causal link between the strategy and outcome becomes evident thereby increasing self-efficacy and causal attribution to controllable factors (Paris & Byrnes, 1989; Borkowski & Peck, 1986). To sum up, students are scaffolded to engage in the cyclical processes of SRL; they are not simply asked to practice applying strategies.

The common thread in both of these approaches is the teacher as a model and coach who guides students in using self-generated feelings, thoughts, and actions to meet adaptive goals in the context of curriculum based meaningful tasks. A second impressive commonality is their effectiveness in developing SRL beliefs and processes as they heighten academic achievement. Finally, the key common feature is that neither approach fully examined transferring the effects of their interventions across contexts such as academic domains (e.g., social studies to science).

SRL AND TRANSFER

As stated earlier, the literature on self-regulation research barely covers the topic of transfer; however, there is a separate large body of research on this topic. Research relevant to the purposes of this study is briefly described here. Transfer is an active and dynamic process of extending knowledge learned in one context to another context (Byrnes, 2008; Bransford, 2000). Transfer is defined as active and dynamic because learners choose and evaluate strategies to extend into the appropriate context while considering resources and using feedback (Bransford, 2000).

Transfer is conceptualized as near or far according to dimensions of content and context (Singley & Anderson, 1989). Skill, kind of performance expected, and memory demands required are the content of what is being transferred. So if the same skill is required on two tasks (e.g., math), the task requires the same kind of performance (e.g., adding two numbers), and both have similar memory demands, transfer would be considered "near." As one or more of these features change, the transfer is considered "far." Context refers to where the content was learned and where it is being transferred to. Near transfer describes the use of strategies taught in one context that are utilized in a context that closely resembles the teaching situation. Far transfer, on the other hand, is the use of strategies in a context that is extremely different from the teaching situation.

Factors that influence transfer are: (1) characteristics of initial learning (e.g., if the learning was mere imitation of drawing a Venn diagram or actually creating one's own diagram); (2) degree of decontextualization (e.g., learning how to use Venn diagrams in reading and using that skill out of its context in math); (3) the difficulty of making representations at higher levels of abstraction (e.g., how challenging to compare and contrast certain concepts such as democracy and republic); (4) relationships between learning and transfer conditions (e.g., the contextual differences between learning to use a Venn diagram at school and transferring its use to home when comparing and contrasting video games); (5) Metacognition (e.g., how well the student estimates her/ his own mastery of creating Venn diagrams); (6) lack of conditional knowledge (e.g., if the student knows when to use the Venn diagram and when to use a flow chart); (7) lack of conceptual knowledge (e.g., if the students knows the purpose and limits of Venn diagrams rather than simply knowing how to draw overlapping circles).

Interventions aimed at transferring strategies from teacher guided situations to independent learner situations within the same academic domain have been successfully implemented, though are relatively uncommon (Palinscar & Brown, 1984; Schoenfeld, 1983; Scardamalia, Bereiter, Steinbach 1984). Interestingly, these transfer interventions have the same key features as SRL interventions. Modeling, coaching, and scaffolding are the techniques used to teach skills (Bransford, 2000).

THE PRESENT STUDY

The aim of this study is to conduct a classroom-based SRL intervention modeled after the work of Zimmerman (1996) and Butler (1995; 1998). Our approach to teaching SRL processes and transferring them across subject domains is based on Zimmerman's (1996) and Butler's (2003) guiding principles and was an integration of the their models' techniques along with explicit and systematic strategy transfer instruction. Among 5th graders, we attempted to improve the self-regulatory processes in the social studies domain and considered whether performance would generalize to other academic contexts.

The goal is to further advance our current understanding of SRL through investigating the following research questions in early adolescents:

(1) Is it possible to promote SRL in 5th graders using an intervention collaboratively constructed by a classroom teacher and university researcher?

The handful of SRL interventions conducted to date has generally been targeted for much older students in high school or college. It is not clear whether sufficient levels of strategy use, self-reflection, and metacognition could be fostered in a sample of 5th graders. In addition, it is commonly the case that

interventions implemented by researchers in laboratory settings produce stronger effects than interventions designed by researchers but implemented by teachers in their classrooms (see O'Donnell, 2008 for a review of evidence in this regard). Such findings suggest that teachers may not have the same level of commitment and insight into the theoretical basis of interventions as the researchers who designed them. In the present study, however, the first author is an experienced teacher who gained considerable expertise in SRL theory as a doctoral student. We target fifth grade because it is an important transition year in which students need to progress from being highly dependent on teachers and parents to being more self-regulated in middle school.

(2) *Will students trained to be more self-regulated using the content and tasks of one domain (e.g., social studies) show heightened levels of self-regulation on another, untrained domain (e.g., mathematics)?*

The issue of transfer is extremely important because it pertains to the possibility of increasing the power of an intervention in a lateral fashion. Few studies of SRL have examined the issue of transfer and it will be useful to determine whether a single intervention focused in one context generalizes its effects to another context. As noted in many reviews of the literature (e.g., Detterman, 1993; Singley & Anderson, 1989; Byrnes, 2008), skills learned in one domain rarely transfer to another. When transfer does occur (as in the highly cited work of Palinscar & Brown, 1984), the finding is noteworthy. We created an intervention to overcome some of the limitations of prior studies in order to increase the chances of transfer. The goal was to foster internalization and appropriation of strategies – not mere imitation.

METHOD

Participants were from a fifth grade classroom in an elementary public school that is located in an urban section of a large city in the Northeastern region of the United States. In the United States, students are ten to eleven years old in fifth grade. Table 1 shows the demographic composition of the classroom. As can be seen, the group was diverse in terms of gender and socio-economic characteristics.

As for instructional approach, the teacher differentiates instruction according to her students' level of prior knowledge. Also, the teacher has a nurturing relationship with her students. For example, she provides her students with supplies and snacks when they need it along with extra tutoring.

Table 1: Demographic Characteristics

Gender	
Males	12
Females	15
SES	
Free/ Reduced Priced Lunch	11
Full Price Lunch	16
Ethnicity	
African American	6
Caucasian	14

MEASURES

Quality and Quantity of Self-regulatory Process Measures. While students engaged in challenging math and writing tasks weekly, they filled out their self-regulated learning graphic organizer to notate the following: their task interpretation, goals set, strategy, self-observation data germane to task performance, self-evaluation, and adaptive or defensive inferences (Figure 1). All of these tasks were explained to students. Only the strategies and self-reflective phrases written on the graphic organizer before and after the intervention were used as data. The purpose of the other portions of the graphic organizer was to guide students through the phases of SRL. Zimmerman (1996) suggested methods to assess SRL processes and the open-ended prompts were modeled after his methods. The researcher coded the data and her teacher's assistant blindly coded the data as well. Before the scores on the strategies and self-reflective data were entered into analyses, inter reliability was conducted on these scores through using the Kappa coefficient as presented in Table 2. Kappa corrects for chance, and is therefore more stringent than percentage agreement.

Self-regulated Learning Graphic Organizer

Task Analysis, Goal Setting, Strategy Planning

Paraphrased Problem & goals	How I feel about this problem
Information needed to meet goal(s)	Importance of this problem
Plan to solve the problem	How confident I feel

Strategy Implementation w/ Self-Monitoring

Show	Explain

Self-Reflection

Did I meet the goals of the problem? (This is your outcome.)
Am I satisfied or dissatisfied with the outcome?
What caused this outcome?
What steps will I take now?

Figure 1 Self-Regulated Learning Graphic Organizer

Table 2: Kappa Coefficient of Self-Regulated Learning Process Variables

Variable	Pretest	Posttest
Math Strategies	.46	.79
Writing Strategies	1.00	.79
Reading Notes	.88	.66
Science Notes	.79	.60
Reading Summary	.54	.73
Science Summary	.84	.60

Writing Strategy Use. Writing strategy tasks were developed by the first author to measure strategy use. The task is only one item. Both pretest and posttest prompts stated, "Write about an important moment in your life." The strategies planned and implemented were scored as 0, 1, or 2. A score of 0 represented inaccurate or no strategy use with or without explanation; 1 reflected accurate strategy use with partial explanation; and 2 represented accurate strategy use with a complete explanation.

Before and after the treatment, the teacher administered the task to her class during their typical writing periods. There was no time limit.

Math Strategy Use. Math strategy tasks were items released by the 6th grade Math standardized test utilized in the school district. There were two items on each measure. Strategies planned and implemented were scored from 0 to 2 according to accuracy and explanation where 0 was no or incorrect strategy use with or without an explanation; 1 was correct strategy use with a partial explanation; and 2 was correct strategy use with a complete explanation.

This task was administered by the teacher to the group. There was no time limit, and students completed the task during their math lesson in their classrooms. This measure was given before the intervention and repeated after the intervention.

Transfer and Adaptation Measures. Transfer and adaptation were measured through analyzing their reading and science summaries and notes for strategies that were originally generated for summaries and notes in social studies. The raters were the researcher and a teacher's assistant. The second rater was trained on how to discriminate summaries and notes that qualified as 0, 1, 2, or 3 (Figure 2). Science and reading notes were the foci of transfer analyses because math instruction typically does not involve note taking. Each study skill was assessed for transfer and adaptation differently. Text comprehension transfer or adaptation was assessed through the strategies demonstrated for independently written summaries for reading and science (Figure 2).

Transfer or adaptation of note taking skills was measured through reviewing the quality of students' notes from reading and science from before the intervention and after the intervention. Specifically, transfer or adaptation of note taking skills were measured through scoring the notes in terms of their informativeness and focus ranging from 0 to 2, where 0 indicates not or barely informative and focused to 2 which indicates completely informative and focused.

Reading Summary. A reading summary task developed by the first author was collected. Students were read a teacher-selected short story from her school district's mandated reading program. The teacher selected the text to use from this program to

ensure that the text was on her particular students' reading and interest levels. Students were then given as much time as they needed to read and summarize one story during regular class time. No student took longer than one hour to read and formulate her/ his summary. The summary was scored based on the following criteria: (1) described main ideas while omitting minor details (2) information is paraphrased and organized (Figure 2). For example, a summary scored as 1 partially describes the main idea with only supporting details using only paraphrased information.

Score	The student's summary --
3	Demonstrates complete knowledge of summarizing through describing the main topic and includes only important information while omitting minor details. Information is organized in a clear way and restates the meaning in the reader's words.
2	Demonstrates partial knowledge of summarizing through partially describing the main topic and includes some important information while including or omitting minor details. Information is organized in a clear way and restates the meaning in the reader's words.
1	Demonstrates partial knowledge of summarizing through partially describing the main topic and includes some important information while including or omitting minor details. Information is not clearly organized; meaning is restated in the reader's words.
0	Demonstrates partial knowledge of summarizing through partially describing or incorrectly describing the main topic and includes some important information while including or omitting minor details. Information is not clearly organized; reader incorrectly interprets the meaning.

Figure 2 Summary Rubric

During this testing session that took place during regular class time in the students' regular classrooms, reading summarization was examined. After the intervention, this measure was repeated where the teacher selected one story that she felt her students would be interested in as well as be able to comprehend. Teachers then allotted the students class time to read their short stories and write a summary.

Science Summary. Science summaries were collected in the first week of the intervention prior to the implementation of any procedures and after the intervention. Students read about a self-selected science topic such as scientific inquiry from their school district's recommended science website for 3rd through 5th graders. Again, students had an unlimited amount of time to read their websites and write their summaries on their individual topics. While students wrote their summaries, they had the option of referring back to the website. During this testing session that took place during regular class time in the students' computer labs, science summarization was examined. After the intervention, this measure was repeated where the teacher selected a piece of science text that she felt her students would be interested in as well as be able to comprehend. Teachers then allotted the students' class time to read the science text and write a summary.

Score	Quality of Notes
2	Notes completely focus on all material presented; no extra details
1	Notes partially focus on some material presented; no extra details
0	Notes inadequately focus on some material presented with or without extra details.

Figure 3 Note Taking Rubric

Reading Notes. Reading notes was a teacher-made measure, which was administered during a read aloud of one chapter of *The Horse & His Boy (Prince Caspian for posttest)* on a blank piece of loose leaf. These notes were taken before any intervention procedures were carried out, and children received no prompting on note taking. At the end of the chapter, notes were collected on the same day.

The teacher-led read aloud was approximately thirty minutes long. Notes written were scored on a scale ranging from 0-2. Scores of 0 reflected unfocused notes with or without extra details; notes scored as 1 reflected partially focused notes without extra details; the highest score, 2, reflects completely focused notes without any minor or extra details (Figure 3).

Science Notes. Science notes were collected before and after the procedures were in place as well. During a lecture on inertia, students wrote notes, and after the intervention students took lectures notes on Newton's first and third laws. At the conclusion of the lecture, science notes were collected.

The teacher-led lecture was approximately forty-five minutes in length, and all notes were collected at the conclusion of the lecture. Notes written were scored

according to their focus and informativeness based on the same note taking rubric used for reading notes (Figure 3).

Summaries and notes were coded independently by two raters before and after the intervention to ascertain if the summarization and note taking strategy instruction transferred or adapted to reading or science. Again, Kappa was used to measure the degree of correspondence before entering data to ensure reliability of the scores. Results from determining rater reliability are presented in Table 2.

PROCEDURES

The intervention was constructed by converting Butler's (1998) and Zimmerman's (1996) principles into a SRL intervention for early adolescents. It should be noted, however, these formal principles were very consistent with the intuited approach utilized by the first author in her own teaching before she immersed herself in the self-regulation literature as a graduate student. The program consisted of six components that were designed to foster self-reflection after learning in order that adaptive inferences and transfer would occur. Self-reflection after learning was the recurring theme throughout this intervention for two reasons: (1) in the first author's experience, it has improved achievement in all domains with many types of learners; (2) SRL interventions in the literature rarely seem to capitalize on the processes that students engage in during the self-reflection phase. The six components of the program included (a) self-consequating for strategy use, (b) study skills instruction, (c) math quizzes, (d) challenging writing and math tasks, (e) strategy transfer/adaptation chart, and (f) modeling and facilitation of SRL processes. A week of the intervention at a glance is shown in Figure 4.

Self-consequating for Strategy Use. The first dimension of self-consequating for strategy use was an ongoing instructional technique to aid the students in strategy awareness and use. At any point during class when students spontaneously used and/or modified a learning strategies (posted in the classroom and explained to them), the student raised her/his hand, stated the strategy and its purpose, and self-rewarded through placing a sticker by the individual's name on the bulletin board.

Monday	• Self-reflection chart on previous social studies quiz outcome • Self-reflect on previous week's summarization effectiveness, set goal for summary, and plan strategy for new topic o Declaration of Independence o Support students in implementing strategy o Homework: student completes summary on Declaration of Independence • Self-consequate for strategy use • Model/ facilitate SRL o Main character's conflict
Tuesday	• Math Task • Self-consequate for strategy use • Model/ facilitate SRL o Main character's conflict • Peer and self-checking of summary strategy implementation • Math quiz if selected
Wednesday	• Summary due on Declaration of Independence • Peer discussion on note taking goals and strategies before lecture begins • Students take notes while teacher lectures on Declaration of Independence on graphic organizer or outline template • Homework: Students revise notes taken in class through comparing them to teacher/s notes • Math Quiz if selected • Self-consequate for strategy use • Model/ facilitate SRL o Main character's conflict
Thursday	• Writing Task • Peer and self-checking on effectiveness of note taking • Math Quiz if selected • Self-consequate for strategy use • Model/ facilitate SRL o Main character's conflict
Friday	• Social Studies Test on Declaration of Independence • Strategy Transfer/ Adaptation Chart • Math Quiz if selected • Self-consequate for strategy use • Model/ facilitate SRL o Main character's conflict

Figure 4 Example: Week at a Glance

For example, while students were varying the dimensions of a prism and calculating the volume each time a dimension was changed, a student spontaneously stated a strategy. The student's strategy was to just use the pattern that she noticed to find the volume rather than calculating it each time. The student(s) received immediate feedback for self-

monitoring and implementing strategies so this behavior was maintained not only for the individual, but for the entire class as well. At the conclusion of three weeks, the two most strategic students had a lunch of their choice with the teacher.

Study Skills Instruction. The second dimension, study skills instruction, was grounded in Zimmerman's (1996) SRL: The Academy Model. Recall that there are five goals to this model, but the present intervention focused only on text comprehension and note taking skills.

Study skills instruction was conducted in two phases. The first week of the intervention (phase one) consisted of students preparing for a social studies test on Friday using their own devices. This data served as the springboard for self-regulatory processes. During this initial week, students executed the following without any guidance in any aspect of SRL: (a) summarize a social studies section of a chapter (b) take notes from lecture. This information was the basis for self-monitoring and self-evaluation. Specifically, on Monday, students wrote down in their homework planner that a summary on the particular section was due Wednesday and a test on that particular section was on Friday. On Wednesday, the teacher presented the concepts through lecture with an outline on the board. On Friday, the ten-question assessment was administered. The content assessed depends on the school district's pacing schedule requirements for that week. Further, the structure of the test varies: short answer, true/false with false corrections, multiple choice, fill in the blank, and essay. Along with these weekly quizzes, a cumulative, multiple choice exam was administered every three weeks

The onset of phase two for both of the study skills was self-reflection, goal setting, and strategy planning once the students receive their social studies test score and reflected on their self-recorded information from the first week. Self-recordings were written on their Self-Reflection chart in which students quantify their level of effectiveness using a discrepancy score derived from the difference between their predicted, desired score and their obtained score. The purpose of this chart was to capitalize on students' self-reflective processes. After self-reflection, students constructed strategies using the obtained and discrepancy score as feedback. Information on this chart was not part of any analysis. These processes occurred in cooperative groups on the following Monday (or Tuesday if there is a school holiday). Regardless of Monday school holidays, the schedule for phase two remained unchanged: summary was due on Wednesday, and the test was on Friday. Further, teacher monitoring of strategy implementation for all study skills occurred during peer homework checking in the morning. Peer homework checking was not just students reading each other's work to each other. Rather, students reflected on their own work and their peer's work in a critical way. Any students found having difficulty implementing strategies effectively were provided support during lunch and recess periods. The activities in phase two were repeated weekly for the six-week duration of the intervention.

Text comprehension was developed through summarization. As mentioned earlier, the summary from phase one was a gauge of text comprehension that was used for developing self-regulatory processes. On Monday in small groups, the teacher and students focused task analysis on summarizing a section of the Social Studies chapter. During this session, the teacher coached the students through the processes of task analysis. Through strategic questioning (Butler, 1998), the teacher scaffolded students in generating and/or selecting strategies based on their Self-reflection Chart. Some examples of strategic questioning are: *How did you do on your last social studies test? How do you think your summary affected your understanding of the material? What should you do before, during, or after summarizing to reach your goal?* Helping the students write the beginning sentences of the summary using their strategies concluded the SRL session as the summary was completed as independent practice for homework.

Again, during peer homework checking, the teacher monitored students' strategy implementation through collecting summaries after peer review. Peer review consisted of students self-reflecting on their own summaries as well as evaluating their partner's summaries. Effective implementation was evidenced through students writing a description of the strategy used below their written summary. In the next Monday session, the quality of the summary was ascertained through comparing the content of the summary to the content sampled in the test.

In conjunction with the development of summarization, class note taking was taught. Parallel to the instructional format of the above skill, phase two began with self-evaluating how well their current

notes reflect the tested content. Current notes were then compared to the teacher's exemplary notes in hierarchical and concept mapping form. Students and teacher collaborated to set goals to improve note taking followed by strategy construction. This discussion consisted of the teacher explaining her/ his notes. That is, the teacher and students discussed why some information was included and omitted along with which format (hierarchical or concept map) more clearly conveyed the information for individual students. For homework, students self-evaluated their notes through assessing whether or not they omitted any information by comparing their notes to the teacher's notes. This step ensured they had the necessary notes for test preparation. In doing this, students independently practiced their modified strategy because they had the feedback to adapt their notes. Also, students practiced their strategy in the following Wednesday's social studies lecture. Before lecture began, students reviewed their goals and plan so they were prepared to implement their strategies during lecture. Customized blank concept maps and outlines that align with the lecture's structure were distributed to students upon request. After lecture, the students and teacher evaluated note taking through discussing the teacher's focus in her/ his notes and the utility of the different formats.

Through informally probing students about their strategy implementation throughout the week, the students who needed extra support were identified. Students struggling with strategy implementation or who were simply not executing their plan received additional support during their lunch and recess periods. There was no punitive action taken against students who did not fulfill their strategy plans. To address these issues, the teacher and student identified deficiencies and scaffolded strategy implementation while working on techniques that helped them persist through tasks such as self-rewarding and imagery. Recall that prior research suggests that building conditional knowledge and engaging in metacognitive processes promote transfer (Palinscar & Brown, 1984; Schoenfeld, 1983; Scardamalia, Bereiter, Steinbach 1984). These principles of transfer theory are exemplified in Study Skill Instruction by the consistent calibrated teacher support, peer and self-monitoring, and self-reflection throughout the intervention.

Math Quizzes. As another graded opportunity to practice, transfer, and adapt self-regulated learning strategies over the six weeks (Zimmerman, 1996), math quizzes were administered weekly. A fifteen minute assessment on percent, decimal, and fraction equivalent forms was administered to the students on the day they signed up for. Flash cards with the assigned list of equivalent forms were kept on a key ring in the students' baskets. Each Monday, more equivalent forms were added to the list as more quiz content. Through the flash cards' constant availability and self-selected quiz date, students had flexibility in test preparation.

The teacher did not fully facilitate SRL with this task as it was the student's opportunity to transfer the adaptive behaviors they learned over the weeks to another domain. However, students self-recorded their scores each week on a line graph kept in their math section of their binders, but there was no further collaboration to urge students to make an adaptive inference, and subsequently engage in task analysis, strategy implementation, and self-reflection processes. Essentially, these quizzes were treated as any other assessment teachers typically administer where it is completely the students' responsibility to accurately interpret the outcome (score) independently, and make the appropriate inference.

Challenging Tasks. In addition, challenging tasks in math and writing were administered weekly that call upon self-regulation in order to meet the goals of the math problem or writing prompt. These tasks were considered challenging because they were complex and multistep, but not frustrating (Perry, 2003).

Math problems were released items from the sixth grade math PSSA; these constructed response problems were multi-step constructed response problems that reflected real world issues .Writing tasks qualify as challenging because the process of writing is complex and multistep. Along with the paper stating the problem, each small group also received a SRL graphic organizer for students to note their: goal(s), strategies (newly constructed, transferred, and adapted is identified), and evaluations of the work (Figure 1). Only the strategies demonstrated on independently done math problems and graphic organizers were analyzed; other problems and other portions of the graphic organizer were used solely as a reflective exercise.

The other student material was a pack of Post-it notes for the summative activity. Upon completion of the task, students displayed their solutions and SRL graphic organizer so other groups could peer-review their math work and SRL processes. Here, students

wrote their reviews on a Post-it note and adhered it to the problem. The Post-it stated whether or not they agreed with the goals set, strategies, and the work as well as an explanation.

The other iterative challenging activity for students to practice SRL behaviors was writing an essay or narrative each week. The phases of writing resemble the phases of SRL, so writing was easily taught in this manner. Each week a prompt was posted where students: (1) set the goals of their writing, (2) strategize how to meet those goals in their writing, (3) brainstorm and utilize heuristic strategies for when ideas are seemingly depleted, (4) organize brainstorm into hierarchy or map, (5) compose a rough draft, (6) receive teacher and peer criticism, (7) compose a final draft, (8) give the draft to their teacher who evaluates it according to state genre specific writing rubric, (9) self-reflect on their writing. The challenging tasks were not only used as opportunities for students to exercise their self-regulatory processes taught during social studies, but as a measure of the effects on the quality and quantity of self-regulatory processes, that is strategy use while self-monitoring, throughout the intervention. Only strategies demonstrated on the SRL graphic organizer or loose leaf were used for analysis.

Transfer/Adaptation Chart. An additional method to encourage strategy transfer was the Transfer/ Adaptation Chart; initially, how to use this chart was demonstrated, and then students filled it out once or twice a week for the duration of the intervention. This instructional method bridges self-regulation and transfer as this is a decontextualization activity. Here students build connections between strategies and various contexts where they could be extended or adapted (Byrnes, 2008). This forty-five minute activity was fast-paced and had students rotating to learn the most interesting and effective strategy transfer or adaptation for that week. It helps students foresee possible ways to transfer and adapt strategies (Bransford, 2000). Rotation occurred every five minutes, and the interviewee was designated by the name a student randomly selected. Each interview was five minutes long where students asked questions and recorded the answers on the designated space on the chart. The conversations generated by the chart's questions were designed to foster self-evaluation of the interviewee's strategies used that week. This situation was conducive to transfer and self-reflection for both the interviewer and interviewee because the interviewer modeled self-reflection and transfer for the interviewee while the interviewer actually was guided through self-reflective processes by the chart's questions. The questions aimed at the interviewee addressed the following properties of a strategy: value, transfer, adaptability, and effectiveness: (1) *Why do you feel your strategy is useful?* (2) *How can you use your strategy to help you with work in another subject?* (3) *How can you modify your strategy so it can help you in another subject?* (4) *When have you ever actually transferred or adapted this strategy? How did it work out?*

Modeling and Facilitating of SRL. The final component of the intervention, which was threaded throughout daily instruction, was SRL modeling and facilitation. Self-consequating for strategy use, study skill instruction, math quizzes, challenging writing and math tasks, and strategy transfer chart are the targeted, systematic methods of promoting self-regulation in fifth graders.

Beyond these planned lessons, SRL was taught through how the teacher handles problems in the classroom. An example of a problem is purchasing an expensive class set of novels. The teacher and students collaborated on reaching the goal of earning enough money to purchase them. Together, they implemented the fundraising strategy and monitored its effectiveness. SRL was also modeled and facilitated in planning class trips through discussing why previous trips were more interesting than the others or why some trips worked out more smoothly than others. Here, adaptive inferences were concluded from former outcomes. In addition, classroom management was an opportunity to take students through the phases of SRL. To clarify, the teacher would restate the goal of the lesson, remind students to monitor their behaviors and ask themselves to determine if their behavior was leading them to or obstructing them from goal attainment.

Another opportunity to integrate SRL instruction throughout the curriculum was read alouds and reciprocal teaching. While reading to the class, the teacher explicitly described how a main character was self-regulating to resolve the internal and external conflicts along with elaborating on the nature of the main character's causal attributions and inferences. Here, the teacher described her/ his metacognitive processes in understanding the text as well. As both an opportunity for students to exercise the SRL processes that they witness during read alouds, and for students to extend the study skills, students took

on the role of the teacher and explicitly described the main character's processes and use of study skills to their teacher and fellow classmates. The last example of the numerous opportunities to reinforce SRL was to have students detect and correct common errors in summary content, math computations, and essay coherence and grammar.

RESULTS

Recall that the present study was designed to provide answers to two research questions: (1) Is it possible to promote SRL in 5th graders using an intervention collaboratively constructed by a classroom teacher and university researcher?; and (2) Will students trained to be more self-regulated using the content and tasks of one domain (e.g., social studies) show heightened levels of self-regulation on another, untrained domain (e.g., mathematics)? In what follows, results pertinent to these main research questions are presented in turn. The results are organized as follows. In the first section, we present descriptive statistics on the main variables. In the second section, we examine the possibility of promoting SRL processes by paired sample t-tests. In the third section, we examine the generalization of SRL processes by means of paired sample t-tests. Estimates of effect size were computed for each significant difference.

DESCRIPTIVE STATISTICS

Scores in strategy use, summarization, and note taking comprise the main variables. Pretest and posttest ranges, means, and standard deviations are reported in Table 3.

Table 3 Descriptive Statistics for SRL Process Variables

Variable	N	Range	M	SD
Pretest M. Strat.	25	0-2	.06	.24
Posttest M. Strat.	25	0-2	1.00	.69
Pretest W. Strat.	25	0-2	.07	.27
Posttest W. Strat.	25	0-2	.88	.43

Question 1: Evidence that SRL can be elevated in 5th graders in a classroom based intervention.

Paired sample t-tests were conducted to detect any differences in writing or math strategies before and after the intervention in students' scores (Table 4). These analyses revealed gains in both math strategy use and writing strategy use.

First, strategies written while engaging in a challenging math task were examined for accuracy and explanation. As shown in Tables 5, the results suggest strategy use improved from pretest to posttest, t (25) = 5.91.

Table 4 Mean Math Strategy Use and Writing Strategy Use

Math strategies	
M	1.00
SD	1.69
Writing Strategies	
M	.88
SD	.43

Table 5 Pre- to Posttest Changes in SRL Processes

	Pretest		Posttest				
Measure	*M*	*SD*	*M*	*SD*	*t*	*df*	*p*
R. Summ.	1.07	.62	2.38	.63	7.96	25	<.001
S. Summ.	.50	.50	2.11	.95	8.75	25	<.001
R. Notes	.23	.51	1.57	.70	8.61	25	<.001
S. Notes	.73	.66	1.69	.54	6.33	25	<.001
W. Strat.	.07	.27	.88	.43	7.26	25	<.001
M. Strat.	.06	.24	1.00	.69	5.91	25	<.001

Question 2: Issue of Transfer

Paired sample t-tests were conducted on reading and science summaries and notes. These analyses were conducted to see if there would be transfer and adaptation of SRL strategies from the trained area

(social studies) to two areas that were not explicitly trained (reading and science).

To see if the transfer or adaptation of strategies occurred, summaries written in reading and science were scored using the Summary Rubric described earlier and analyzed through paired sample t-tests. Results suggest that reading summaries showed a large and significant improvement from pre to posttest, t (25) = 7.96, $p < .001$**.** Further, summaries written on physical science topics showed an increase in quality from pretest to posttest, t (25) = 8.75, $p < .001$. Therefore, the SRL process of summarizing taught through focusing on self-reflection in the social studies context transferred to reading and science contexts. These findings indicate that (a) self-reflecting on the strategy - outcome link and (b) planning goals and strategies based on the inference that strategies produced the outcome improves summarization within and beyond the target context.

Taking notes was also taught using the principles of SRL in the context of social studies. Just like the summarization instruction, reflective activities were designed and implemented to promote transfer or adaptation of strategies, namely strategies while taking notes during read alouds and science lectures. T-tests were conducted on the scores derived from the Note Taking Rubric to determine the efficacy of this design. The chapter notes taken during read-alouds improved from the beginning of the intervention to after the intervention, t (25) = 8.61, $p < .001$. Similarly, the quality of science notes taken during lecture increased from the beginning of the intervention to after the intervention, t (25) = 6.33, $p <.001$. These results suggest that self-reflecting on how one takes notes and its connection with an outcome such as a quiz grade can improve the strategy of note taking across contexts.

DISCUSSION

The purpose of the present study was to promote the development, transfer, and adaptation of SRL processes in students across academic contexts. With respect to the issues of transfer and adaptation, we tried to promote the acquisition of SRL strategies in the social studies domain, and hoped that students would transfer and/ or adapt these strategies to their reading, math, and science assignments using self-reflective activities. Our results generally supported these predictions. In what follows, we consider the implications of our results.

Prediction 1: Early adolescent students would acquire SRL strategies

Fifth grade students who engaged in all phases of self-regulation (particularly self-reflection) demonstrated gains in SRL processes. Analyses of students' graphic organizers revealed that strategy use, metacognition, and self-reflection improved from pretest to posttest. In fact, strategy use improved in domains where the strategies were not instructed—writing and math.

These findings are in line with other studies that attempted to instill self-regulatory strategies in students. For example, Zimmerman and Kitsantas' (1997) writing intervention using the Cyclic Self-regulatory Model for Study Skill Instruction also improved writing performance in their sample of male high school students. Further, Butler's (1995, 1998) Strategic Content Learning approach has yielded similar compelling evidence for the efficacy of SRL based interventions for students with learning disabilities as well as for students in regular classroom settings from eighth through eleventh grade (Butler, et al., 2001). Graham's (2007) Self-regulated Strategy Development method produced outcomes in line with our study—students under the SRL condition improved from pretest to posttest in writing compositions.

One of the strengths of this study is its synthesized theoretical basis of Zimmerman (1986), Boekaerts (1995), Winne (1982), and Byrnes (2008). Their complementing theories were integrated to structure this multifaceted, multimethod intervention. Portions of the intervention were based on individual aspects of each of these models. We believe our positive results derived in part from the integration of these portions.

In addition, however, we believe we may be among the first researchers to demonstrate comparable findings in children as young as fifth grade. Wolters and Pintrich (1998) and Wolters, Yu, and Pintrich (1996) found evidence of self-regulated learning in a self-report study of 7th and 8th graders but did not conduct an intervention to elevate performance. Our findings are encouraging given the important transition from other to self-regulation that occurs in many school districts as children leave elementary school and enter middle school.

Overall, our findings showed that the approach used here, that is, guiding students in identifying their own

weaknesses, setting goals, and planning strategies to ameliorate these weaknesses while emphasizing the causal link between strategy, effort, and the outcome—can be a powerful teaching method for multiple content areas and skills. The results of this study demonstrate the strides that students can make when given the opportunity and the guidance to self-regulate their learning. To promote adaptive inferences, teachers should engage students in self-reflective activities rather than simply evaluating students without any dialogue about the processes that led to the desirable or undesirable outcome. These practices promote SRL, which is necessary for complex cognitive tasks and linked with academic achievement.

Prediction 2: Transfer of self-regulation from one (trained) domain to another (untrained) domain

Use of the reflective activities such as the Strategy Transfer/Adaptation Chart, Self-Reflection Chart, daily self-evaluation, and daily peer evaluation contributed to students learning to be more self-regulated beyond the domain in which they were trained. Although SRL strategies were only taught in the social studies domain, heightened levels of strategy use were evident in reading and science. Students did seem to transfer summarizing and note taking skills to other domains. Under the SRL condition where self-reflection was fostered, summaries and notes in science and reading improved from pretest to posttest.

We believe that these results make a significant contribution to the literature by beginning a discussion on self-reflection during strategy training with middle school students. Previous approaches focused on older students such as college students and high school students. Most importantly, the transfer and adaptation of study skills—summarizing and note taking, fills a major gap in self-regulation research. According to a meta-analysis of the literature conducted prior to 1996 (Hattie, et al., 1996), no work has been done to adequately address the generalization of strategies after training, though Wolters, and colleagues (1996) along with Wolters and Pintrich (1998) found similar relations among SRL constructs across domains. In a few recent studies, albeit without systematic transfer instruction, strategies have generalized to other domains (Butler, 2003; Graham, et al., 2007). Our study, in contrast, was designed to be explicit in promoting reflection and evaluation of students' own strategies so they can be used or modified in another context. Further, this research design had students systematically using self-reflective activities and discourse to promote the generalization of strategies.

Interestingly, the results of this study are contrary to what normally occurs in transfer research. Bransford (2000) asserts that transfer is extremely difficult when skills are taught in one domain. In this study, strategies were taught only in social studies and they transferred to the domains of science and reading. Transfer may have occurred in this study for the two different domains because not only did the methods align with the fundamental features of initial learning and decontextualization outlined by Bransford (2000) and Byrnes (2008), but self-reflective activities had students explicitly connect their strategies to other future contexts within the social studies domain and beyond. One further key aspect that promotes transfer is the recognition of a common goal in two different situations (e.g., the goal of writing a summary for sections of a social studies or science chapter) and similar strategies for accomplishing this goal (Singley & Anderson, 1989).

Nevertheless, transfer was not as evident in the domain of math, though there was a significant increase in self-regulatory tendencies in math after the intervention. This finding could reflect the fact that different strategies are required for processing and completing math and social studies tasks. Perhaps the shift from one of these domains to the other is an example of "far transfer," which occurs less often than "near transfer" of more similar tasks (Singley & Anderson, 1989). It is also possible that the math curriculum utilized by the school district fosters a certain amount of strategic thinking on its own. Future studies should attempt to analyze whether these or other possible explanations account for the results.

Overall, the combined impact of the methods used in this intervention may have implications for changes that teachers may want to make in their daily practice. Should our results be replicated in additional studies, the findings suggest that teachers should model how they engage in the phases of self-regulation while guiding students through these phases whenever they are instructing them on a particular strategy or skill. By promoting both self-regulation and adaptation of strategies in early adolescents, teachers are aiding their students in building the ability and awareness to control their own behaviors, cognitions, and

environment to meet educational goals. The importance of teachers instructing students how to self-reflect and generalize self-regulatory processes is evident in its role in student achievement. The importance of social transmission of knowledge is certainly consistent with contemporary socio-cultural theories (Rogoff, 2003; Vygotsky, 1978).

As noted earlier, none of our two main findings were foregone conclusions. That is, prior to conducting our study, it was not clear that we would be able to instill self-regulation tendencies in fifth graders, or that children would generalize these strategies across domains. If these results can be replicated, this research informs classroom teachers of what may be necessary for them to fulfill the privileged responsibility that they have undertaken—student success under their watch and beyond their scope. Our results suggest that the behaviors that teachers model and use to engage their students could be similar to those described in this intervention. Self-regulation shifts the power of learning from the teacher to the student. Aside from self-regulation returning control to the learner, the planning, monitoring, and motivational components thereof are necessary for highly demanding and increasingly complex cognitive tasks that students face as they progress through school.

FUTURE CONSIDERATIONS

Given the findings on transferring and adapting SRL strategies, a future consideration for other studies on transferring and adapting cognitive strategies should be to create conditions with different types of self-reflective activities. Here, these activities would be assessed to clarify which methods are most effective for generalization. Before firm conclusions can be drawn from our findings, it will be important for other collaborative teams of researchers and classroom teachers to implement a similar intervention with different domains and different age levels (e.g., 6th and 7th graders). It will be also important to consider ways to determine why our findings for the domain of mathematics were not as strong as for reading, writing, or science. Ideally, the goal is to create new instructional strategies that promote self-regulation and academic achievement in all domains. Our results provide some optimism that such a goal can be accomplished.

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WORKSHOP C: SRL IN TELES WITH FOCUS ON LEARNING BEYOND SCHOOL

SUCCESS FACTORS FOR COMMUNITY LEARNING: A CONSTRUCTIVIST PERSPECTIVE

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Community learning, online learning, Radical Constructivism, social SRL, written interaction.

ABSTRACT

Community learning in TELEs is supported by several kinds of online community interactions, for example in forums and wikis. I suggest that a radical constructivist theory of knowledge could shed new light on these *written interactions* and provide some relevant benefits to *social SRL* in a CSCL (Computer Supported Cooperative Learning) environment. After a short introduction to my radical constructivist perspective I present practical recommendations for written community interactions interpreted in the light of that perspective and conclude by linking them to demands that CSCL imposes to SRL.

INTRODUCTION

A specific strength that technology enhanced learning environments (TELEs) can offer to enable and foster community learning consists in opportunities for computer-mediated social interactions, i.e. by means of structured discussions in forums, collaborative writing in wikis, shared visualizations in mind maps or typescript conversations in chats. These computer-mediated written interactions are particularly facilitative of a social construction of individual and shared meanings because *"the nature of online interactive writing itself … supports meaning-making"* (Lapadat, 2002). Within these collaborative learning scenarios self-regulation of learning (SRL) becomes a dual phenomenon, both individual and social (Järvelä & Järvenoja, 2011) and requires from students *"the ability to strike a balance between individual and social aspects of knowledge construction"* (Delfino & Persico, 2007, p. 30). Such socially challenging learning situations lead us to consider the increasing importance of creating sustainable interactions between students - both as part of a small, distributed learning group and as members of a large online course – in order to achieve the potential of technology enhanced community learning. In these learning interactions, challenges to and demands on social SRL often come about as a result of problems related to different understandings of the concept of knowledge (and of the practice of knowing) which tacitly affect the conversational attitude of the learners. These differences may not be noticed or not taken seriously, often resulting in diminished participation or even a breakdown of interactions in the learning community. Many people will recognise that interaction problems come about from a downward spiral of misunderstandings, mistrust and lack of frankness. My experience of conventional approaches to stopping this downward spiral is that usually they are not effective. How then can students develop their social SRL skills in a way that enable them to meet the mentioned challenges and succeed in taking advantage of the new opportunities for social interactions offered by TELEs?

Given the nature of online interactive writing and its unique capacity *"to facilitate both joint social construction of meaning and individual construction of meaning"* (Lapadat, 2002), I suggest that an essential contribution to answering this question could be provided by a radical constructivist view of

knowing: by shedding new light on these interactions it could contribute to bringing about increased mutual understandings, frankness and trust in community interactions and by that promote sustainable community interactions and social SRL.

CONSTRUCTIVIST BASICS

In discussions about Radical Constructivism (von Glasersfeld, 1995), people often ask the question: "What makes this way of thinking so difficult?" Some years ago this apparently trite question followed me incessantly and for some hidden reason led me to childhood memories of an anaesthetic. Since I had experienced the anaesthetic as a short sleep, this memory produced an association with sleep. This supplied the key word for designating the difficulty that a lot of people (but in part also myself) experience with Radical Constructivism.

We sleep a sleep; it is the sleep of dogmatism. As long as somebody sleeps this dogmatic sleep - or "slumber" as Kant called it (1783) - he or she will not be able to understand Radical Constructivism thoroughly. Now, what in this context does „dogmatic" mean? It means that we do not examine the limits of our faculty of knowing, that we are not aware of such limits and so silently and without noticing it ("like sleeping") assume that we are able to know everything, that reality is fully accessible for the extending of our rational knowledge.

Distinctions of Being

Luckily Kant introduced a distinction which could help rouse us from our dogmatic slumber. It is the distinction between two forms of being. On the one hand we have the „Dinge an sich", the given (the absolute, the existence) as a form of being that is not accessible to our rational faculty (including our perception, understanding, imagination, judgement). On the other hand we have the accessible „Dinge für mich", or things as lived experiences, as that form of being in which things are accessible to our rational faculty. But the question is: why can things be rationally accessible to us only as lived experiences? The Italian philosopher Gianbattista Vico answered this question shortly before Kant. In 1710 he wrote *„Verare et facere idem esse"* (Vico, 1710). He assumed that everything that is rationally accessible to us (verare) must be rationally produced by us (facere). Kant kept spinning this thread further and proposed in his main work (Kant, 1781/1787) that through lived experiences produced in this way we can attain objective knowledge. In the chapter „Analytics of Concepts" he developed a new concept of objectivity (Bettoni, 1997, 2000) that, in order to distinguish it from the objectivity of dogmatism could be written in this way: {objectivity}. Or „objectivity in parenthesis".

Logic of Experience

The next steps were then taken by Ernst von Glasersfeld and Humberto Maturana. Starting from Silvio Ceccato's contributions (Ceccato, 1964a,b), von Glasersfeld further developed Jean Piaget's Constructivism and elaborated the theory of knowledge that he called Radical Constructivism (von Glasersfeld, 1974). This approach suggests understanding knowledge not as „Logic of the Given", like in dogmatism, but as „Logic of Experience". In this conception the essential feature of knowledge is that it enables us to reach our goals. We aim for certain goals; we do something to get there and if we reach these goals, we then know that the knowledge we used "works" or is valuable. That is the 'viability' of knowledge. "Via" means way and "viable" is intended here as having a chance of going on that way and reaching a goal, indicating therefore something "feasible" or "practical".

Our ideas of the world which allow us to reach our goals are viable. Through them, however, we do not find out anything about the world in itself, about the logic of the given. We know only something about our experience, about our ideas; we know that they lead to success or to failure. Those ideas which lead to successful actions, which persistently contribute to achieving a relatively stable fit into our conceptual networks can be regarded then as {objective} ideas, when also the objects they involve have turned out to be viable. They are then "objective in parenthesis" i.e. {objective}, according to this new conception of objectivity inspired by Kant and Maturana (Maturana 1988, 1998).

However, how do we make these ideas? They are constructs; and interesting here is the way in which their construction is organized as organic and not as mechanical constructive procedures or courses of events (operational sequences). Knowledge emerges in an organism or in a living system, and the essence of a living system is fundamentally different from the essence of a machine. The essence of a living system (organism) is autopoïesis, or in other words "self

generation". Instead, the essence of a machine is limited to “self motion”. Kant gives a famous exposition of this (Kant, 1790, B292-3): *“In a watch … one part is certainly present for the sake of another, but it does not owe its presence to the agency of that other … For a machine has solely motive power, whereas an organized being possesses inherent formative power.”*

In the same way in which a living system – like cells, a cell system, a living body - forms and develops itself, in line with Piaget (1967) I see a formative, organic principle at work also in the generation of knowledge. That is at least my approach; I try to understand knowing and knowledge in this way, with constructive procedures or operational sequences organized according to an underlying organic principle. Knowledge in the head is organized in an organic, dynamic way, and this is how we build our logic of experience by means of autopoïetic procedures.

Maturana, who developed the concept of autopoïesis, says: *"The product of the functioning of the components is the same functioning organisation that produced them."* (Maturana, 1980, p.9). Therefore knowledge results from cognitive processes in the dynamic form of a functional organization which extends or modifies the existing functional organization and has itself the faculty of producing knowledge. So the intellectual capacity grows in a dynamic way. That is an important point: the dynamics of knowledge could be thought of in this way through an autopoïetic model of knowledge organization.

How determines What

Based on the previously presented view of knowledge as "Logic of Experience" I attempt to concentrate the foundation of Radical Constructivism in one single sentence, the first axiom, and say: "How determines What”, or more precisely, my own How determines What. This What is here reality, as we see it and/or the given as all that we consider as being given: both were determined through my How (and have become my reality, my given). Accordingly this What are the things here. However, only according to my lived experience - not according to things in themselves - and the How consists in the operations of this lived experience (Bettoni, 1999) in the autopoïetic knowledge system that is alive.

In the dogmatic conception of knowledge, that is, if one does not make this distinction between the (inaccessible) things in themselves and the things as lived experiences - unconsciously or because one does not want to do that distinction - then the What is the same for all. Of course the What of each individual is also determined by the How. However, taking a dogmatic view means that all must agree on one and only one What, and the What is identical for everybody and absolutely real and true in itself.

In the conventional approach to science the student or researcher then is a person who finds out what this unique What actually is. He is therefore a discoverer. On the contrary, in Radical Constructivism the What is always dependent on a person who produces it through her specific How. In this case the student or researcher is an inventor. Another person can produce the same What (the same invention), provided that she performs an equal How. Therefore in Radical Constructivism one can only agree on a shared What, when and only when participants can negotiate a certain What that is recognized as reasonable for attaining certain common goals. But one can never say that a What is absolutely valid. In fact, the absolute What, the logic of reality, is not accessible (“operational closure”) and the shared What is in fact a distributed collection of many more or less different Whats, one for each person.

SUCCESS FACTORS

To begin with, it seems important to clear up which *criteria of success* we want to define for community interactions. In this case I will base my considerations on a distinction that Schulz von Thun (2000, p.15) draws. He distinguishes between humanity and effectiveness and suggests that to be successful, conversations should balance and take equally seriously these two aspects. Effectiveness, that is purpose, planning, evaluation, and so forth - everything that one emphasizes and expects today when one speaks of work or assignments - should be compensated by a commitment to humanity, for the promotion of sustainable human factors including respect, appreciation, frankness, solidarity and self-realization.

The question is then: How do we establish such community interactions in which humanity and effectiveness are balanced and taken equally seriously? If we agree on this striving for equilibrium between humanity and effectiveness, how can we

realize it and how can Radical Constructivism contribute something to that? In the following I have summarized the contribution of Radical Constructivism in the form of recommendations, which can be derived from the basics presented in the previous sections. What further inspired me in this case were also some practical reflections on foundations of constructivist theory that Sonja Radatz (2008, p.32-55) has developed for her approach of a Systemic-Constructivist Coaching:

1. Negotiating how things really are leads to an illusory, ephemeral agreement.
2. We cannot know how people really are, only how we experience them.
3. To negotiate a What I must talk about my How.
4. Even if we experience (live a situation) objectively, we are always part of our experiences: {objectivity} in parenthesis.
5. Shared meanings (or models) require acknowledgment and appreciation of individual meanings.
6. Shared meanings require participation in a cooperative, creative process.
7. Behind a statement do not forget the substance of the tacit knowledge it refers to.

1. Negotiating how things really are leads to an illusory, ephemeral agreement

In a community a sustainable (not illusory) agreement on meanings is something to which one strives again and again. But if one strives for an agreement over a particular subject, one should always consider that the agreement can never be about how things “really” are in themselves. There can in fact never be an agreement over the “true nature” of what is; that would be illusory and hence not sustainable. And if we do not give up this illusion, then any agreement situation (a shared meaning) will be like that of a person who sees water in the desert and walks in its direction in order to refresh himself. Only after coming closer will he see that his perception was a mirage and that the water can not be reached so that he cannot quench his thirst. That is the problem with illusion: we can attempt indeed to base our negotiations and final agreements on how things really are, but it will be difficult to reach sustainable results.

What I know does not describe things as they are in themselves; it only describes things as I experience them, in my life, as I construct them mentally (see the “I message” by Thomas Gordon, 2001). Reality is objective only for me, individually, and it is then the system of my validated - therefore not random - ideas, the system of the ideas that were successful in my lived experience. We cannot therefore rely on a reality which should be identical for all of us, we can only take seriously many {objective} realities. In a community many realities are indeed always simultaneously available. For every individual community member it is always a question of objectivity in parenthesis, as Maturana (1988) writes. Now, if an agreement is sought in this community, it should be considered that it cannot be about how things are in themselves. Rather, what should be sought is an agreement about how the individual objective realities of the community members could be collectively incorporated and could provide a collective experience of meaningfulness. We have here to do with a process of negotiation of meaning. But from a constructivist point of view there can be no single shared meaning (Cobb, 2000), only the process can be shared. I can therefore never assume or expect that all community members see the things in the same way as I see them. If I have the illusion that there could be a single meaning for all, then in my community interactions I will experience many disappointments and frustrations.

2. We cannot know how persons are, only how we experience them

This is the transfer of the first recommendation to the level of interpersonal relationships. Imagine a conflict situation in the learning community: statements like "That student is a traitor" or "That teacher is cowardly" do not make any sense in a constructivist approach. The problem is this little word “is”. To be cowardly or to be a traitor are absolute statements claiming validity for all situations and for all times and therefore referring to properties of things (here: persons) in themselves.

However, as previously seen, these properties are something that in Radical Constructivism are considered inaccessible. At most I could say “I experience that teacher as cowardly”, explicitly bringing myself into that consideration in the form of an I-message. I could also say, „I experience his behaviour as cowardly”, which probably fits even better. However, I cannot say “his behaviour is cowardly" because that would again represent a true-nature-statement, this time about the behaviour.

3. To negotiate a What I must talk about my How

This thought is based on the idea that in cognition the What is constituted by the How (constitutive operations, see section 2). When I talk over what I know, I use expressions of the discourse of my community (shared reifications). However, with those expressions I connect some very specific meanings, my own, particular meaning. What is particular? The particularity lies in my activity, in my operations by which I produce my meanings. As a consequence, in order to successfully negotiate our meanings we must walk behind the descriptions, behind the words, and behind the described thing (the What). From there we rise to the mental operations that constitute the What, up to the How (the source). Our focus should be directed towards which operations we, or the current speaker, use to build a specific meaning of the What we are speaking about. We therefore need to distinguish between How and What. That is the first step. The second step consists then in trying, as far as possible, to advance, to ascend in the direction of the How, in order to consider our own operations. If we see something, *how* did we look at? If we hear something, *how* did we listen? When we use a concept, *how* did we think it? As Elsie Spittle (2005) writes: *"Being aware of experience on an external level is helpful, but being aware of how we create experience is the true gift."*.

4. Even if we experience (live a situation) objectively, we are always part of our experiences: {objectivity} in parenthesis

Radical Constructivism does not need to consider everything as subjective. We can build our ideas as {objective} ideas if we validate them through action, knowing that we keep on being still involved also in these validated results. In other words we can in no way "subtract" ourselves from our own results. In the perspective of an objectivity in parenthesis we can keep on using the term and the word "objective", but I would suggest that we always put it between parenthesis if we want to think and to write in a radical constructivist way. {Objective} means the I-message: *„I am part of this objectivity that I'm offering now"*. This {objectivity} never means that what is said is absolutely valid for everyone. By making an idea become {objective} we do not achieve a statement or a knowledge that is absolutely valid. We may achieve a timeless knowledge, but even that we can never prove, because we do not have any grip - at least rationally - on reality. We may have a mystic access, but that would be a completely different topic.

5. Shared meanings (or models) require acknowledgment and appreciation of individual meanings.

Negotiated or shared meanings are very important in community interactions: there is a need to agree on meanings and to use also common models. However, these negotiated meanings presuppose recognition, appreciation and acceptance. Why? The reason is that they are built up from individual meanings; these are basically all meaningful, i.e. make sense, in the experiential field of the individual who developed them through her participation, reification and other processes and has become their owner.

I found this assumption of meaningfulness (and the request for recognition it implies) very useful in the development of knowledge-based systems (Bettoni & Fuhrer, 2001). In that context I worked with domain experts that owned the know-how that I, in my role as knowledge engineer, was supposed to incorporate in a computer application. In computer science in such cases the classic approach for producing a knowledge model consists in having the information scientist focusing either on the computer and its features or on formal logic and its axioms. However, this constitutes a difficult obstacle which, since it mostly remains unconscious and unnoticed, hinders the development of the knowledge model. In this way many projects fail and many potential projects are not launched all. In my role as knowledge engineer I attempted to reverse the priorities and to put first the recognition, acceptance and esteem for the individual knowledge of the domain experts. Only when this basis was first formed, I looked then at what had to be changed in the knowledge model if the computer-constraints and formal logic were considered. My motto here was "Logic of Experience first!". In projects with this approach both participation in the development of a common knowledge model is important as well as the respect for the inner, intimate union of the knower with her knowledge as a primary constituent of her identity.

6. Shared meanings require participation in a cooperative, creative process

For reaching shared meanings (and/or models), special attention should be dedicated to the process of 'negotiation of meaning' (Wenger, 1998). In this

process one should make sure that individual meanings receive the recognition, acceptance and esteem that they deserve. I, as a community member, do not assume that there is an absolutely valid knowledge and do not judge the individual meanings of other members against that. Rather, I try to understand how these individual meanings make sense in the experience of the person who brings them forward. It may be that together we then find certain logical mistakes on the level of the operations - of the How - and can even just correct them.

The main job when negotiating meanings or models, however, consists in performing the negotiation first at the level of the operations - of the How - so that afterwards also the related meanings – the What – will be easily and fairly negotiated. In that way creativity also gets a greater chance because in shared meanings there is always something new, an original part that we build up from scratch together with others - and what we need to do that is creativity. But one can much better disclose this creativity when one does the step from the What up to the How – or when the new is sought on the level of the operations. Edward de Bono, one of the best known creativity experts (de Bono, 1967), wrote extensively about this. His statements about how one can support creativity are compatible with Constructivism, although he never claimed to be a constructivist.

7. Behind a statement don't forget the substance of the tacit knowledge it refers to.

This point is particularly important when managing the community's knowledge. If we assume that our knowledge is organized in an autopoïetic way, then we become suddenly aware, that in such a context designations (reifications) are only static instruments that can catch only a small part of the dynamics of knowledge - *"the word dies away already in the feather"* as Faust said (Goethe 1817, verse 1724).

Hence in my approach I consider explicitly designated knowledge merely as a shadow of the dynamic knowledge in our head. In order to emphasize this important distinction between two kinds of knowledge, one speaks in knowledge management of explicit (the shadow) and tacit (the body) knowledge. Explicit knowledge is what one expresses, what is written down, stored on compact discs, held in the library, condensed in instructions, or embodied in infrastructures and facilities: a machine factory which has facilities like for example a production plant, has also explicit knowledge in form of different machines placed in a certain spatial order. Tacit knowledge on the other hand is knowledge in the head of the human being. If we make statements or interpret statements, we should always consider then behind a statement there is always this dynamic, tacit knowledge which contains much more than only what is expressed in the statement about it.

This can well be illustrated by the shadow of a body. The body contains much more structure and dynamics than the shadow does. The same happens for the relationship between tacit and explicit knowledge. We know therefore much more than what we express and make explicit. This is why we should always draw a distinction between these two kinds of knowledge and in learning community conversations consider that the explicit statement of a community member is always only the shadow of what she or he is thinking or feeling.

APPLICATIONS

How would a typical teacher using TELEs and community learning approaches apply these suggestions to improve interactions among learners? How would they be shared with learners in a way that they could not only understand, but apply them in order to improve the quality of their interactions? This contribution is theoretical, yet, since many readers would obviously ask these kinds of questions, I will try to give some application hints and concrete examples. First of all one should aim at creating opportunities for social-dialogical processes. This is in line with Paulo Freire, who stresses the importance of dialogue and dialogical actions as an instrument of liberation in adult education (Freire, 2007). Secondly one may find these dialogue opportunities in many learning scenarios suitable for TELEs. A collection of these scenarios with activities, tasks, strategies and tools as well as pedagogical advices, examples and links can be found in the "Resources" pages of eduhub.ch, a platform for new learning technologies at Swiss universities (eduhub, 2011). Finally, in order to devise suitable dialogic activities that can be smoothly introduced into these scenarios, one should try to look at scenario's activities with an appreciating attitude towards alternative viewpoints; the activities must then be redesigned with the aim of helping the students to let alternative viewpoints emerge, then share, cultivate and appreciate them as equally legitimate. Take for example the scenario "Collect Student Exam Questions" (eduhub, 2011), which

aims at motivating students to review a theme or a complete course; “alternative viewpoints” in this case would require different questions and their related justifications and answers on the same issue or aspect of the theme, all developed by students. Two ways to let “alternative viewpoints” emerge that we experienced in an online course were asking the students to “devise the most challenging question” and “to contribute suitable pictures for visualizing the questions”; in both cases, with the support of a forum discussion, we facilitated the related social-dialogical process of construction and reflection.

CONCLUSION

In this paper I have argued that within collaborative learning scenarios computer-mediated written interactions can become a challenging learning situation with high demands in terms of social SRL skills as a result of problems related to different understandings of the concept of knowledge and the practice of knowing which tacitly affect the conversational attitude of the learners and can lead to diminished participation or even a breakdown of interactions in the learning community.

For supporting students in developing the needed social SRL skills, I have proposed seven practical recommendations for online interactive writing based on a radical constructivist view of knowledge and knowing. They are intended to facilitate joint social construction and negotiation of shared meanings by bringing about increased mutual understandings, frankness and trust in community interactions. Our hypothesis and hope is that this would contribute to the development of social SRL skills imposed by CSCL environments (Lapadat, 2002; Delfino & Persico, 2007 p. 30; Bergamin et al., 2011) like, for example:

- easily bringing into the conversation the needed higher order thinking,
- efficiently expressing one’s thoughts by literate writing,
- becoming more effective in making meaningful contributions,
- activating a deeper commitment to participate,
- feeling more comfortable with taking the risk entailed in expressing one’s perspectives
- actively contributing to the formation of a pleasant social climate,
- openly negotiating decisions and agreements
- and last but not least providing helpful feedback and support to other community members.

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DEVELOPING SELF-REGULATED DISTANCE LANGUAGE LEARNERS: A PROMISING PRACTICE

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INTRODUCTION

Movements referred to as widening participation, equity, and the democratization of higher education are occurring in many countries. These movements recognize the advantages of extending opportunity for a tertiary level education and emphasizing lifelong learning to develop an educated workforce, strengthen economies, and increase global competitiveness (e.g., see Caneiro & Steffens, 2006). Distance education and technology enhanced learning environments (TELEs) are a common means of providing these educational opportunities as brick and mortar institutions cannot meet the increasing demand (Gourley, 2009) nor are they sufficiently flexible to accommodate today's diverse learners. Course designers and instructors must consider how to support learner success in distance education courses and help them navigate the TELEs characteristic of these courses.

Although the majority of higher education institutions offer some form of distance education (Parsad & Lewis, 2008), learners may struggle with this mode of learning in terms of possessing sufficient independence and discipline. Success in these contexts requires learner self-regulation, or the ability to control the factors that affect learning (Dembo, Junge, & Lynch, 2006). To realize the goal of fostering self-regulated learning (SRL) in distance education TELEs, the Model of Self-Regulated Distance Learning (Andrade & Bunker, 2009, 2011) serves as a framework to guide course designers and teachers in helping students develop SRL behaviors as they master course content. The model aims to help students increase their levels of SRL, capacity for autonomy, persistence in the course, and mastery of course content.

This study measures the efficacy of the model as applied to a distance English language course for intermediate level learners. Learners simultaneously

worked on increasing their English language proficiency and their SRL skills. First, we introduce the model and its theoretical basis. Next, we describe the methods for the study, followed by the results. Finally, we discuss the findings and their implications.

REVIEW OF THE LITERATURE

The Model of Self-Regulated Distance Language Learning (Andrade & Bunker, 2009, 2011) is based on Moore's (1972, 2007) theory of transactional distance and Zimmerman's (1994) six dimensions of SRL. As we apply the model to English language learning, language acquisition theory is also pertinent.

Moore's theory of transactional distance involves three components: structure, dialogue, and autonomy. Structure is designed into a course through the objectives, assignments, due dates, textbook, schedule, and other organizational elements. Dialogue involves interaction with the teacher, peers enrolled in the course, and agents of the institution. It might include e-mail, telephone, video conferences, and written and oral assignment feedback. Teacher voice is evident in various elements of the course, such as the materials and interaction systems, and can also be considered a form of dialogue (e.g., see Anderson, T., 2007; Moore & Kearsley, 2005; White, 2005).

Autonomy has been defined numerous ways, but can best be conceptualized of as involving two key components—choice and capacity. Choice refers to the learner's freedom to make decisions about learning, specifically setting goals, selecting materials, determining how and what to study, and evaluating performance (e.g., see Holec, 1981; Hurd, 1998b, 2005; Little, 1991, White, 2003). When learners do not have much input related to a course, the level of autonomy is low. In these cases, structure is high, meaning that decision-making about what and how to learn are controlled within the course or by the teacher.

Capacity is a somewhat different element. It refers to the learner's ability to be self-directed in terms of being an active learner, taking control, and awareness and use of learning strategies (e.g., see Garrison, 2003; Holec, 1981; Hurd, 1998a; Vanijdee, 2003; White, 2003). When learners have the capacity to be autonomous, they are more likely to achieve success in a distance learning context. When structure and dialogue are high, the "transactional distance" (Moore, 2007, pp. 90-91) between the learner and the teacher decrease, and the level of autonomy decreases. Although high levels of structure and dialogue may provide necessary scaffolding and support for learners, these components should ideally lead to the learner building the capacity for independence and needing less structure and dialogue to be successful.

SRL is closely related to capacity in that it involves learners being self-directed and responsible for their own learning. It provides a framework for how learners can control the process of learning. SRL involves six dimensions: motive (e.g., reasons for learning, goals, self-talk, rewards and punishments), methods (e.g., strategies and tools for learning), time (e.g., time management, not procrastinating, when to study), physical environment (e.g., identifying and eliminating distracters), social environment (e.g., seeking help, collaboration, communication), and performance (e.g., evaluation, reflection, strengths and weaknesses, revising goals) (Dembo et al., 2006; Schunk & Zimmerman, 1994; Zimmerman, 1994; Zimmerman & Kitsantas, 1997; Zimmerman & Risemberg, 1997). Learners who can manage these dimensions and show evidence of self-regulation have high levels of academic achievement (Dembo et al., 2006).

A well-balanced language course needs four strands or components (Nation, 2001). The course, including class work, homework, and individual study, should consist of approximately equal amounts of time on these four strands. When designing a distance course, these elements must be carefully considered.

1. Meaning focused input: Learning language from reading and listening; the main focus is on the content not on the language itself.
2. Meaning focused output: Learning language from speaking and writing; this involves practice using the language to communicate.
3. Language focused instruction: Deliberate study of grammar, vocabulary, pronunciation; the focus is on the language and how it works.
4. Fluency development: Learners practice familiar vocabulary and structures using each of the four skills – listening, reading, writing, speaking; no unknown language is used.

For distance language learning, opportunities for input and output may be limited in a non-English-speaking environment; thus, they must be built into the course. Meaning focused input (reading and

listening) and fluency development (practice) occur through the dialogue and structure of the course; meaning focused output (writing and speaking) occurs through dialogue. Language focused instruction (study of how the language works) is accounted for within the structure of the course.

The Model of Self-Regulated Distance Language Learning indicates how interaction with structure and dialogue contributes to self-regulation (Andrade & Bunker, 2009, 2011). Learners begin a course with initial levels of SRL, commitment, and language proficiency (or the content specific to the course). In our case, dialogue is provided through instructor feedback, e-mail, discussion boards, and live tutoring, which offer support and opportunities for language practice. Structure occurs through the study guide, calendar, audio and video presentations, and the textbook. SRL activities, designed to provide goal-setting, application, and reflection opportunities, are included for each of the six dimensions. As students work with the course materials, learn and practice the language, and participate in SRL activities, they increase their self-regulation, capacity for autonomy, likelihood of persisting, and language proficiency.

To determine if the stated outcomes of this theoretical model can be achieved, the study focused on two research questions: 1) How do the features of the model, (i.e., the dimensions of SRL, structure, and dialogue), help learners overcome the challenges associated with distance learning and achieve desired learning outcomes? 2) What evidence exists that the model (i.e., the dimensions of SRL, structure, and dialogue) is effective in increasing learner self-regulation, capacity for autonomy, persistence in the course, and language proficiency?

METHOD

The context for the study was a private, religiously-affiliated university in the United States. The institution enrolls 2,400 students, the majority of whom belong to the sponsoring religious organization. A distinguishing feature of the university's enrollment is that it consists of nearly 50% international students, primarily from Asia and the Pacific Islands. As these students have limited opportunity in their countries to develop the academic English language skills needed for success in higher education, the institution provides English language course work in which students enroll in their first few semesters of study.

Although students placed in these courses may concurrently enroll in other courses appropriate to their level of language, increasing their proficiency takes time. Thus, the institution determined to develop and offer distance English language courses to prospective students so that they could prepare for their studies on-site. The majority of these students come from low socioeconomic backgrounds, may be the first in their families to pursue higher education, and may have limited access to and knowledge of technology.

The research for this study was conducted in an intermediate level English language distance course. This level would be approximately comparable to the B2 level on the Common European Framework (Council of Europe, 2001). The course is primarily asynchronous and delivered online using a course management system. Structure is provided with a detailed study guide and calendar outlining what students need to do each week in terms of studying the language and submitting assignments. The study guide provides links to instructional components of the course which include audio and video presentations and textbook assignments. Additionally, dialogue is accounted for by means of a weekly live appointment with a tutor through Skype. The tutor provides feedback on students' writing assignments using the reviewing tool in Microsoft Word and students have the opportunity to ask questions about organization, content, grammar, and other aspects of the course in their weekly tutoring session. The teacher interacts with students through e-mail and by giving feedback on assignments and tests. Students can comment on each other's writing through a discussion board.

The language objectives for the course focus on improving students' reading and writing skills. Students build their reading comprehension skills and vocabulary through the activities and exercises in the textbook and online course materials. The content of the readings is the basis for writing assignments, which are predominantly at the paragraph level. Students learn how to write a topic sentence and develop it with specific details and examples. They practice a variety of rhetorical patterns for paragraph writing (e.g., comparison/contrast, narrative, persuasion), and elements of cohesion and unity.

In addition to the language aspects of the course, as part of their weekly assignments, students are given the choice of a variety of SRL activities focused on

the dimensions—motive, methods, time, social environment, and physical environment. At midterm and at the end of the semester, they evaluate their performance, the sixth dimension of SRL, by reflecting on their progress and goals and identifying areas for future emphasis. These can involve course content (writing), or specific elements of SRL such as changing their study environment, improving time management, or making better use of their tutor sessions. By helping students to develop SRL behaviors, the intent is to improve their ability to be disciplined and independent, particularly critical in a distance education context.

The SRL assignments begin with a survey through which students identify the areas of SRL they want to address. Activities involve self-assessments, recording their use of time, goal setting, developing positive self-talk, making the most of teacher conferences, restructuring their physical environment, classifying distractions, and so forth. Allowing students a choice in their selection of activities provides some degree of autonomy. Assignments involve language practice as students listen to a mini lecture, read a text excerpt, complete a survey or chart, or answer questions. After completing the activity, students reflect on it in their learner journals and teachers respond to the journals. The journals have a two-fold purpose—building SRL skills and writing practice. In their journal entries, students apply what they are learning in terms of paragraph writing, specifically organization, content development, vocabulary knowledge, and grammatical accuracy. Learner journals were 10% of the students' grades and were scored using a rubric with categories for content and quality of writing.

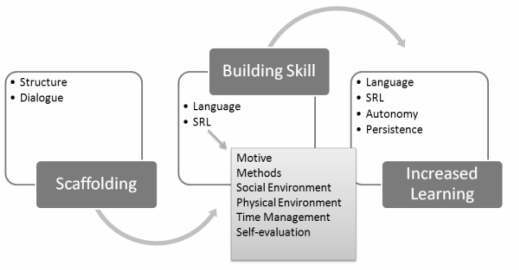

Figure 1: Increasing self-regulated distance language learning through course design.

A total of 20 students participated in the study over the course of two semesters, 11 the first semester and 10 the second semester. They were from the following countries: Cambodia (26.32%), Hong Kong (26.32%), Indonesia (21.05%), Japan (5.26%), Mongolia (5.26%), Taiwan (5.26%), China (5.26%), Papua New Guinea (5.26%). Twelve students were female and 8 were male.

Figure 1 shows the design features used in the distance language course. To determine whether the outcomes delineated in the model were achieved, we examined student learner journals, course completion rates, and advancement information. Students were informed of their rights related to the study and gave their consent to participate.

RESULTS

Analysis of the qualitative data—student journals—was accomplished using NVivo software as well as hand coding. The research questions guided the coding process. Journals were reviewed for insights related to increased SRL, autonomy, language proficiency, and commitment. We identified initial themes from the data and assigned them a code, continuing to sort and refine the categories through the constant comparative method to determine primary themes and subthemes (e.g., see Glesne, 1999; Lincoln & Guba, 1985; Tesch, 1990). Triangulation was accounted for through multiple sources of data (i.e., journals, completion rates, and advancement information). Trustworthiness was ensured by having two researchers discuss the data and coding processes (e.g., see Lincoln & Guba, 1985). We first examine the findings from the journals, and then review completion and advancement information. As the students' English language proficiency is developing, quotations from journals may contain grammatical errors. These are retained to preserve the students' own voices.

Increased SRL

Evidence of increased levels of SRL was apparent in learners' journal comments. Related themes focused on four areas: 1) controlling the physical environment and managing time; 2) demonstrating awareness and application of methods of learning, 3) identifying and addressing challenges, and 4) indicating the benefit of the activities. These comments reveal that students understood SRL and were able to control factors and conditions affecting their learning.

Physical environment and time management. Students increased their awareness of how the physical

environment impacted their learning by evaluating the places they studied. Through this process, they identified appropriate times for study in particular locations and distractions they needed to control. For example, some studied at an internet café when the café was not busy. Others had difficulty with the "many lures" in their homes and recognized the need for discipline and not surfing the internet or having the TV on when they were doing course work. Several were successful studying on public transportation systems (e.g., bus, train). The work place was advantageous for some but not for others. A number of students did not have internet access in their homes and needed to utilize internet cafes or work places for this purpose, thus had determined a schedule for components of the course they could do at home and those they needed to do elsewhere. The following comment represents some of these factors.

I'm grateful to have a good place to study at home with a good environment and a computer to support me in studying. I can begin studying immediately and sit in front of my computer without any disturbance at home, and I can concentrate and study well. Usually I will look at my study course and see the due date for the assignments to submit. I would read my textbook to study the grammar, strategies, and things that I need to learn from the book, and continue to work on the exercises because this is my priority. I study and do the exercises and assignments using my computer at home, but not the Internet, because of the connection. After finishing all the assignments I would review them using office computer, and then send them to the teacher. How lucky I am to have such a good study environment and computer to support my study. I do not need to go to Internet café. Study while waiting for the bus is also help me to better understand the materials, and at home I could review them.

Another element of controlling the factors affecting learning was use of time. Students indicated that the activities in the course helped them recognize how they spent their time and more effectively plan what needed to be done as illustrated in the following quotation.

While I am keeping track of my activities for 24 hours, I learned that "Time is a precious thing". From this activity, I am able to know what I did in a whole day. I can see my worst time and my best time. For example, I used most of my time for watching TV; sleeping at evening time; teaching my nephew; going to my friend's house; and reading the student guide. And what surprises me? Watching TV and sleeping at evening time took more of my day than I expected.

One student indicated how following a schedule helped him overcome procrastination.

Before, it is very difficult for me to follow the daily schedule. It is because I am very lazy and I always to delay my works. I will have many excuses for me to hold my work. I can't concentrate on my work and stray from the temptations. After this activity, I try to follow my daily schedule and it is a very good start. The advantage is there are more study times for me. And there are enough entertainments for me to relax. I can balance my daily time.

Awareness and application of methods of learning. By participating in the SRL activities, students became aware of various learning strategies. These included prewriting, previewing reading materials, taking reading notes, identifying the main idea in readings, preparing specific questions for tutoring sessions, and using the study guide to answer questions and determine due dates. One student wrote about how he used his textbook to enhance his learning.

Actually, getting help from my textbook is what I do regularly. There are three mains reason I need help from my manual. The first reason is that I want to gain more understanding about grammar sections of each unit before I take grammar quiz or test. Consequently, last week I took a grammar quiz in Unit 5. Of course, I reviewed the grammar lesson that offered in the unit before I took the quiz. It helps me a lot on the quiz and I got good score, as a result. The second reason is that the textbook could help me find the idea and teach me how to write different styles of paragraphs, descriptive paragraph, for example. Before I could begin my writing I need to know what type of paragraph and its structure. Also I should study how to put my idea, chronologically. So reader can catch the main ideas of my paragraph easily. . . . To sum up, getting help from my textbook is the best strategy to get high score on both quiz and test.

Other entries were not as specific. The following student simply lists methods of learning without providing details as to how she had applied them. Even so, the excerpt does demonstrate awareness of new possibilities and a belief in their importance.

Actually, there are many choices and strategies to use in this distance education course. Those include daily schedule, using study guide and text book, place to study, strength and weaknesses being a language learner, and getting help. According to my experience these are the important factors that can help me in this online course.

Challenges. Students indicated a number of attitudes toward learning and learning English specifically. One commented, *"When I think of English, I always get a fear in my mind."* Others mentioned similar emotions such as nervousness about tutorials, depression, confusion about course content, and blame or guilt for not doing assignments as well as challenges related to balancing work, home life, and study, and maintaining motivation. The most common theme in this area resulted from a writing prompt asking learners to evaluate how to change negative self-talk into positive self-talk as illustrated in this entry.

Furthermore, as we strive to have self-confidence, we also can improve ourselves and overcome our weaknesses. When we haven't achieved our best, we can always do better. When we make mistakes, we should forgive ourselves. We can change our weaknesses into strength, and it means that we can change the negative into positive. We need to have courage to do better every day. I'm grateful for who I am, because I have great motivation to improve a little bit better in my life.

Benefit of activities. The last area indicating an increase in SRL behaviors involved numerous comments related to the benefits of the course activities. Students attested to the fact that their test scores and grades had increased, their academic and learning skills had improved, and their English proficiency had advanced. Students also gained insights into themselves as learners. One student commented, *"The activities have opened my eye of what other ways there are to make a study become more and more fruitful."* Another said, *"I've got a chance to know myself better. I also found out which part I could work on and become a better learner."* A third indicated, *"By doing these activities I have been learning about how to be a good student and my English have improved, too. Also, my learning skills improved greatly."*

Some students initially lacked motivation to do the SRL activities (called Manage Your Learning or MYL in the course). One stated, *"In fact, I was lazy to do the activities. I am so thankful that I have done most of them and get benefits from them."* Finally, students also indicated the intention to apply what they had learned to other areas of their lives and to future contexts.

This activity has been helping me a lot during this online course. I've been trying to apply all of the principles that I've learned from into my live too. I plan for my next day before hand, figure out what I should do to make the next better, make sure that everything that I'm doing or I'll do will help me to accomplish my goals, etc. I've also shown many principles from this activity to my friends. I love MYL, and I'll keep applying it into every phrase of my learning journey.

Overall, evidence in the student learner journals was strong related to the ability to understand and apply aspects of SRL and even to continue these behaviors into future learning situations.

Capacity for Autonomy

Related to autonomy, three primary themes from the student journals demonstrated that students had the ability to be self-directed and active in their own learning processes. These included the ability to identify their strengths and weaknesses in terms of their performance, to seek help when needed, and to set and achieve goals. These attributes demonstrate that students had developed the capacity to be independent learners; they could evaluate themselves, determine their needs, and adopt appropriate approaches to meeting these needs. In essence, through these behaviors, they made choices about what and how to learn. We next illustrate these behaviors through the words of the students.

Strengths and weaknesses. The following excerpt provides details as to how one student identified a weakness in his study habits and set a goal to overcome it. He also identifies weaknesses and strategies related to improving language.

From these activities, I found my weakness which is procrastination. This is my big obstacle. It makes me always delay my works. Sometimes, I cannot submit the assignments by the due day. But from this class, I make a difference. I set a goal for my weakness. For example, I will finish the assignments of two days before the due day. . . . About the grades, I found that

my grammar and tense are not doing very well. I need more improvement in these two areas. I will do more grammar and tense exercises. And ask the tutor more about the grammar and tense.

Although the student does not indicate how he will complete assignments early nor does he identify specific grammar areas or verb tenses, he shows awareness of his weaknesses and some idea about how to address them.

Other students commented generally on the benefit of examining their strengths and weaknesses, as indicated in the following excerpt.

I felt it is really interesting to see my strengths and weaknesses. It's came out with some questions after I read my list, such as "How can I improve on this one?" "Why am I good/not good at this one?" "Which one should I put more effort in it?" Because of those questions, they helped me to gain a farer view as an English learner. I felt like I was stuck in a hole, I didn't know what I should work on. Now I can see more about myself and I can start to work on the most needs that I have.

This student indicates understanding of the benefits of self-evaluation in terms of being responsible for identifying weak areas and planning to address them. Another student concurs with this thinking by saying, *"I have to admit that knowing our strengths and weaknesses is essential for our improvement. Once we know our weaknesses, we can improve it. Knowing our strengths encourages us to keep doing better."*

Seeking help. Independence is characterized by an environment of interdependence among teachers and learners (Little, 1995), thus the ability to recognize the need for and seek help is a positive behavior. Self-regulated learners know when they are having difficulty and view seeking help as a useful strategy (Dembo et al., 2006). High-achieving students are more likely than low-achieving students to ask for help from instructors (Dembo et al., 2006).

For the language learners in this study, seeking help is a strategy that has the potential to improve their ability to learn independently in a distance context. Overcoming fears related to asking for help, recognizing that asking for help is a positive behavior, and understanding that multiple sources of help can be utilized in a distance context – peers, teacher, tutor, native speakers—were evident from the journal entries.

The following excerpt exemplifies how the dialogue in the course through e-mail and tutorials helped one student overcome affective factors related to her learning.

The best way to ask for help is sending e-mail to my teacher. Also, I would like to ask my online tutor for helping me. It is because I can get the answer immediately. The most important thing is not be afraid to ask. Asking questions is good for our learning.

Along the same lines, another student commented, *"I can do my assignment more quick through their [teacher/tutor] helps. It is the way to overcome my weakness – asking. I do not know why, maybe I am too shy. Communicating with others always is a problem to me."*

Other students recognized numerous supports in the course. *"We can get help from many ways, such as teachers, tutors, textbook, course materials, classmates, e-mail . . . there is nothing we cannot solve from this course if we seek help."* One student overcame negative feelings about the course through positive interactions with the teacher and tutor.

At the beginning, I felt so bad to take this course. Because I am not good at writing and do not like it at all. But now, I feel much better. I know my teachers and tutors have helped me a lot. They try their best to answer my questions and help me to build up my writing skills.

As a result of seeking help through the dialogue provided in the course, students overcame their nervousness and *"felt warm and confident"* as if they were *"regular class students."* They also gained confidence in speaking and using English as they communicated with their teacher, tutor, and classmates. *"They try to understand me and I try to understand what they said. It improves my listening and speaking also. And I get more communication."*

Set and achieve goals. Similar to the other areas, many of the journal entries indicated an overall appreciation for the benefit of setting goals as this quotation illustrates: *"From doing this activity, I learnt that getting goals is very important for our learning. When we get goals of our learning, we*

would have more energy to achieve our goals. It gives fresh impetus to us." Beyond these general observations, student responses discussed the importance of short, intermediate, and long term goals as well as reflected on specific areas for goal setting. Another area of impact was identifying values, or what is most important in one's life, and linking these values to goals.

To illustrate, one student indicated that she valued communicating with foreigners and thus had enjoyed learning English from a young age. Her long term goal was to communicate clearly in English. Her intermediate goal was *"attending writing course and reading as many writing books as possible."* Short term goals included *"daily English practices"* and creating a *"short list of tasks."*

Another student aptly described the relationship between values and setting goals as follows.

To identify values and to set goals, they are both important to me. Especially after I identify my values, it makes my goals more realistic. Just like attending steeplechase, if there is no track, jumping hurdles, or water obstacles; you can only stand at the beginning line and don't know what to do. I really like this activity to help me have a firmly understanding on my values, and I can set my goals to help me to achieve it.

As evidenced from the journal entries, students demonstrated capacity for what, when, and how to learn as well as the ability to evaluate their performance. They showed increased awareness of the characteristics of a successful learner, greater levels of confidence, and insights into the learning process.

Commitment and Persistence

The students indicated clear reasons for learning and sources of motivation. A common motive was to improve their English and be admitted to the university. *"I want to learn more and prepare myself for studying at [name of university]. I want to cultivate more self-confidence."* This focus strengthened commitment and persistence. Other sources of motivation were derived from application of the SRL strategies such as using the study guide, tutor and teacher feedback, studying the textbook, and examining assignment models. *"I did not hesitate to spend times for writing. I tried to read the writing samples and the instruction in the study guide again and again. As a result, I love writing a paragraph as I can do it well."* As this comment illustrates, success creates enjoyment in learning.

The theme of being disciplined and working hard was also prevalent. *"I try to be strict with myself because I want to be a good learner."* In some cases, commitment was linked to a self-imposed structure.

I need to discipline myself, especially in time allocation. I have to make a schedule so that I can study properly and regularly. I must motivate myself and have a commitment to spend more hours after office hours to study at home every day. By doing this I will be able to finish all the assignments on time and at the same time I achieve my goals to study well and be a good student. Work hard is needed when we want to be successful.

This comment indicates that the student is a self-regulated learner—she uses time well, is motivated, and has goals.

The following comment indicates one student's attitude about the course and the support she received. *"Without the help and encouragement from my teachers and tutors, I know I may give up."* This support was provided through the dialogue, or interaction, in the course. A related source of motivation is reflected by the following comment. *"I work hard and then send my assignment to my teacher or tutor. My teachers sometimes give me a high score, which makes me so happy. For this reason, I get more motivate in my study English."* Others were similarly motivated—in this case by recognition of improvement. *"I am interested in learning English although there are lots of difficulties for me. Every time I see my improvement, it encourages me to keep going."*

A strong theme connected to commitment and persistence was spiritual strength. As the institution sponsoring the course is religiously affiliated, the majority of the students enrolled shared a strong religious faith. This faith, and accompanying religious activities, served to increase students' ability to develop SRL and be successful in the course. For example, the following two comments demonstrate how students believed help through prayer would assist them in better time management. *"I will seek help by prayer. Most of the time, I feel extremely tired after work. I will ask heavenly father for more energy.*

Also, helping me for a better time management in the busy daily life." "I know that the Lord does answer our prayer, for I have prayed to him a lot to bless me to know how to use my time wisely and always find time to study."

Related to religious activities, students' values were derived from their religious beliefs and these values were related to their motivation for taking the course and for setting goals leading to success. The following quotation illustrates this point.

To me, eternal life, family, and education are the most important values. And I think they can all relate to taking and completing this course. Taking this course is like on the way to the eternal life, we don't see our teacher just like we don't see our Heavenly Father. But once we complete it, we will gain more knowledge and become more fruitful. As long as we enduring to the end, there is no effort wasted. By taking and completing this course definitely can help me to have better capacities.

Another student was inspired by verses from scriptures indicating the importance of seeking learning. He comments, *"I have found way to motivate myself. These verses are the inspiring verses for me, and I realize that knowledge is very important in my life, and that I need to study for my future and salvation."*

Related to reasons for learning and motivation, students indicated that having clear goals is motivating and reaching goals provides encouragement. *"To know what my goal is and how to do it is the best motivation."* Another linked motivation, goal setting, and religious faith.

Finding things to motivate ourselves to study is very important because those things will help us stay focus and strive to fulfill our goals and dreams. Those things are the divine strength that help us move forward with great faith and hope through the trials and challenges of our life.

Student comments related to commitment and persistence demonstrated their views that SRL helped them be successful in the course; this is true in the sense that reasons for learning, motivation, goal setting and achievement of goals, interaction with tutors and teachers, positive feedback, and success in learning were of value to them. Therefore, it is apparent that the SRL activities influenced their desire to continue in the course. These components were also mediated through religious faith and spiritual strength.

Completion rates for the distance students were slightly lower than for the on campus students—95% compared to 100%. However, an important distinction must be made. On campus students are required to stay enrolled in order to maintain their student visa status with U.S. immigration services. If they withdraw, in most cases, they need to return to their home countries. A completion rate of 95% is excellent for distance education students. Additionally, 47% of the students were admitted to the university and enrolled in on-campus courses after completing their distance course work.

Increased English Proficiency

Although the topics for the reflective journal entries were not focused on language learning specifically, but on the application of SRL skills, the content of the entries demonstrated students' self-reported improvement in English. Advancement data demonstrated actual gains in proficiency.

Some comments were general statements claiming increased proficiency through the use of SRL or Manage Your Learning activities such as, *"By doing these manage your learning activities I have been learning about how to be a good student and my English have improved,"* and *"I found out how to learn language, how to use the study materials and I saw my strengths and weaknesses and I know what my learning style is."* The following comment also demonstrates a direct connection between the activities and self-reported English improvement.

First of all, I did not know how important manage your learning was. I was supposed to submit Manage Your Learning for each unit every week. During the course time, I submitted many activities' responses. Now I found out how important these activities were. These activities helped me to improve my English.

In several instances, students observed specific new knowledge gained through application of the dimensions of SRL.

I have learned about what is academic writing, how to write the paragraph and essay that I didn't know before. This information helped me by showing the

way to write in the correct skill and it also make my paragraph or essay more interesting.

The student goes on to say that he utilized the grammar correction symbols provided by the teacher on his writing assignments to improve his grammatical accuracy. In other cases, increased English proficiency involved adoption of new methods of learning as illustrated by the following entry.

The reading strategies given in this course materials and the textbook will help me a lot . . . . I preview the course materials before I begin working on each unit (Study Guide, textbook, Bb); I will look at the assignments that will be due before I start working in each unit; I find any learning helps that might be in the Study Guide or textbook (hints, objectives, definitions, boldface or italic print, summaries, tables or figures), and I also look for main ideas when I am reading.

Another student shows that she feels confident that she will improve by applying new methods of learning.

I know that I had better read more on the sample paragraphs in the manual and use those writing styles to develop my writing skill. By doing so I believe that my writing will be better and I can get high score on my vocabulary test. I will improve my English, finally.

The following entry demonstrates how one student applied time management strategies and overcame her lack of confidence as well as improved her writing and vocabulary skills.

After I choose both of reading and writing courses, I find it was really difficult, and I became very busy suddenly. There are lots of works to finish. It is a big challenge. At beginning, for writing a paragraph I took dictionary to find a proper words or I got some relative information from website. I took a long time to finish a paragraph. I reschedule my daily life. Lots of reading, writing, computer questions and all of thing are new to me, I did not know how to arrangement and balance my life. . . . After a period, I find the more I do writing, the more skills and vocabularies I got. I feel writing becomes easier. Even though I still do not very well, I am not fearful to write any more. I know I can not improve without them [manage your learning activities].

Several students commented that they did not have opportunities to improve their speaking skills in their own countries or to find native English speakers to converse with. *"It is hard to find out the people, speaking English in my area."* The live tutorials in the course and discussion groups with classmates addressed this need. *"This program played a crucial role to help me improve my speaking skill. It was good to talk to native people like my tutor." "I can meet my tutor session 30 minute a week and my classmate one day a week, by doing so I hope my speaking will improve."*

These excerpts demonstrate that students report increased awareness of how language learning can be accentuated through the use of SRL strategies and behaviors. The requirement to complete SRL activities and reflect on their value helped them, they claim, to modify their approaches and learn the course content.

Advancement rates to the next level course for the distance students were lower than for on campus students enrolled in face-to-face courses—77.7% compared to 86%; however, advancement between levels in the program varies by semester. The advancement rate for the distance students would not be atypical of a class of students on campus.

DISCUSSION

The outcomes of the course as measured by learner journals, completion rates, and advancement data demonstrate that the inclusion of SRL components is advantageous. Students' understanding and ability to apply the dimensions of SRL to control the factors affecting their learning, their capacity for autonomy, language proficiency, and commitment to the course were evident.

The research questions were answered affirmatively. With regard to the first research question, the features of the course derived from the model helped learners overcome challenges, specifically lack of confidence, busy schedules, limited English usage opportunities, unfamiliarity with study strategies, and lack of motivation to achieve course outcomes. Evidence for this is reflected in numerous journal entries listed above. Addressing the second research question, the findings indicate that the model is effective in increasing learner claims of self-regulation, capacity for autonomy, persistence in the course, and language proficiency.

In spite of overall positive findings, the content of the journal entries was at times superficial and general in nature. More structure is needed through teacher feedback to guide students to greater specificity and strategy development. Additionally, the inclusion of strategy instruction for vocabulary and grammar learning and other aspects of language would be useful. Students could draw from this instruction according to their needs and the recommendations of their teachers. These changes would help students go beyond statements such as *"I want to improve my reading. I will learn 10 vocabulary words a week."* Students need research-based knowledge of how to do this; otherwise, they could use ineffective strategies and improvement might be limited.

We recommend that the next iteration of the course include instruction of key strategies most closely related to the language focus of the course – grammatical accuracy, vocabulary, and reading. Similarly, as students engage in the process of developing SRL and reflecting on their learning, the teacher must provide specific feedback to illicit more detail in the student's thinking.

Implications

The application of SRL, transactional distance, and language acquisition theories to the course design model provides a framework for effective learning as demonstrated by the findings of this study. Structure and dialogue play an important role in the design and complement the inclusion of SRL activities. As indicated in the model, greater levels of structure and dialogue decrease autonomy in the form of choice, but provide the necessary support for effective learning and decrease transactional distance. In this study, students were provided with autonomy through choice in regard to the SRL activities. Structure and dialogue are also relevant to language learning. Based on the findings, additional structure in the course would be beneficial in terms of increasing SRL and language proficiency as discussed earlier. Dialogue is critical in that it provides language practice as students interact orally and in writing with their peers, tutor, and teacher as well as allow teachers to respond to students in ways that support SRL behaviors.

The model has the potential to positively affect distance learning in a variety of contexts and in different disciplines. Although some distance courses have utilized or studied SRL components such as motivation, reflection, metacognition, and goal setting to aid student success (e.g., see Bothma & Monteith, 2004; Chang, 2005; Hurd, 2000, 2005; Murphy, 2005; Tobias, 2006; Thang, 2005; van den Boom, Pass, & van Merrienboer, 2007), the guiding framework of the Model of Self-Regulated Distance Learning (Andrade & Bunker, 2009, 2011) provides designers, teachers, and students with direction for addressing needs, strengthening weaknesses, and realizing success.

Limitations

As a qualitative study, the findings represent the experiences of only those who participated. They are also restricted to a single institution and a single content area—language learning. Although the study is limited by self-report data in the form of the journals, this information was triangulated with actual completion rates and advancement data. In the learner journals, students may have had the tendency to write what they felt the teacher wanted to hear, especially since they were being graded on their journals. However, the journal grade was based on a rubric which involved evaluation of good writing skills, thus reinforcing the objectives of the course and providing writing practice rather than being focused on whether or not the students had a positive experience with the SRL activities.

Future Research

Future studies could examine students' increase in writing skill and fluency through the use of the SRL journal and compare the specificity of the content related to learning with face to face sections of the class that required a learner journal but did not focus on SRL. Also, the findings support the efficacy of the model, but additional studies need to be conducted of the application of the model to other content areas.

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THE DREAM EXPERIENCE IN THE CONTEXT OF STELLLA 2.0 PARTNERSHIP : APPROPRIATION OF ICT BY A LEARNING COMMUNITY ENCOUNTERING A TECHNOLOGY ENHANCED LEARNING ENVIRONMENT

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Life long learning, community learning, technology enhanced learning environment, self-regulated learning.

INTRODUCTION

The research investigated how participants of a life long learning community project take advantage of a Technology Enhanced Learning Environments (TELEs). In particular, it considered the use of Web 2.0 applications, mobile and social tools regarding to the self-regulated cultural and foreign language learning initiatives.

Nowadays, there are numerous digital technologies, including mobile and social technologies, able to activate or to boost learning in various settings. This technological surrounding, or ecosystem of technologies (Börner, Glahn, & Specht, 2009), makes available different configurations of TELEs defines as a coherence given to the use of devices or techniques when designing practical realization, an effective activity of teachers, trainers, or learners. Many reviews and issues publish reports of practices and of researches associated to diverse levels or kinds of TELEs. It reflects at the same time the developments in technology and the potential it offers to learn, the changes and alternatives introduced in formal and informal education, the questions raised and clarifications required relating for instance to ethic, organizational or pedagogical dimensions.

The potential of TELEs for supporting Self-regulated Learning (SRL) is one of the questions that crosses research on Information and Communication Technology (ICT) in education and training since its first stage up to now, following the progressive refinement and extension of the concept (eg. Pea, 1985 ; Collis, 1993 ; Carneiro, Lefrere and Steffens, 2007). SRL conceptualization involves in its most completed meaning, meta-cognitive, cognitive, affective, motivational and behavioural components (Zeidner, Boekaerts & Pintrich, 2000). It refers to "a set of cross-curricular competences allowing the learners to improve their learning efficacy, as well as to apply and adapt the acquired knowledge across different subjects" (Dettori & Persico, 2008). The assumption is that TELEs can facilitate the actualization of these competences especially relevant in a global environment more and more marked by the "strategic value of knowledge" and to the societal context of a lifelong learning growing demand.

The effectiveness of TELEs on learning is quite well identified for its positive value (Gabriel, 1998) and its influence on SRL has been demonstrated especially on high level thinking (meta-cognitive abilities), in extremely diverse uses of computers in primary school classrooms (Collis, *ibid*.), and with more or less positive academic outcomes, in the specific context of distance or online learning environment (Howland and Moore, 2002, Lynch & Dembo, 2004).

On an other hand, there has been little research on SRL in informal learning within communities of practices, that is to say the way a group of people take over the availability of TELEs components (softwares, websites, web 2.0 applications, mobile and social tools) and realise its potential (with the exception of G. Clough on location awareness provided by GPS devices together with the collaborative affordances of social technologies and learning opportunities around shared experience of physical location ; Clough, 2009). The present research explored whether and how a group of people gathered in a learning community design their own learning paths taking into account or not their ICT context.

STELLLA 2.0 AND DREAM

SteLLLa 2.0 (2009-2011) is the acronym of "*Stimulation of eLearning for Life Long Learning for adults*". The SteLLLa 2.0 project is a project of learning partnership which comes within the framework of the European Union Lifelong Learning Programme (LLP) and more particularly the sector-based sub-programme GRUNDTVIG aiming the improvement of the quality and the strengthening of the European dimension of adult education. It pursues a previous and fructuous cooperation between 7 partners. SteLLLa 2.0 gathers henceforth 10 partners from countries of Europe : Belgium, Cyprus, Finland, France, Germany, Greece, Italy, Lithuania, Poland and Spain. The SteLLLa 2.0 project also fits in with a context of social networking and distance learning.
The objectives of this learning partnership can be described in the following way. First, the project aims to improve the learning process of adults by introducing web based and mobile learning methods in their learning path. Secondly, the project aims to encourage adult learners to self-regulate their learning in determining their own learning process by using flexible learning paths (learn when and where they want, use of individualized learning methods, of the variety of didactics and choose the own speed of learning, learning on demand, communicate while learning). And the third goal of the project is to stimulate adults (both trainers and learners) to use new technologies for appropriate and individualized teaching and learning, when the new methodologies have positive effects in the learning effectiveness. The implementation of the corresponding activities spreads out on two academic years. On the learners side, it combines learning activities and transnational mobility (*nota* : European Union funding does only concern mobilities in the case of this sub-program).

The CUFEF (*Centre Universitaire de Formation des Enseignants et des Formateurs*) of the University of Avignon and countries of Vaucluse is the French partner of the SteLLLa 2.0 project. The Centre contribution to the project relies on its expertise in educational engineering and assessment. In other respects, the Centre contribution is joined to a partnership with a collective of the university community, administrative and teaching staff affiliated members of a trade union group and students aiming to participate, all volunteers to form a learning community to improve their English and to develop their knowledge of the Greek culture. The average age is included between 40 and 45 years old, with a maximum of 58 years and a minimum of 21y., and the English expertise is going from beginner to advanced.

The learning community and the logistic support given by the CUFEF has been named DREAM (fr. *Dispositif Relationnel Expérimental d'Anglais Pour La Mobilité*), that is to say Experimental Disposition to Learn English for Mobility Objective. This disposition relevant with a conceptualization of situated learning possesses the features of a community of practice (Wenger & alii, 2005 ; Wenger, 2007 ; Smith 2003, 2009). Learning activities are initiated among the community. The initiatives include proposals and actions to promote the use of Web 2.0 applications, of mobile and social digital tools. In particular, the learning activity of the community has been able to lean with it's back against a website especially conceived www.cufef.univ-avignon.fr/SteLLLa_2_FR/. The website has notably a weblog and a page to introduce some digital resources or links of particular interest.

LEARNERS ACTIVITIES & ASSESSMENT

The effective starting point of the learning community activity has been a meeting of 12 persons organized in October 2009 to present the project and the DREAM initiative. A participant, student of a trainer course, introduced the website *Livemocha*™ which offers online free courses and represents an access point to a worldwide languages learning network allowing people to help each other and to practice languages together. This session has been organized in a computer room to allow the members of the local learning community to create an account on *Livemocha*™ and to test the functionalities of the

website. The workshop has permit to consider for instance, connecting with people, progressing through lessons with oral and written exercises, having chat (written or talk) with if needed, guidelines for conversation.

The workshop included a self-assessment of English proficiency using the framework of the Common Reference Levels for Languages. The discussion that followed permitted to the beginners to identify the resources-persons and for the advanced persons to listen to the demand of the beginners. The learning activity of the community started from that day with a use and exchanges based on *Livemocha*™ and remained for a couple of weeks to a month, depending from the participants. Some participants are still using the website and some haven't login after the initial workshop.

At the end of November a group of learners initiated a weekly appointment at lunch time. The goal of these meetings was to speak English together, to correct homework members send by mail (ie. different exercises like questionnaires, songs with missing words, list of words, etc.) or to discuss expressions. These learning activities in a real world social context went on until summer vacation. They have been reinforced by punctual social events corresponding to calendar celebrations or to the welcoming of groups of learners from SteLLLa 2.0 partners' organizations.
In April, a group of learners participated to a mobility in Greece organized with of the RA CTI (*Research Academic Computer Technology Institute)* our Greek partner in the SteLLLa 2.0 project. The mobility has represented a practical and intensive experience for all the learners. The discovering and familiarization with the contemporary Greek world has been accompanied by an immersion in intercultural exchanges, including presentations of research and development works quite unfamiliar to the DREAM members belonging to the administrative staff of the university.

Following the mobility, an evaluation has been realized to determine how the learners view this learning experience. Nine members of the community (14 active participants at that stage) gave back a form which includes questions relating to ICT contribution to learning within DREAM.

The answers are very positive concerning an involvement which has participate for some of them, to the improvement of their knowledge and skills (ie. social skills, mastering of a foreign language…), to the raising of their motivation level for life long learning or for being involve in such a project. On the other hand, the answers show a cleavage concerning the resources and means. Some members are positive again (5 persons), considering themselves as being privileged or expressing eventually a lack of time ; other members (4) quote insufficiency or inadequacy of the resources. The details given for explaining this second point of view are a lack of personal effort, an insufficient duration of the meetings, an inadequacy to the person progress and an issue of organization.

The technological surrounding is far from being put forward in those problematics, as it has been in the activities of the group (cf. supra).

CONCLUSION

ICT and Internet in particular, have upset our living, our ways to interact with people, to learn and to work. The DREAM experiment shows that the appropriation of the digital technology surroundings is not self-evident for learning contrary to what an optimistic vision of digital age could present (eg. Flichy, 2010). The potential of TELEs for supporting SRL in life long learning has to face several obstacles. The one this study focussed on is clearly cultural. The interest of ICT is still not well understood, very often people ignore their possibilities within an ecosystem of technologies, and there are not trained enough to make use of these possibilities for learning. Obviously, two other limitations can be mentioned. First a financial obstacle. The direct profitability of ICT for personal or collective learning is linked to a certain level of investments regarding technique, devices and networking, and self-training ("*the better equipped the learner is, the more he or she can choose*"). For the moment, the potential arbitrations are not clearly supported by data that demonstrate that the cost of TELEs' appropriation is lower than what it yields. An important obstacle, more humanisticly sensitive, is linked to the place of life long learning in daily life. What is the benefit for a person to spend many hours to adapt himself or herself to TELEs and to learn from TELEs ? Excepted self-esteem when career are only influenced by diploma or certificate. A larger and visible integration of informal learning in human resources management plan or in academic curriculum would be more than a symbolic measure. At last, further researches should take interest to the issue of strengthening SRL with TELEs in community learning, eg. to develop a guidance that make able to

establish a balance between structure and freedom of choice, to learn in a self-regulated way.

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NEW PERSPECTIVES TOWARDS THE DESIGN OF A DEAF-CENTERED E-LEARNING ENVIRONMENT

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Conceptual metaphor, deaf education, embodied cognition, recreational e-learning environments, storytelling, visual interaction.

INTRODUCTION

Research done in the field of pre-linguistic deafness has uncovered specific problems in the production and comprehension of written language. Such problems can be found in most deaf communities despite the presence of rehabilitation paths, which may or may not include the use of sign language. Learning written language has proved to be a stressful activity for deaf learners, leading to de-motivation and dropping off even at early stages of the educational path.

Within the Italian FIRB-VISEL[1] project, we are investigating the possibility to offer a self-regulated learning environment to deaf adults. The aim is to increase knowledge of their cognitive, relational and communicative-linguistic profile considering their different linguistic and communicative backgrounds.
The exploitation of innovative possibilities given by e-learning has been addressed to improve deaf people's writing and reading skills, providing them with learning strategies to enable self-education in the field of language. In the design of such an e-learning environment we are working together with deaf researchers to ensure the development of appropriate strategies meeting the real needs of the deaf community.

Theoretical bases of our work are storytelling, embodied cognition/semantics, imitation, and the construction of educational games. The objective is to create a highly immersive visual environment and recreational interfaces motivating deaf learners while interacting with the system.

This paper presents the preliminary work done within the FIRB-VISEL project. It opens with an overview of the literacy problems related to deafness and the way in which information technology can intervene to overcome them. A theoretical framework will be introduced to explain the design of the educational and interactional framework of a Deaf-centered E-Learning Environment (DELE), which will be introduced at the end of this intervention.

LINGUISTIC DIFFICULTIES IN PRELINGUAL DEAF PEOPLE

Deaf people officially certified in Italy are about 60,000, but it is estimated that this number does not reflect the true dimension of the problem, as official surveys on deafness often do not consider the extreme variability in which the lack of hearing appears, confusing complete deafness with deaf and mute pathologies. According to the latest surveys[2] done on the matter, about 11 of every 10,000 children born deaf.

It is widely known that, all over the world, deaf children and, later, adults experience dramatic difficulties in achieving appropriate receptive and expressive skills not only in oral language but also in written language.

Literature has proven that deafness is a deficit, but not a cognitive one. However, schooling in Italy still offers no effective systematic response to the problem of deaf education. The social cost of this situation is enormous: deaf people are often excluded from written communication; in many cases, they cannot perform professional tasks involving minimum competences in written language and cannot access higher levels of education.

Research in this field (Caselli et al., 2006; Fabbretti & Tomasuolo, 2006), reveals that deaf people, especially those whose deafness began at the pre-linguistic stage (before 18-30 months), have typical problems in the acquisition of written language and in the development of linguistic skills. The fact that literacy problems appear in all linguistic communities could be seen as a deafness-specific more than a language-related issue. On the other hand, these problems are specific for each culture and each

[1] "E-learning, deafness, written language: a bridge of letters and signs towards knowledge society" (FIRB-VISEL, http://www.visel.cnr.it). Coordinated by Dr. Elena Antinoro Pizzuto from the Roman Institute of Cognition Sciences and Technologies of the National Research Council (ISTC-CNR), Italy. Project code: RBNE074T5L.

[2] Survey done by the Istituto Nazionale di Statistica (National Institute of Statistics-ISTAT), *Condizioni di salute, fattori di rischio e ricorso ai servizi sanitari (Health conditions, risk factors and medical service use)*, 2005. The survey has interviewed 60,730 families and can be found at http://www.istat.it/salastampa/comunicati/non_calendario/20070302_00/ (last visited 23 November 2010).

language, and they are not always comparable. In Italian, for example, deaf people show particular weaknesses in the use of free morphology, pronouns, prepositions, articles and the verbal system.

Considering the difficulties deaf learners meet during the acquisition of verbal, and, in particular, written language, deaf people often experience language acquisition as frustrating. . This means they need tools and educational methods aimed at welcoming and resolving their difficulties. This is often a difficult task, due to the differences in the speech therapies and educational paths, leading to different writing skills. Any possible solution has to adapt both to the type (genetic, medical, etc.) and degree of deafdeafness (profound, severe, moderate, mild), as well as the learners' specific linguistic and communicational competences and abilities.

It is important to note that, as documented by an extensive international literature on the subject, these difficulties remain in spite of the substantial improvements made, in the last decades, in the medical treatment of deafness (e.g. digital hearing aids and cochlear implants that enhance or restore, in different ways, the sense of hearing). The vast majority of deaf learners still remain at levels of oral/written language skills that are markedly below those of their hearing peers. As a result, many deaf individuals experience dramatic difficulties in accessing the vast body of written knowledge as well as the rich learning environments made available by advanced multimedia technologies (most notably e-learning environments). Appropriate written language skills remain a pre-requisite for successfully exploiting the possibilities arising from such new learning environments. As ascertained in recent experiments conducted in the field (Pizzuto, Pietrandrea, Simone, 2006), without a written representation of the language they know best (i.e. Italian Sign Language – LIS – Lingua dei Segni Italiana), it is very difficult for Italian deaf signers to achieve a full understanding of the 'world of writing'.

In order to design appropriate e-learning environments for deaf learners it is necessary to recognize and take into account both the specific needs and the remarkable cognitive and communicative potential that deaf learners possess in their unimpaired sensory modalities, i.e. vision. For a large number of deaf learners these potentials also include the use of visual-gestural or signed languages as a primary means of communication.

In this paper, we will introduce the work done within the research project "E-learning, deafness, written language: a bridge of letters and signs towards knowledge society" (FIRB-VISEL, RBNE074T5L, http://www.visel.cnr.it). This project aims at designing and testing a prototype of e-learning environment for promoting written language abilities in deaf learners (both signers and non signers), taking in due account the special needs of this population. We intend to design and produce new e-learning tools which can be effectively used to promote appropriate receptive and expressive written language skills in deaf Italians who studies in high schools and/or Universities, who are professionals involved in the education of deaf children and/or in LIS courses designed for hearing, hard of hearing or deaf people.

Based on an "open source" platform freely accessible to all interested educational institutions, the e-learning tools we intend to design and produce will be characterized by a fundamental flexibility so that it can also be used, with the necessary changes and implementations:
a) For other teaching and learning activities (i.e. High School and University courses on different topics);
b) By deaf students with different communicative and linguistic backgrounds, including foreign immigrants and deaf students of other European countries, who use other oral/written or signed languages.
The desired e-learning platform will take into due account:
a) The abilities and the communicative and linguistic choices of adult deaf learners using LIS or verbal language for their daily communication;
b) The specific information processing (linguistic and non linguistic) by deaf people who, unlike hearing people, need to rely primarily on a single sensory channel,the visual one, and cannot exploit an integrated use of the auditory and visual channel.

The aim of the project is to enable deaf Italian to achieve a level of competence in Italian similar to that of their peers both filling their gaps and giving them the necessary strategies for self-assessment and learning.

USING TECHNOLOGY IN THE EDUCATION OF DEAF PEOPLE

Why should we choose an e-learning platform for the improvement of deaf people's literacy skills in their national language? The answer to this question comes from two considerations:

1. the use of technology among the deaf community, and
2. the way in which face to face deaf education has benefited from the introduction of multimedia content.

The extreme flexibility and possibility given by the Internet media has been already explored and exploited by the Italian deaf community. In the field of "information and entertainment", the Italian community of deaf signers is contributing to the growth of the video-blog "VLOG sordi"[3], in which deaf signers are free to upload video content about any possible topic. Video is one of the preferred formats by deaf people, since it allows the collection and transmission of visual contents such as sign language, and subtitling audio contents.

It is very easy to find "deaf content" on social networks based on video sharing (such as YouTube, which is also the base for VLOG) or allowing the integration of multiple contents on a unique online platform (Facebook, Delicious, Twitter, to name a few). Unfortunately, there are no recent systematic researches on the use of New Technologies by deaf learners.[4] However, the analysis of any of the mentioned contents shows the acceptance and utility of these tools by the "deaf community": number of comments and unique responses given to each upload, rich "video-discussions" around topics such as sign language, medicine, access to advanced technology services, events.

The use of instant messaging systems such as MSN, Skype, ooVoo or Camfrog, and the widespread use of the latest generation mobile phones, has increased the possibility of distant communication through the support of video or textual contents.

Manipulating possibilities given by Web 2.0 technologies allows the combination of different type of contents in wider, self-regulated contexts: deaf people are able to exercise their linguistic skills in an informal virtual environment, motivated by the possibility to stay in touch with people they love and to meet other members of the "deaf community". This is a real revolution in the sense of deaf people's independence and self-regulation, for the following reasons:

1. they are finally able to select content in the preferred format, increasing their self-esteem and the possibility for them to express themselves;
2. oral communication can be done over a distance(this is very important when considering that most deaf people cannot hear a phone, even with the support of hearing aids);
3. communication contents can be saved and manipulated for future transmission and conservation.

Coming to the specific field of classroom-based education, national and international studies (Maragna, 2003; Shrimer, 2000; Marshark, 2003) reveal that the introduction of new technologies in school has produced a series of positive consequences, in terms of learners' inclusion in daily activities. In particular, the possibility (given by computers, smart boards, and similar devices) to integrate classroom lessons with a high number of visual alternatives to auditory content, has contributed in increasing learners' attention and motivation, and consequently, led to a higher participation to classroom activities. Recent experiences in this direction includes the use of Smart Boards, the integration of multiple technological supports through the use of online platforms for their organization and distribution (i.e. social networks, blogs and other softwares for contents manipulation) and distance education or e-learning.

In the definition given by Schrimer (2000), "distance learning involves the delivery of instruction when the teacher and students are separated over distance and/or time and can involve combinations of one and two-way audio, video, and computer linkages." (Schrimer, 2000, p.74). The e-learning environment gives access to multiple contents and communication possibilities for both teachers and students. Online, writing is a bridge to communicate and to get into relation with other learners facing the same problems and desires.

We believe this to have a positive effect on the linguistic development of deaf people, giving them the possibility to discuss about their abilities in the linguistic modalities in which they feel more comfortable. In contexts like these, the use of written language becomes "natural" and can be improved by the daily use. Contrary to what happens in a "traditional" educational context, where students are

[3] http://www.vlog-sordi.it

[4] The latest systematic research of which we have detailed information has been done by Bianchi, L. (2004). However, his research does not consider the use of distant learning technologies.

de-motivated towards writing and improving language skills, the online learning environment gives deaf learners the possibility to be in the center of a real and involving communication context. Current e-learning solutions designed for deaf learners have shown the utility of inserting video-chat alternatives for learners' interaction. This is particularly useful in the case of deaf learners using sign language: the use of video-chat helps in the creation of learning communities using sign language as a meta-language to reflect and share doubts and considerations on the learning path they are working on.

An idea of how current e-learning environments have faced the problem is well given by two interesting products specifically designed for deaf learners: the multilingual deaf people in Europe Acquiring Languages through e-learning (DEAL)[5] platform, and the German Aachener Internet-Lernsoftware zur Berufsqualifizierung von Gehörlosen (Aachen Internet didactic software for deaf people professional education - AILB)[6].

The DEAL environment proposes online courses for teaching Italian, Spanish and German as a second language for deaf students engaged in professional education to become commercial secretaries. The courses are addressed to absolute beginners in the target language and students are expected to reach competence level A2 of the Common European Framework of Reference for Language Learning and Teaching (CEFR). The whole course is divided into 10 Didactic Units (DU), opened by a subtitled introductive animation setting the base of the exercises within the DU. Sign language is used to support written text when giving explanation for both activities and lexical/grammatical issues. While working on the single activity, students can rely on lexical or grammatical micro-windows clarifying words or expressions' meaning in sign language. Courses go from cooperative (synchronous) to individual (asynchronous) learning modalities. Students' cooperation and content sharing while learning is fundamental to the construction of meaning and knowledge. For this reason, video-chat features are introduced to allow the possibility for students to interact with each other and the tutor while learning. The DEAL platform has been developed for either online or classroom-based lessons, where the tutor has the role of coordinating the lessons and intervening in case of difficulties with any part of the platform. The DEAL experimentation has revealed that deaf students often experience technical difficulties while using the learning environment itself. This issue has been considered in the design of DELE (as well as the new phase of the DEAL-TOI project): navigation has been adjusted to better meet students' visual organization of contents.

The AILB platform has been developed with the direct involvement of deaf researchers and around the idea that, in order to keep and strengthen mathematical, reading and writing skills, deaf people do not need any additional teacher or interpreter. Instead, they can learn through the intelligent use of the Internet and the amount of content accessiblefrom the Web. AILB suggests a stimulating environment for self guided and explorative learning. Content is proposed both in text and sign language, with a high level of visualization. The environment is developed in such a way to stimulate interactive and explorative learning, also through video-conferences in group of peers.

Visual content, learning and self-education strategies, video-conference facilities and sign language: these are the ingredients building current e-learning environments for deaf learners. However, non-signing deaf learners seem to have been left behind. How can we include them in an efficient e-learning platform? We will try to suggest a solution in the next paragraphs.

[5] The Deaf people in Europe Acquiring Languages through e-learning (DEAL) project has been developed within the Lifelong Learning Program of the European Commission, from 2006 to 2008. The project has been awarded the European Label 2008 for Innovative Projects in Language Teaching and Learning, and has been re-financed as a Transfer Of Innovation for 2009-2011, enlarging the educational offer to English and adjusting the platform according to the results coming from the DEAL evaluation by users. Both phases of the project development have been coordinated by Istituto Statale per Sordi di Roma (State Institute for the Deaf in Rome). Further information can be found on the project's website: http://www.deal-leonardo.eu.

[6] The Aachener Internet-Lernsoftware zur Berufsqualifizierung von Gehörlosen (Aachen Internet didactic software for deaf people professional education - AILB) project, has been supported by the Federal Ministry of Health and Social Security, Germany, and developed in 2003-2005. After the first phase, the project has been re-worked and has been published in 2007 as AILBII. All information about the project are available to the website http://www.vibelle.de/ (last visited 29 November 2010).

THEORETICAL MODEL

In order to exploit the deaf-specific visual approach to acquiring knowledge, we are referring to Storytelling and Cognitive Embodiment as our main theoretical model, where Cognitive Embodiment can be seen as a general framework composed of several conceptual tools, such as Conceptual Metaphor and Conceptual Blend. Let's go into more detail about this model.

Storytelling is a very pervasive way of modeling experience. Jerome S. Bruner claimed that "we organize our experience and our memory of human happenings mainly in the form of narratives – stories, excuses, myths, reasons for doing and not doing, and so on" (1991). In particular, he discovered ten features of narratives:

1. **Narrative diachronicity**: each narrative describes events occurring in time, according to a sequential, diachronic order;
2. **Particularity**: narrative refers to particular events, which are instances of broader types. For example, the names of the story's characters could be changed without really altering the story itself, but they are important to create the "suggestiveness" of the story;
3. **Intentional state entailment**: every character of a narrative must be endowed with intentionality, i.e. beliefs, desires, theories, etc., and have some elements of freedom, such as choices to be taken;
4. **Hermeneutic composability**: the interpretation of a story as a story, i.e. as a narrative entirely composed of events, is one of the earliest cognitive abilities to appear in children and one of the most widely used forms of organizing human experience. Recognizing the "narrator intention" and a shared background knowledge provide the basis for interpretation;
5. **Canonicity and breach**: narratives tell of something unusual happening in a canonical context, even though such "breaches" of canonicity are often quite archetypical into the narrative tradition (e.g. the betrayed wife, the skilled stealer, etc.);
6. **Referentiality**: stories are not required to accurately refer to reality, but verisimilitude rather than verifiability is considered to be important in narrative;
7. **Genericness**: every narrative can be recognized as a "kind", or genre, of narrative (e.g. tragedy, comedy). Genres can be thought as "guides for using mind" (Bruner, 1991);
8. **Normativeness**: since every breach of a conventional expectation supposes a norm to be breached, narrative is necessarily normative. Narrative is basically concerned with cultural legitimacy, i.e. discussing the legitimacy of social and cultural norms;
9. **Context sensitivity and negotiability**: context sensitivity is concerned with intention and background knowledge for narrative. Context sensitivity turns narrative discourses into resources for cultural negotiation: in that different intentions, or tellers, provide different perspectives on the same sequence of events, and the shared background context makes it possible to achieve a cultural coherence;
10. **Narrative accrual**: narratives, being shared among people, participate in the creation of a culture, a history and a tradition.

In this, humans live within stories and see themselves as the main characters of their own stories. Stories occur in our conceptual and social domains, helping us both to give a personal interpretation of the events of our lives and to negotiate such interpretations among people. Moreover, storytelling is a proper tool for implementing a constructivist methodology for learning (McKillop, 2005). Students trying to construct stories are engaged in making sense of their experiences, in a deep reflection on their understandings, and must carefully design their goals in order to create a story. Afterwards, storytelling allows them to share the result of this meta-cognitive process with others, spurring a shared reflection.

McDrury and Alterio (2002) propose an overall learning model based on storytelling. In order to enhance students' reflective abilities, the learning activity should be organized in five steps. First, stories have to be found by students, choosing them with respect to many factors, such as the expectations about the learning activity, the emotional response to the learning context, and so forth. Second, stories have to be told. This phase, as said above, entails the need for the students to organize their own thoughts and to design their narrative goals. The third and fourth steps are called the story "expansion" and "processing". Here additional insight is reached through dialogue, i.e. by asking questions, looking for solutions, seeing the story from different points of view or comparing the story with similar ones. Finally, solutions and narrative methodologies are evaluated, showing students alternative practices that could have been used.

Storytelling can be described as a particular domain embedded in a more general framework. In the

position we hold in this paper, the Cognitive Embodiment (CE) theory provides such framework.
CE involves philosophical, psychological and scientific concerns (Lakoff & Johnson 1980, Johnson 2007, Lakoff 1992, Imaz & Benyon 2007, Lakoff & Núñez 2000), stating a radical claim: all human knowledge begins from the body. According to CE, from the very beginning of our life, our experience is gained basically by means of our body. We experiment the environment by sight, movements, touching, hearing and smelling it, interacting with objects around us, performing actions, causing changes in the environment and experimenting events that occur without our desire. From a CE perspective, fundamental bodily-based cognitive structures, called Image Schemata, are built through such experiences, e.g. containment, force, balance, link, path, etc.

Other fundamental cognitive functions are used in order to project this body, image-schematic knowledge, onto conceptual and abstract domains. In particular, Conceptual Metaphor is represented as a mapping between two domains, usually a concrete, bodily-related and a more abstract one. Examples of Conceptual Metaphors can be found almost everywhere in human disciplines. Every human language uses conceptual metaphors to communicate meanings at any level of complexity. When we speak, we often understand a domain in terms of another one. An excellent example is the worldwide used metaphor Love Is a Journey (Johnson 2007, Imaz & Benyon 2007). Sentences like *we are driving too fast*, *we're stuck*, *we are at a crossroad*, *our relationship has hit a dead-end street*, etc. represent good examples of this metaphor. In this case, the map in use is the following (see Figure 1):

1. lovers → travelers;
2. love relationship → vehicle;
3. lovers' common goals → common destinations on the journey;
4. difficulties in the relationship → impediments to the travel.

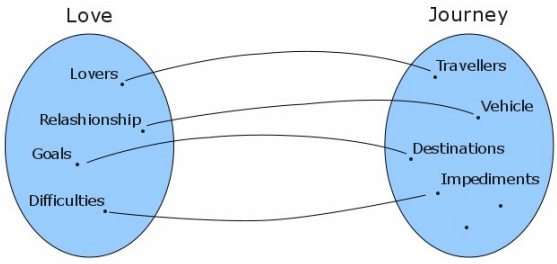

Figure 1. A Conceptual Metaphor schema.

Conceptual Metaphor is not only a sort of language embellishment, but it indeed represents our actual way of understanding concepts and situations. For example, a sentence like *look how far we have gone* can be stated without the need to explicitly mention the structure of the metaphor. In this sense, Conceptual Metaphor is said to "preserve inferences". Moreover, it could be possible for the more concrete domain to show elements which are not included in the metaphor mapping, whereas all the abstract-domain elements are always mapped. For example, in the Love Is a Journey metaphor, we are trying to understand love by using the more concrete structure of the journey domain. Of course, all the love-domain elements must be mapped, but some elements of the journey domain, such as the eyes color of the lovers, can be omitted without breaking the metaphor's integrity.

Such a fundamental role of Conceptual Metaphor in understanding concepts will be self-evident if we provide some examples about the metaphors within the domain of mathematics. Lakoff and Núñez (Lakoff & Núñez 2000) describe in great detail many of the metaphorical bases of our mathematical understanding. For example, considering the arithmetic domain, they provide four grounding metaphors used to understand related concepts, i.e.: Arithmetic as Object Collection, Arithmetic as Object Construction, Arithmetic as using a Measuring Stick and Arithmetic as Motion Along a Path. Let's pick up two of these metaphors: Arithmetic as Object Collection and Arithmetic as Motion Along a Path. If Arithmetic is thought as a path where one moves along, the presence of a natural element that maps the Zero arises, while such a natural mapping cannot be found in the first metaphor. In fact, thinking of the Zero element would imply accepting that a collection with no elements is a collection at all, which is a metaphor itself. Another difference between the two mentioned metaphors is that the "moving along a path" metaphor allows one to imagine moving away from the origin in both directions of a linear path, obtaining negative numbers. The set of negative numbers cannot be obtained by using the Arithmetic as Object Collection metaphor, so it is clear how much our way of thinking is constrained by the metaphor we use.

Conceptual Metaphor is also widely used in art: Johnson (2007) provides a very detailed analysis of the conceptual structures used in art. As Johnson argues, "various arts make use of the very same

structures and processes that operate in ordinary, everyday meaning-making, including images, image schemas, metaphors, qualities, feelings, and emotions". Johnson's central claim is that meaning goes far beyond what can be put down in words, and art provides a prototypical, intensified, and highly integrated experience of meaning. Metaphors can be found in visual arts as well as in music and in poetry. For example, the image-schematic domain of balance is often projected onto the visual domain in visual arts. Moreover, Johnson cites three Conceptual Metaphors that represent the ways we conceptualize music: the Moving Music metaphor (used when we refer to music as something that moves), the Music Landscape metaphor (referring to our experience of physically moving our body through a spatial landscape) and, finally, the Music as Moving Force metaphor, that uses our experience of being moved by external, environmental forces, like wind, water and so forth.Finally, Conceptual Blend (CB) is the main tool that will be used in order to actually implement CE and Storytelling in a computer-based learning environment. CB allows building a new conceptual domain from two existing ones. A Conceptual Metaphor can provide the two input domains, where the resulting one represents both a synthesis and an implementation of the metaphor itself. Such a new domain exploits the inferential structure of either one or both of the two input domains, and also reveals a new emergent structure.Computer Science and, in particular, Human-Computer Interaction are fundamentally built via Conceptual Blends (Imaz & Benyon 2007). In fact, graphic interfaces as well as old-style consoles, windows, widgets and all interaction paradigms are implementations of hidden metaphors: in other words, Conceptual Blends. The Computer Desktop is perhaps the most common example (see Figure 2).

The Office domain provides the well-known inferential environment, while the Computer-commands domain should be hidden to the end users. In fact, only the Office structure (i.e. the general appearance of the environment and some basic interaction paradigms) is projected into the blend, trying to exploit user's familiarity with such an environment, whereas computer commands are provided through the interface but are not explicitly shown. As in a real office, users can find common objects to interact with, such as documents, folders, a trash can, and so on, and computer commands are executed through the interactions with such visual elements.

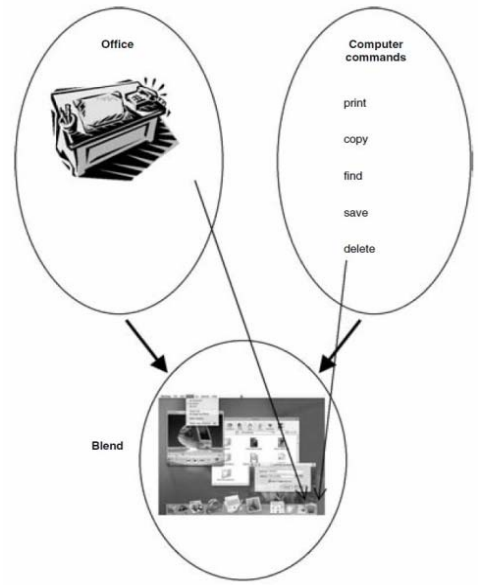

Figure 2: The Desktop Blend (see Imaz & Benyon 2007)

Nevertheless, several differences with respect to a real office environment can be found. Due mainly to the bi-dimensional perspective of this blend, a new structure emerges, concerning topological, spatial and interaction issues. For example, unlike a real Office, the trash can is positioned on the desktop. Moreover, we cannot go "in depth" when trying to explore the environment: in order to show the contents of an object (i.e. a directory) we always need a new visualization space, which is a new graphical window. The model presented above is used to design and implement a Deaf-centered E-Learning Environment (DELE). In fact, in our opinion, Storytelling and CE are very important resources to be used in any learning environment. In particular, we think that our model can be successfully used in places where deaf learners are involved; thanks to the possibility of metaphorically represent the learning process and its activities as a graphical multimedia story.

LINGUISTIC AND EDUCATIONAL APPROACHES

The actual trend in deaf people education is to consider the written form or the national language as a second language (L2). However fasinating, this approach does not consider the peculiarities in deaf people's language learning.

If we consider the body as a first parameter for learning, and a ruler to measure the educational path to be followed, we need to take into account its peculiarities. One of the first distinctive features encountered when approaching the deaf reality is the lack of hearing. However, it is also easy to find that they actually possess higher visual abilities. For this reason, in constructing specific paths for linguistic education, we could recur to deaf photographic memory, their sense of guideline, a much defined mental organization, and their familiarity with concepts like body control, exclusion, opposition, space and time. But let's proceed with order.

Due to the lack of hearing in the acquisition of a natural language, deaf learners can hardly be considered as native users of Italian (Italian L1). In fact, in most of the cases they do not acquire it from their primary caregivers as up to 95% of deaf children are born to hearing parents and, in the interaction with their hearing counterparts, they lack the exposure to verbal language. Thus, their hearing loss impedes natural acquisition. In the same time, LIS (Italian Sign Laguage) cannot be considered a native language because, in most of the cases, it is not – at least initially – shared between caregivers and child.
LIS (and any other sign language) is extremely rich in its structure and lexicon as well as the verbal language itself (Italian). However, despite many deaf students eventually use LIS or a variant for their daily communication, there are significant differences between LIS and many spoken languages. One of these is the fact that sign languages have no written form, reason for which deaf students have to learn how to make sense of print, for which there is no model in their manual language. As a result, Italian, in both the aural and written form, is a language to which deaf learners arrive late and in an 'imperfect' way because of the delays in exposure both aurally and in print. Following Keenan and Schmitz (2006), this form of Italian used by deaf students could be called a "primary language" rather than first or even second language.

In the case of hearing learners Pit Corder (1991) defines as *interlingua* the language system – or grammar - used by second language learners. Corder believes that the production of second language learners reflects rules inferred from their native language. Evidence of the existence of these rules has been given through the analysis of the systematic nature of errors. Errors in texts produced by foreign language learners occurring with enough regularity to be labeled, are called developmental. According to Dulay, Burt and Krashen (1982), these errors show that the learner simply has an incomplete second language rule system: the errors they make will self-resolve as student's knowledge of the target language becomes more complete. Some of the errors evidenced are: omitting grammatical morphemes which do not contribute to meaning, e.g., *She opened present*; double marking a feature when only one marker is needed, e.g., *She didn't walked home*; generalizing rules, e.g., *oxes for oxen*; archiforms, or using one form in place of several, e.g., *Her walk with Bob*; using two or more forms in random alternation, e.g., using *he* and *she* randomly regardless of the gender of the person in question; and misordering items in constructions, e.g., *What you are doing*? (Dulay, Burt & Krashen, 1982).

The rules coming from interlingua are systematic even though they don't match with the grammar of the target language. Put another way, the learner constructs an interlingua system with its own rules and these principles drive his communicative production. The communicative production of a second language learner could best be described as a perfect interlingua production rather than an imperfect target language production.

In a theoretical application of interlingua theory to deaf people's language acquisition, we could conclude that any deaf learner acquiring a language goes through a series of grammar and "communication" rules. The multimedia and multitasking typical of the e-learning environment, is perfect for discovering and developing the interlingua abilities used by deaf learners.

In the construction of the e-learning environment of the VISEL project, our approach begins from the assumption that all human beings learn in different contexts by emulation, imitation, guided by needs and through immersive interaction with others.

Language courses based on grammar give a remarkable support to learning processes, but what makes the difference is the input, the "melting pot" of information that everybody personalizes in very different ways. In the past, many language learners have accepted a view of grammar as a clearly delineated and internally coherent structure which is best understood as a self-contained system. It has been widely proven that this kind of approach is not enough to carry the learner to a real linguistic

competence. The history of foreign language teaching has seen, over the years, the passage from a text-driven approach (deductive methods) to a greater focus on the learner (inductive methods first and humanistic-affective later). For example, the silent way, suggestopedia, and the Total Physical Response approaches shift the attention on the person, on his/her way of perceiving the input and to personalize and assimilate the instructions that he/she receives. Contextually, studies in the field of neuroscience have confirmed the physiological nature of learning. According to these studies, human brain possess "mirror" neurons which are able to recognize the self in the other's body, making faces expressions and movements meaningful, and allowing us to predict and anticipate the intentions of the speakers. For this reason, in the FIRB-VISEL project, we want to suggest a different way of approaching the rules of written language, considering it as part of a broader range of systems underlying the organization of social contexts, and emphasizing its role and influence in human interaction and cognition.

In order to re-create a natural communication environment in an online environment, we are studying the structure of existing games, such as "The Sims", "Trivial Pursuit", "Monkey Island", "Pet Society" and "Farmville". Each of these tools contains ideas which are inspiring for our e-learning environment. For example the Sims helps with empathy and embodiment, while Trivial Pursuit is a perfect blend of culture and fun. Pet Society, or Farmville, popular social games from the Facebook social network, give us hints for interaction and collaboration while playing. In Monkey Island we have the idea of the language as a means to achieve a goal: if you want to go on into the story, you have to read and think about the suggestions. As a consequence, the learning path of our e-learning environment will be seen as a story in which learners will move through the use of an avatar, acting in the virtual learning system and interacting with specifically created learning objects. These will be adapted to increase deaf people's comprehension and interaction in the system, also through cooperative activities.

Cognitive semantics will help us in designing new ways to improve text accessibility, reflection andproduction skills. The e-learning environment will be visually-grounded and the didactic tools and written materials will be made available in different forms according to the specific needs of the learner.Differences and similarities between the L1 and the L2 learners will be defined, as well as the activities and pedagogical procedures to facilitate the process of understanding written Italian by both signers and not signers deaf learners. For that concerning text adaptation, we will refer to Bhatia (1983) and his suggestion to use Easification as an alternative to Simplification. Easification devices guides the reader through the text without making dramatic changes that could affect the approach to text complexity by the students.

The basic idea is to build a path to acquaint deaf learners with written Italian in all its forms. This is necessary in order for them to access the whole world of written text: from the package leaflet of any medical treatment, to the successful understanding of academic terms during the University experience. All these activities will be done in a realistic and dynamic context where writing will be the tool to achieve a goal in the recreational-educational e-learning environment as well as in everyday life.

TECHNICAL CHARACTERISTICS, INTERFACE AND SYSTEM INTERACTION

Since the FIRB-VISEL project's target population is High School and University students and young deaf professionals, the story we aim to implement for DELE is provided by means of a University Campus metaphor (Figure 3).

Figure 3: A draft of the Campus environment in DELE

In our mock-up, when entering the campus story the user is impersonated by a virtual avatar used to

explore the graphical environment made available. In this way, deaf people's visual-body skills can be exploited in order to grasp information, and body-based general inferences can be naturally suggested through the virtual character moving into a virtual environment. General image-schematic structures are implemented (i.e. enter places, manipulate objects, meet other characters, etc.), reaching an intuitive and easy interaction with the system and avoiding the lack of motivation that could come in interacting with highly textual interfaces.

Information browsing is not arranged in a textual tabular fashion, but, in moving through the virtual environment, the user is asked to move within the sub-environments (sub-stories) to accomplish several learning tasks. The entire learning environment is arranged by means of stories within stories, each implementing a different, task-specific metaphoric environment. In order for information to be mainly encoded visually, all graphical elements into the environment have a semantic relevance. For example, background images are chosen to embed the "general feeling" of the environment task, giving additional information other than text (see Figure 4).

(a) (b)

Figure 4: two possibile environments for DELE. (a) a configuration menu; (b) a newspaper learning environment menu

As the picture shows, graphical elements convey semantic information. For example, a graphical background showing a complex mechanism is used in a menu for choosing general system settings, while a newspaper background is chosen to represent a learning environment about newspaper texts. Moreover, several other pages can be accessed from within these environments, and graphical blocks showing iconic semantic information about such pages are included as menu elements.

In DELE the user input can be acquired by means of standard hardware, such as mouse, keyboard and web-cam (Bottoni et al., 2010). Through the use of these hardware tools, we are implementing some facilities aiming to improve the interaction possibilities of DELE. In particular, we are evaluating the use of a gestural recognition module through web cam. In this way, simple gestures could be recognized to implement alternative ways to execute some general system commands, such as browsing the environment or asking for on-line help. Such a feature seems to be interesting to deaf users, due to their natural gestural approach to communication. In this way, although only the visual channel can be used by the deaf, multimodality is not missed.

Storytelling is implemented as a structural part of DELE. In fact, each learning process has a natural visual representation as a story, i.e. a path where the users move through (see Figure 5).

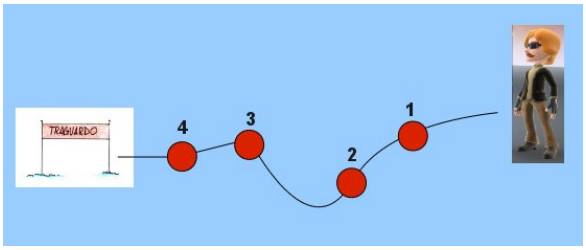

Figure 5: The learning process as a path

The "Story Engine" module of DELE provides such a path to be dynamically generated by the system: for example, when the user enter a learning story, the next step in the learning process is suggested by the system, as well as several other resources, in the form of information on users who have already passed these activities, help materials, in-depth activities, and so forth. Moreover, Digital Storytelling is implemented in DELE, taking into account the users' motivations, the digital stories produced, and the conclusions reached by means of the public discussions moderated by live tutors. Users' stories could be considered as a sort of homework about themes which are directly related to the learning contents or personal interpretations and creative elaborations of such contents. Intentions relating to each activity are elicited from users and collected by DELE, and conclusions are stored and processed in order to automatically elaborate a sort of "society's culture" that is shown to users. In fact, as stated above, Bruner claimed that narratives participate in the creation of a culture and tradition. In DELE, such a culture will be visualized by the regular access to the environment by the users. Such information could be given through news to be published on the campus main square. In this way the human-level approach

will be exploited, and a concrete social environment with aspects which are similar to the real life is built.
As in many e-learning environments, collaboration is seen as a main concern. The digital stories developed by users could be used as help for others, representing direct experiences of users facing learning-activity problems. Forums will metaphorically be represented as public news boards within the campus, and a particular type of activity, called *laboratory*, will be provided in order to implement activities to be carried out together with other users, collaborating in real-time.

In the implementation stage, we are working with Moodle[7] as our basic development tool. Being one of the most celebrated open-source e-learning platforms, already adopted by a big community of users and developers, it provides a rich architecture for documentation and support. First of all, we are customizing the core code of Moodle in order to setup the desired graphical appearance and logical behavior of DELE. This is a straightforward operation, thanks to Moodle's modular design, which allows the decoupling between GUI-related functions and logic-specific ones. On the other hand, a rich library of general-purpose, already-tested functions is implemented within this platform, which represents a great resource in the DELE development.

Finally, we are working on preliminary experiments using an eye-tracking equipment in order to better understand the deaf-specific gaze patterns used to explore electronic pages. Results provided by such experiments will suggest the design a graphical arrangement for DELE with a high accessibility pattern for deaf people.

CONCLUSIONS

In this paper we have tried to give an impression of the core of the theoretical and technical framework in which the FIRB-VISEL project moves. The goal of improving deaf learners' literacy skills (actually under level B1 of the CEFR) needs the development of peculiar language education methodologies that we are trying to address in this project.

In the FIRB-VISEL project we have decided to invest in deaf people's visual skills, applying embodiment theories in the design and development of both the educational and interactive path of the e-learning environment and adapting different educational methodologies to meet their needs.

We expect the project to improve deaf people's awareness of their skills and capabilities, and to enable them in the use of strategies for self-regulated learning overcoming traditional barriers between themselves and the target language.

[7] http://moodle.org/

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WORKSHOP D: SRL IN TELES WITH FOCUS ON TECHNOLOGY

A RESULT-DRIVEN APPROACH TO THE DESIGN OF SELF-REGULATED PROBLEM-SOLVING ENVIRONMENTS

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INTRODUCTION

Teaching should care the transfer of important notions and foster the capability to apply them to solve real problems, filling the gap between "knowledge" and "know-how".

New technology can be exploited to improve teaching effectiveness on both sides. On one hand, using carefully crafted online resources, the network can be a precious tool to achieve the goals of the Self-Regulated Learning approach, with its personalized approach to learning which is not possible in regular classes. On the other hand, the Problem-based Learning approach allows a more involving teaching and learning setting, where the student is more motivated to apply what he is learning.

Since both approaches tend to loosen the teacher's control over the individual learning process, a frequent testing of both the learning level and the ability to solve real problems becomes an important factor of success. However, a continuous assessment is realistic only if supported by suitable IT tools.

Computer-based assessment systems are essential to this purpose. However, most of such systems can offer only a limited support, but a "good assessment" should verify the student's ability to apply his knowledge to solving problems; a "good test" should therefore accept creative answers (even those which significantly differ from the expected ones).

In this work we survey some recent papers (Fiorentino et al., 2009a,b) where, exploiting the distinction between *solutions* and *results*, we obtain computer-based problem-solving environments that gently guide the student to find his own solutions instead of forcing him to reproduce teacher's ones. In Fiorentino et al. (2010) we show how to generalize the methodology to other topics such as physics, computer programming and interactive geometry. In Fiorentino (2010) we take into account teacher's *solutions* to allow the student to fine tune the task difficulty. The student's working environment becomes a sort of computer-based tutor, which is able to suggest hints and evaluate student's solving efforts. In this way the teacher may propose harder problems while keeping the student able to self-tailor the task to his individual competence.

At the time of writing, this work has been accomplished for the problem-solving environments using spreadsheets, database querying, physics, and computer programming.

The paper is organized as follows: in section 2 we recall the *result-driven* problem-solving approach (Fiorentino et al., 2009a,b); in section 3 we report on how we use teacher's *solutions* to get self-regulated problem-solving environments Fiorentino et al. (2010); in section 4 we show some examples of such environments Fiorentino (2010), Fiorentino & Galatolo (to appear); finally, in section 5 we draw our conclusions.

RESULT-DRIVEN PROBLEM-SOLVING

We start with an introduction to the result-driven problem-solving approach aimed to devise "tests" involving non-elementary problems. We focus on problems which allow "operative solutions", i.e. solutions that a computer can "understand" and execute to obtain the corresponding (typically numerical) results. Clearly, a *procedural solution* leads to different *results* according to initial data, but the *solution* itself is typically independent of them. This distinction between (operative) *solutions* and *results* is a key point of our approach.

Open answers and result-driven evaluation

The evaluation of open answers for non-elementary problems requires deep knowledge of the subject and didactic experience; we think that this will stay out of computers reach for a while... The automatic assessment that we propose moves the focus from *solutions* to *results*: we still require a procedural solution as an "answer", but we infer its correctness from the results that it produces. We automatically assess computer executable *solutions* by comparing the student's *results* with those arising from reference *solutions* given by the teacher. We call this a *result-driven evaluation*.

Hierarchies of sub-problems

In order to extend the result-driven evaluation to non elementary problems we adopt the "divide et impera" strategy. The teacher splits the solution of complex problems into a sequence of simpler steps (sub-problems); the student will recover the solution of the original task by solving all the sub-problems.

The splitting will fit our method provided that each sub-problem:

- is "simple enough" provided that all the preceding ones have been solved;
- is "elementary enough" to be assessed by a result-driven evaluation (more about this in the following);
- is given a mark which is a suitable fraction of the whole task score.

The student is therefore asked to solve the original problem by going through the solution of all the sub-problems, proposed as standalone sub-tasks. In solving them the student is free to use any previous *result* and to further divide any sub-problem into simpler ones. A complete assessment of the whole test is given by a result-driven evaluation of the solutions given to all sub-problems. A weighted sum of all the respective marks provides the score for the whole test.

Operatively independent sub-problems

The result driven-evaluation also provides a good solution for two difficulties which usually arise when the solution is obtained through steps.

The first one is about *blocking steps*: when the student is unable to solve an intermediate sub-problem, he may be prevented to solve some of the following (and depending) ones also, thus blocking the overall solving effort.

The second difficulty concerns *error propagation*: a wrong solution given to one of the sub-problems will spoil the results of all depending ones.

Both arguments seem to show that the functional dependencies of the solution steps may spoil the benefits arising from the splitting of the original problem. When solving a sub-problem the student may need to refer some of the preceding ones, but what he really needs are their *results*, not their *solutions*. We remove both difficulties by making all expected *results* available to the student.

The student will overcome all blocking steps by simply referring (teacher's) *results* for any sub-problem he is unable to solve. Moreover, by *always* referring (correct) *results*, the student will also prevent error propagation.

It is worth noting that the availability of the *results* allows the solution of each problem as if all the others had already been solved. All sub-problems become operatively independent, allowing different problem-solving approaches within the same framework. For instance, the student may cover the whole set with a top-down or with a bottom-up approach, without having to wait for the whole solution to be built to check its correctness.

Clearer goals and immediate feedbacks

Misunderstanding of the assignment is a major cause of failure in problem-solving. The outlined approach allows a clearer problem posing because, together with the textual descriptions supplied by the teacher,

the expected results provide a non-ambiguous and concise picture of what the student is asked to obtain. The combined analysis of sub-problem description, input data and expected results clarifies the requirements and allows a dramatic simplification of textual descriptions since many details are immediately grasped with a glimpse of the expected results.

Moreover, the exposure of the expected results allows the student to compare of his own *results* with the expected ones. When his *solution* produces correct results he is encouraged and motivated to keep on working. On the contrary, when the *results* are different, he is challenged to correct his *solution*.

Hierarchical links to recognize

It may seem that the complexity of the original problem is spoiled by the teacher's splitting as a set of simpler sub-problems. However, the fact that the collection of sub-problems is given does not imply that the full hierarchy structure is also supplied. The documentation might describe only the overall problem and each sub-task, leaving to the student the duty of discovering the underlying functional dependencies.

If we think of problem solving as the aptitude to analysis, synthesis and organization, then stimulating the perception of logical interdependencies by giving the collection of all sub-problems, is an effective didactic strategy to nurture such capabilities.

By solving the whole collection of sub-problems, the student proves his knowledge of the subject and his control of the related tool (i.e., a spreadsheet, a database, a compiler, etc.). The student also proves his capability to catch the complexity of the whole problem and his recognition of functional links among the sub-problems.

It is interesting to point out that we may infer, or even force, the recognition of the underlying hierarchy. In fact, having the results of all sub-problems available, the difficulty to solve each sub-problem (using results of the others if required) is just a fraction of the original complexity. On the contrary, solving each sub-problem without exploiting any intermediate result will inevitably lead to a (possibly much) harder work. Recognizing the relations and properly using them might be essential to accomplish the whole task.

Modulation of difficulty

The proposed method naturally provides some tools to modulate the difficulty and allow the "growth" of students' solving ability.

The recognition of sub-problem dependencies may (greatly) simplify their solution. The teacher may therefore modulate difficulty by making this dependency net more or less apparent. The sub-problems collection may be proposed in many ways:

- Dependencies among all sub-problems are plainly shown, for example with a graph.
- The collection is grouped by "levels", i.e., basic sub-problems are listed first (this is "level 1"), followed by those using only "level 1" sub-problems (this is "level 2"), and so on.
- The "levels" may be explicitly shown or not.
- The collection is topologically sorted: each sub-problem may depend only on previously listed ones (thus without a neat "level" separation).
- The sub-problems are randomly listed, leaving to the student the whole task of "sorting them out".

The list is ordered by increasing logical difficulty. Each step requires a quantum leap to the student's capability to find out the relations and thus recover the complexity of the whole test. As student's confidence with the subject increases, the outlined sequence can be adopted as a teaching strategy to foster problem-solving capabilities.

Difficulty modulation may also be obtained by varying problem "splitting granularity". The teacher may break up complex tasks into sets of sub-problems with different average difficulty. For instance, given a fine-grained splitting, we obtain a more difficult one hiding some of the sub-problem and let the student either try to directly solve the remaining ones or split them into smaller ones (thus recovering some "hidden" steps or inventing new ones).

By combining these two strategies, the teacher may accommodate the complexity growth from "toy" to "real life" problems, gradually training students to appreciate, plan and implement complex solutions.

INDIVIDUAL DIFFICULTY MODULATION

In the previous section we analyzed how the result-driven approach may accommodate increasing test difficulty as students improve their solving skills. However those methods work at the class level. In

this section we show how teacher's *solutions* can be exploited within this framework to provide a better student experience (Fiorentino, 2010).

Traditional tests typically fit the average student, with the risk of being either trivial for the most skilled student or almost impossible to solve for the weakest. The "ideal test" should allow each student to tune it to the difficulty level he feels appropriate.

The first steps in this direction are already available within the outlined framework. The result-driven evaluation does not force the student to mimic teacher's solutions; he can pursue his own, provided that it yields the expected results. In our opinion this is very important. The student may find a "good" solution or a "bad" one (in terms of style or efficiency) but, provided that it is "correct" according to our result-driven evaluation approach, it deserves the full mark. We experienced that this is very "rewarding" for the student and essential for his total involvement. The competition to find the "best solution", their comparison among peers, and the final discussion with the teacher, offers endless learning occasions.

Another source of individual customization of the test is provided by the sub-problem independence granted by the availability of all results (see section 2.5). It allows the student to undertake the sub-problems collection in the order he thinks to be easier to deal with. He can select the tasks (he thinks) he will be able to solve, self tailoring in this way the test to his own competency level.

Exploiting teacher's solutions

A good way to individually modulate difficulty is to set up a test with a lot of hidden information and hints, and let the student environment reveal such clues on demand. We tried to achieve this goal improving the problem solving environments to be more assistive both during lab classes and at home.

Emulating the full teacher assistance is out of the reach of computers but, if we limit the assistance to the most that can be prepared in advance, then something can really be done.

In order to understand what the student may need, we recall some of the main causes of failure and the possible remedies. The student may be unable to solve one of the sub-problems for several reasons:

- He may not understand the requirements, even having the textual description and the expected results. Further explanation, or a different restatement of the task, is needed to start up the student.
- He may be unable to correctly place the sub-problem within the network of dependencies. He may be missing the prerequisite steps that make the sub-problem much easier to solve than tackled on his own. In this case more details on the dependencies are precious.
- He may be unable to figure out "structure" of the solution or some of its details. Revealing some information about the teacher's solution may allow the student to continue on his own again.

In the last two cases it seems unavoidable to reveal details of the teacher's solution. It seems unlikely (if

Table 1. Concept analogies in different fields.

	Spreadsheets	**Database Querying**	**Phisycs**	**Computer Programming**	**Interactive Geometry**
Solutions	Formulas	SQL or QBE	(Differential) Equations	Source code	Constructions
Hidden Solutions	Cell-protected formulas	Dynasets as tables	Numerical code	Binary code	Hidden constructions
Results	Numbers, strings,	Recordsets	Values, functions, plots	Outputs	Lines, curves,
Sub-problem Composition	Collections of linked formulas	Queries of queries	Formula compositions	Subroutine calls	Constructions with macros
Development & Research Status	**Done**	**Done**	**Done**	**Done**	**Work in progress**

not even impossible in principle, such as in computer programming) to automatically "understand" why the student's attempt is wrong and provide reasonable hints on how to amend it. So, during the test, when the student is unable to provide his own solution the system will drive him towards the one devised by the teacher.

Along this line, the system should be able to store hints at authoring time and administer them during the test. Such suggestions may be directly provided by the teacher or obtained by analyzing his solutions. In fact, since "operative solutions" are the building blocks of our approach, the authoring system may carefully parse teacher's solutions to automatically extract a whole bunch of clues (we report some examples in the next section).

Finally, by grading all sub-problems and hints (as detractions) the teacher also prepares the way for an impartial automatic evaluation of student's solving efforts. This is accomplished by an assessment module using the result-driven evaluation; it marks the student's solution by automatically comparing student's results with the expected ones, on a range of significant input data. Hints are also exploited to refine the automatic assessment. Each hint is given a "cost" so, when the student asks for one, the corresponding sub-problem score is automatically deceased. In this way the student gets a fair and impartial evaluation of his overall performance which reflects his own skill and competency.

The student working environment is turned into a sort of computer-based tutor able to suggest hints and evaluate student's solving efforts.

SOME EXAMPLES OF RESULT-DRIVEN PROBLEM-SOLVING ENVIRONMENTS

The approach analyzed so far can be applied to many topics, provided that a few basic requirements are met: the topic should suggest hierarchical structured problems; their solutions should be given in a way (language or formalism) that a computer can understand and execute to produce intermediate and final results; it should be possible to neatly separate *solutions* from *results* and hide some of the formers. Table 1 summarizes concept analogies in some areas.

At the time of writing, some result-driven problem-solving environments have been developed along the lines described in the previous sections. We have environments for teaching problem-solving with spreadsheets (Fiorentino et al., , 2009a), database querying (Fiorentino et al., 2009b; Fiorentino; 2010) and computer programming Fiorentino & Galatolo (to apprear). In the next subsections we shortly summarize their main features; we refer the reader to Fiorentino et al. (2010) and to the cited references for in-depth descriptions.

Problem-solving with spreadsheets

The great capacity to organize, analyze and present data in powerful and effective ways makes spreadsheets a great problem-solving tool. However, spreadsheets have been often considered as good 'toolboxes' for tackling problems rather than as didactic resource in themselves. We reverse the process: we exploit their most advanced functions (such as formula hiding, conditional formatting and what-if scenarios) to build a richer didactic environment. In the resulting environment, according to our result-driven approach, the teacher's *solution* is hidden, while the corresponding *results* are always recalculated and available to the students.

We introduce the method using the example shown in Fig. 1 and refer the reader to Fiorentino et al. (2009a) for further details.

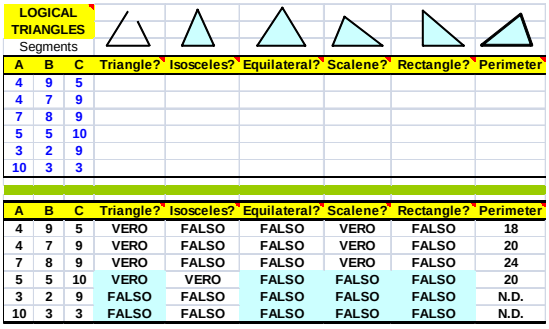

Fig. 1. A simple result-driven spreadsheet example

Fig. 1 shows a very simple problem concerning Boolean functions where, given three segments in columns A-C, the student is asked to provide formulae to check whether each triple forms a triangle, an isosceles one, and so on. The notes (which pop-up hovering the cursor on the red triangles) provide full textual description for each task.

Advanced spreadsheets such as Microsoft Excel or OpenOffice.org Calc provide all the features needed to fully implement the outlined result-driven method:

Problem decomposition. Complex problems may be solved using chains of formulae involving many cells or columns. Even in the very simple problem shown in Fig. 1, some tasks become significantly simpler using previous results.

Operative solutions. A *solution*, valid for all input data, can only be given as a formula and the system automatically recalculates it when its input changes. In the above example the student is supposed to provide his formulae in the upper part of the worksheet. He may not simply provide TRUE or FALSE since the input data keep changing (using the built-in random mechanism)!

Results. These are the calculated values. It is possible to hide the corresponding *solution* (formula) exploiting the built-in protection mechanism. In this way it is possible to hide teacher's *solutions* while always showing the corresponding *results*. There is an example of this in the lower part of the spreadsheet shown in Fig. 1, where teacher's solutions are working on a replica of the input data, shoving the correct results while the formulae are hidden to the student.

Independent sub-problems. The student can refer the values (results) contained in all cells, even those which are protected. In this way he may refer teacher's solutions, bypassing blocking steps and preventing error propagation.

Immediate correctness feedback. The student may immediately check his solution by comparing his results with the expected ones shown below. Any difference is also automatically spotted by the system using the built-in conditional formatting feature.

The system also allows using and assessing more complex features such as pivot-tables and manual operations (recorded as macros). The teacher may prepare hints that the student may ask for during the problem-solving class. Moreover, formulae can be easily parsed to automatically extract hints from teacher's solutions (we will say more on this when describing the next environment).

Finally, the system may check the robustness of student's solutions assessing them using different sets of input data.

Application to database querying

Database querying is a typical problem-solving activity: a complex interrogation may involve many basic constructs as well as several intermediate steps. Database querying is also a setting where all the ingredients of the result-driven approach find almost natural counterparts:

Problem decomposition. Complex queries can be split into query-of-query chains.

Operative solutions. Solutions can be given either as SQL commands or by means of forms such as Query-By-Example (QBE), which is a graphical and more intuitive way to compose SQL code.

Results. These are the dynasets produced by the SQL or QBE solutions and can be shown as simple tables. To complete the picture, we recall that it is straightforward to create a new table containing the dynaset produced by a query; this provides a perfect way to show the expected *results* (dynasets) of each query while hiding the corresponding *solutions* (queries). Teacher's solutions can be used to produce result tables containing the expected recordsets.

Independent sub-problems. When composing solutions made of query-of-query chains, the student may refer the above cited result tables. In this way he may face the query set in any order, bypass blocking steps and prevent error propagation.

Immediate correctness feedback. The student may immediately check his solution by comparing his dynaset with the expected one stored in a result table. Moreover, SQL code can be easily parsed to automatically extract a whole bunch of hints from teacher's solutions.

A problem-solving environment for database querying has been implemented within the Microsoft Access DBMS coding all necessary functionalities within the system. We briefly recall its main features referring the reader to Fiorentino et al. (2009b) and Fiorentino (2010) to obtain further details.

The authoring system

To create a new test, the teacher starts with a standard Access database, a set of data retrieval tasks and composes his own collection of solving queries in the usual way. The authoring system will use this standard Access file to produce a student problem-solving environment where all teacher's queries (the solutions) are replaced by tables containing the corresponding dynasets (the expected results). Within the authoring subsystem the teacher will also give marks and textual descriptions for all the queries (sub-problems).

In order to provide a rich set of hints, teacher's solutions are fully exploited. By accurately parsing SQL code, the authoring subsystem automatically generates several hints *for each query*, covering most database problem-solving aspects:

- Dependency indication, such as the list of tables or, more interesting, the sub-queries used by the query. This will help the student to properly place the query within the solving hierarchy.
- The use of basic query constructs such as used fields, selection criteria, the use of the "Null" keyword, ...
- The use of advanced functions, such as grouping, aggregation functions, asymmetric joins, …
- Querying techniques such as the use the UNIQUE or DISTINCT constraint, result limiting (TOP), Multiple table usage, …
- The teacher's solution itself!

The teacher may exclude or edit any automatic suggestion, for instance, tuning its "cost". He may contribute to the set, providing notes and integrations out of the reach of automatic analysis, such as:

- Alternative textual reformulations of the requirements, to frame the interrogation task from different points of view.
- Textual hints about which construct should be considered first to simplify the task.
- "Structured hints", i.e., partial solutions, given either as sketchy SQL code or as incomplete Query-By-Example layouts, from where students may start solving.
- Alternative solutions showing different solving strategies

As already stated, within the authoring system the teacher is asked to mark queries and rate hint. In the student environment, an evaluation module will automatically assess the student's solution by comparing results, collecting marks and keeping into account the "cost" of all requested suggestions.

The student environment

Upon opening the database produced by the authoring system, the student will find the standard Access environment, with some extra features to help him concentrate on the problem solving activity:

- A new menu and a toolbar, to keep relevant information (relationships, query description, teacher's notes) just one click away and provide easy access to hints administration and the automatic assessment.
- In the "Tables" section of the database window, the authoring subsystem has created a new table for each query; it contains the expected result and it is named after the query with an "xTx" prefix.
- In the "Query" section, the student will find placeholders (empty QBEs) for all queries he is supposed to write. The student will "answer" by editing them and composing his solutions.
  When editing a query, the student can refer result tables. So he may think that all the others queries have been already solved.
- A form showing the textual specification for all queries. It also offers a tab with a textbox where the student may take personal notes.
- The hints form shown in Fig. 2, allows to select the topic, check its cost and, if accepted, accessing its text or QBE.

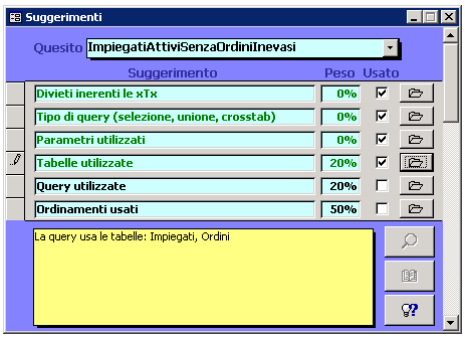

Fig. 2. The hints window

- The student will also find a form to automatically perform a full result-driven evaluation.

The automatic evaluation module will compare the student's dynaset with the expected ones spotting major and minor differences.

Major differences will likely require substantial adjustments to the student's solution. Among these there are:

- Functional issues. The student's query fails to execute.
- Structural differences. The student's dynaset lacks some required fields.
- Set differences. The two recordsets are different.

In all these cases, nothing can be automatically (and reliably) said about the correctness of the student's solution and it is therefore marked as "wrong".

The automatic evaluation also spots some minor differences such as: more columns than expected, the columns are wrongly ordered, columns label are different, columns in the wrong format. These errors lead to score detractions that can be recovered with minor adjustments to the student's solution.

The automatic evaluation also keeps track of all hints given to the student. Obviously, the final score is obtained as the sum of the weights of the solved queries, diminished of the total cost of the accepted hints.

Application to computer programming

Another field, naturally ready for a result-driven approach, is computer programming. Each building block of the method has its natural counterpart in this setting. Source code clearly plays the role of *solution* while object code is its obvious "hidden" equivalent. The outputs are the equivalent of our *results* and can be freely inspected without revealing teacher's solutions. In order to achieve problem decomposition, the main programming task can be divided into smaller functions or subroutines. For each of these, the system may provide only the teacher's object code, which can be used to obtain correct results for any input data.

The student is asked to provide the source code for each subroutine (sub-problem), and is free to call teacher's object code, thus achieving sub-problem independence. The correctness of student's solution is evaluated by comparing the student's output with the reference one produced by teacher's object code.

A new problem-solving environment of this kind has just been completed [5], extending a popular Java IDE which is now open-source: BlueJ. This is a very interesting learning, designed for beginners but it offers some high-level features such as the automatic graphical UML generation from the source code.

Application to interactive geometry

Interactive geometry is another didactically appealing setting where the same approach can be profitably applied. In fact, open source environments such as Geogebra, can easily accommodate all the requirements of our method. In fact, in this environment it is possible to split a complex construction into macro-steps thus achieving problem decomposition.

The *solutions* are the construction steps that the system records and applies in real time whenever any underlying object (point, line, etc.) changes. The *results* are the actual geometric entities obtained by each interactive construction. It will be easy to "hide" some of the solutions while keeping the final results by simply hiding from the student's view the corresponding construction and the visual trace of any intermediate object. Work in this direction has just begun.

CONCLUSIONS

In problem-solving classes the teacher tutors the students comparing their solutions with his own and helping them devising their own. This kind of tutoring is out of the reach of a computer, especially when it comes to judge student's (partially) wrong solutions. We propose a reduced interpretation: a computer can be a partial tutor by fully exploiting teacher's *solutions* and the corresponding *results*.

Within the outlined environment, the student may benefit from different levels of assistance offered by the system:

1. Teacher's results are provided to be inspected and used by the student with all the reported benefits.
2. The system can offer a range of hints covering almost all fundamental solving techniques.
3. The system performs an automatic evaluation of solutions, by comparing students' and teachers' results, keeping into account all delivered tips.

An interesting keynote of the outlined method comes from the fact that it allows tests that are far more demanding and complete than traditional computer-based ones. In fact, we do not simply ask for the result of a given problem but for a *complete operative procedure* to obtain that result, independently from

the actual input data. It will never suffice to “mess up with the data till the solution comes out”. On the contrary, the student is asked to provide a clear, unambiguous procedure that “even a computer” may understand and execute. It is our opinion that this approach fosters those abstraction capabilities without which no topic is really mastered. Moreover, the way the student interacts with the system, getting continuous feedback while iteratively refining his solutions, greatly stimulates his interest and creativity. In this way, the test becomes an occasion to really learn by doing.

A quite interesting feature of the outlined method is that it allows managing not trivial problems, with their collections of linked intermediate solution steps. Thus, it is actually possible to propose to the student realistic examples of applied problem solving. Teacher may use “real world problems” from the very beginning. The problem-splitting phase and the collection of hints help reducing each sub-problem to appropriate difficulty. In this way, students always face interesting problems and learn how to organize “good solutions” by inspecting how the teacher did it. On the other hand, recognizing and engineering all sub-problems contributes to gain problem-solving abilities.

The whole of expected results, hints and automatic assessment produces a problem-solving environment, where teacher’s solution is proficiently used to support the student solving efforts, and the final score automatically produced by the system reliably assesses the student’s capability of applying notions to solution of non-elementary problems. The method configures itself as a paradigm where teaching, testing and learning operate in synergy.

Student environments for teaching problem-solving skills with spreadsheets and databases have been used by the author for years at the Italian Naval Academy in Leghorn. They allow better lab classes where students are strongly engaged and motivated; moreover, the assistance offered by the system allows the teacher to play a better role during lab classes, working much more on individual needs.

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BLOGOSPHERE: COOPERATIVE AND STRATEGIC ASPECTS OF SELF-REGULATED LEARNING IN FORMAL AND INFORMAL SETTINGS

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INTRODUCTION

The role of metacognition in multimedia environments to improve learning, self-awareness and motivation has been well established (e.g., Cassel, 2002; Cuevas, Fiore, Bowers & Salas, 2004; Cuevas, Fiore & Oser, 2002; Kramarski & Ritkof, 2002); Kramarski & Mevarech, 2003). Findings in the fields of multimedia, distance education and metacognition also suggested that using multimedia tools for enhancing a more conscious form of communication should promote more appropriate cognitive processes (e.g. Deaudelin & Richer, 1999; Kramarski & Zeichner, 2001). This can be due to the fact that learning itself seems to be facilitated when words are in conversational style (Mayer et al., 2004). Narratives and shared modalities of online communication can also be seen as forms of "distributed" cognition where knowledge is embedded in situated discourses (Henning, 2003). Moreover, they facilitate the creation of virtual communities (Garza, 2002).

The link among multimedia, metacognition, cognitive processes and "conversational" communication seems therefore able to promote reciprocal cognitive advantages. To better explore such a link, four experimental studies on virtual communication by means of blogs were designed.

We chose to use blogs since they appear to be a suitable tool to work on multimedia and social aspects. Actually, a blog is a website in which items are posted on a regular basis and displayed in reverse chronological order. It comprises texts, images and

links (to other web pages and to video, audio and other files). Moreover, blogs are based on a conversational style of documentation and therefore appear to be an appropriate modality to investigate the link between multimedia communication and metacognition from a "social-cooperative" perspective.

The general aim of this contribution is to illustrate the results of this research and to discuss possible implications and critical issues of our findings.

AIMS

The first study was aimed at exploring bloggers' cognitive characteristics and spontaneous strategic use of multimedia tools (Antonietti, Colombo & Sala, 2008). The second study was aimed at exploring the role of a blog in promoting metacognitive awareness (Sala, Colombo & Antonietti, 2006), while studies three (Colombo & Mugavero, 2010*)* and four (Antonietti, Colombo & Sala, 2008) introduced the effect of on-line cooperative learning.

More in details, in **Study 1 (S1),** the main aim was to explore the link between individuals' cognitive styles and the spontaneous use of blogs. The specific structure of blogs that combines text, images, and links to other web pages, allows to hypothesise a direct connection between the blog contents and the blog owner's cognitive style. Such a connection would be useful especially to take advantages of social aspects linked to cognitive style (Riechmann & Grasha,1982), and for the possible use of blogs in educational context. Moreover, such a link would allow teachers and educators to use blogs not only to promote social skills among students and between students and teachers, but also too work metacognitively on cognitive styles, in an ecological context.

Starting from the relevant information given by the first study, in **Study 2 (S2)** we focused on possible ways to improve a more cognitive oriented use of blogs, intending this as a way of promoting the benefits that this narrative and social environment may have on self regulation learning. To better highlight specific characteristics that could suggest to prefer blogs to other web 2.0 environments, in this study different in-line environments were compared.

Following this line of research related to empowerment, the aim of **Study 3 (S3)** was to investigate the influence of an online narrative environment on the cooperative construction of novels by primary school children. The study had three mail goals: analyse if an narrative online environment building is related with metacognitive skills development; 2) assess metacognitve competence and try to improve it; 3) verify if online cooperative learning promotes metacognition.

The first three studied highlighted how the role of cooperation and self-regulated learning in multimedia environments, especially blogs, required more investigation. Hence, in **Study 4 (S4)** we tried o explore if and how blogs could promote metacognitive awareness and foster more effective problem solving strategies in adults working in non-formal learning setting. We hypothesised that blogs should not only promote more metacognitive awareness and control (and hence more adequate strategies) but also more cooperation among participants. In addition, we also hypothesised that mystery stories written using cooperative strategies (promoted by using blogs) should be better than the ones written in less cooperative environments.

Given these general outlines, and trying to draw a general picture of our research path, we can see how, starting from a perspective focused purely on the assessment of cognitive skills and spontaneous strategic use of those skill in an ecologic environment (spontaneous blog building and everyday running), we moved towards a more integrated approach. In the second set of studies, starting from the lack of metacognitive awareness highlighted in our first investigation, we added some independent variables (see below for details) in order to assess better ways of using blogs to promote metacognition and self regulated learning in young and adults users.

Our independent variables were:

- Use of technologies (presence vs. absence and/or different kinds of web 2.0 environments)
- Narrative thinking (presence vs. absence).

Our depend variables were: level of metacognitive awareness and control; efficacy of SRL and level of cooperation (study 3 and 4). We also explored differences among using blogs in formal and informal learning environments. Different aims are summarised in Table 1.

Table 1. Aims of the four studies, with links to cognitive and metacognitive aspects

Study	General Aim	Cognition	Metacognition (SRL)
S1	Assessment	Cognitive Coherence (internal/ between blog and owner	Metacognitive awareness
S2	Empowerment	Differences among technologies	Promote teacher/students metacognitive skills
S3	Assessment & Empowerment	Influence of blogging on cooperative and language skills	Promote students' MC awareness
S4	Empowerment	Differences among distinct technologies Different form of online cooperation	Promote metacognitive skills

METHOD

The four studies had several aspects in common: they were all aimed at exploring relationships between blogs' characteristics and different aspects of self-regulated learning. Yet, they differed with respect to samples typologies and learning sets (see Table 2 for a general overview).

Table 2. A general overview of samples and learning sets of the four described studies

Study	Typology	Details	Learning set
S1	Adults	50 blog owners	Informal
S2	Adults (teachers) + Children	31 kindergarten teachers + pupils	Formal
S3	Children	57 primary school students (7-9 yrs, exp) +56 primary school students (7-9 yrs, control)	Formal

More differences can be found in specific experimental designs, which will be described in the next paragraph.

In **Study 1** 50 Italian blogs were analysed. Such blogs were divided according to 5 content categories: personally diary, commentary, amusement, political and specific topics (such as cooking, photography, music and so on). The five categories were balanced. Authors were contacted and asked for permission of analysing their blog and asked for their availability to fill in a short questionnaire.

Simultaneously, the SOLAT (Torrance, 1978) questionnaire was put on line to assesses participants cognitive style (right vs. left), in order to be able to match people's cognitive style with the "style" of their blog. Participants were also asked more general questions about how they designed their blog, what they liked best and what they would change about it, their aims in writing a blog, and so on. Such questions were aimed to explore metacognitive awareness.

Data from questionnaires had been matched with blogs' analyses. Blogs have been analysed according to different variables: use of images (e.g. number of images, images typology, according to Mayer (1993) and their classification – decorative, representative, organizational, explanatory); relationship between text and images; posts' content; main emotion communicated by the post; self-indicators.

With **Study 2** we moved toward an empowerment perspective. Participants (kindergarten and primary school teachers and undergraduates) were divided into four experimental groups characterised by different forms of communication and different levels of multimedia use - paper communication (PC), computer communication (CC), email communication (EC) and blog communication (BC).

Participants were tested to assess the level of their metacognitive competences in order to form homogeneous sub-groups. No differences appeared from this pre-analysis, therefore the participants were assigned randomly to the four experimental groups and than were asked to plan a computer based activity to be elaborated with their pupils. The PC group wrote the narration in a pen and paper modality. The CC group was asked to write it on a computer (using a word editor and being free to use multimedia objects, like clip arts or pictures). The EC group was asked to write their narration as e-mails and to send them to people of the same group. They were free to answer or not to other mails, and to add multimedia features to their messages. For the BC group an online blog where they could write their narration was

created and participants were instructed on the instrument's facilities. A fifth group served as control group, not being involved in any form of narration, but only attending to the pre- and post-test. Each sub-group had to write down a report of the activity, using the particular medium of his own group and according to three phases: Planning (aims, steps, materials…), Performance (the actual evolution) and Conclusions (assessment, discussion, perspective).

All the written texts produced by the four experimental groups were collected and analysed according to the following three main criteria:

1. Mental verbs: number of mental verbs, which reveal the level and the quality of reflexivity and metacognitive competence, used by teachers and by children.
2. Language use: the style of communication, referring to content, medium, social/emotional context, used by the sub-groups
3. Metacognitive strategies: number and typologies of strategies used by teachers and by children.

To ensure the homogeneity of the examined contributions, and given different lengths of the teachers' writings, the mental verbs used in the first two pages of the three research steps for each sub-group were counted.

In **Study 3**, our sample was composed of 113 children (age 7-9 years), equally divided into experimental and control group. The experimental group was asked to create a narration in collaboration with children of other schools, by using a shared blog. The control group wrote a similar narration without using an online environment. Both groups basically had the same assignment and worked cooperatively.

To facilitate writing, it was decided to divide the narration into four step (beginning, crisis, development, solution). In the experimental group, each phase was, in turn, initiated by a class, continued in the second and finished in the last one. Productive work, in addition, was always accompanied by a metacognitive activity during which students were asked to answer a series of reflective questions related to their work. The same metacognitive prompts were proposed to the control group after each phase.

The operative part was preceded by a pre-test (Antonietti & Sala, in press) designed to assess the metacognitive competence (starting level), naive theories on cooperation and groups, and cooperative skills (baseline). The same test was repeated at the end of the project (post-test) to assess the effectiveness of the intervention. In detail, were used metacognitive self-assessment questionnaires and tests of cooperative work (through the composition of original drawings from a defined number of geometric shapes, and respecting the basic rules for group role management), with individual and group assessment.

Concerning the narrative task performed by pupils, we analysed the texts produced (the blogs for the experimental group, and the narrations both for experimental and control group).

Concerning the blogs, we evaluated the presence of self indicators (Bruner, 1998):

— Indicators of coping (action, commitment, resources, evaluation and consistency);
— Reflective indicators (quality, reflexivity, mental verbs);
— Indicators of social self (social referencing and location).

Concerning the narration, we considered the same self-indicators; in addition, we evaluated the narrative complexity, taking into account the length of the tale and the presence and type of morality indicators.

106 adults (mean age: 40.80; SD=12.75; Male = 56%; Female = 46%) joined **Study 4**. They were randomly split into 4 experimental groups and asked to write a mystery based on given characters in fifteen days. They were given specific clues to turn a "simple" creative task in a problem solving task: they were asked to respect specific temporal bounds, use given characters, write an humoristic but realistic plot.

In order to examine the role of different kinds of virtual environment and forms of communication in metacognitive awareness and problem solving strategies use we created the four specific following subgroups:

- Blog Group, asked to solve the problem cooperatively on a blog devised for the research;
- Forum Group, asked to solve the problem cooperatively using a web forum (without the narrative and multimedia aspects which are peculiar of blogs);

- Mail Group, asked to solve the problem cooperatively exchanging mails through a mailing list;
- Control Group, asked to solve the problem individually and send the solution to the researchers by mail.

Before and after the task participants were asked to fill in the Metacognitive Awareness Inventory (Schraw & Dennison, 1994) and then, after writing the mystery, they were also invited to rate their work considering both their cognitive and practical performance. They both rated different aspects of their performance on a 5 point scale and answered to open questions.

Table 3. General overview of the four studies' methods and focused

Study	Method (general)	Focus on…	Instruments
S1	Blog (content) analysis	Cognition (content, use of image) Emotion (content) Metacognition (Self indicators, coherence)	SOLAT Metacognitive interview
S2	Blog (content) analysis	Cognition (language) Metacognitive (mental verbs, strategies)	
S3	Blog (content) analysis + Product analysis	Cognition (product quality) Metacognition (Self indicators, awareness)	Cooperative Assessment (Pre-Post)
S4	Blog (content) analysis + Product analysis	Cognition (product efficacy) Metacognition (Self indicators, awareness) Cooperation (Indicators)	MAI Metacognitive Interview

Meanwhile, mystery stories were rated from five external judges (adults with BA degree in different majors, fond of mystery stories) on five dimensions (humour, coherence, skilfulness, originality, overall evaluation) on a seven-point scale. Participants' interactions (in the three experimental groups) were analysed according to metacognitive and strategic aspects, such as anticipation, planning, monitoring, decision making, use of strategies, and cooperative aspects, relating to questions, suggestions, answers, proposal acceptances, agreement/disagreement, aim interdependence, task interdependence, role interdependence, socio-emotional interdependence.

Instruments and Data Analysis

Trying to summarize the research path traced by the four experimental studies we can highlight a common focus on blog analysis, and differences concerning specific aspects on which each study concentrated. As can be noticed in Table 3 – different studies addressed different variables linked to cognition, metacognition and cooperation. Those aspects will be addressed specifically in the results section.

The data were analysed using both qualitative and quantitative methods, as summarised in Table 4.

Table 4. General overview of data analysis methods

Study	Qualitative	Quantitative
S1	Text analysis	ANOVA Cross Tabulation
S2	Text analysis	Cross Tabulation
S3	Text analysis Content analysis	Paired sample t-test Cross Tabulation
S4	Text analysis Content analysis	ANOVA MANOVA Cross Tabulation

RESULTS

Cognition

In **Study 1**, it was possible to highlight a general coherence in the use of cognitive aspects – linked to the use of multimedia elements and language use according to different topics. Also the emotional content of different posts was coherent with declared aims of the different blogs.

More in details, a first difference emerged in the use of Decorative images ($F(4, 42) = 3.00$, $p<.05$) among the blog categories. Post Hoc Turkey-HSD showed a significant difference between Political and Amusement blogs, where the latter used more

Decorative images. As could be easily expected, strong differences emerged considering posts' content. More in details: Topic posts were more frequent among Topic blogs ($F(4, 42) = 21.02$, $p<.001$); Autobiographical posts were more frequent in Personal and Topic blogs ($F(4, 42) = 24,72$, $p<.001$); Commentary posts were more frequent in Political and Commentary blogs ($F(4, 42) = 10.05$, $p<.001$). Reflective posts were more common in Political blogs than in Personal, Topic or Amusement Blogs ($F(4, 42) = 4.59$, $p<.001$); Amusement posts were more common in Amusement blogs than in other blogs ($F(4, 42) = 3.82$, $p<.001$). Different blog categories appeared also to communicate different emotions. Positive emotions (such as joy or happiness) were more present in personal, Amusement and Commentary blogs ($F(4, 42) = 18.71$, $p<.001$). Sadness and delusion were more present in Personal and Commentary blogs ($F(4, 42) = 13.08$, $p<.001$). Anger was found more in Political blogs ($F(4, 42) = 6.07$, $p<.001$). The use of self-indicators (coping, reflective and social self – indicators) was also found to differ among categories. Coping self-indicators were more present in Personal Blogs, and less present in Political and Topic blogs ($F(4, 42) = 25.65$, $p<.001$). Reflective self-indicators were more present in Personal and Commentary blogs ($F(4, 42) = 7.30$, $p<.001$). The same was true for social self-indicators ($F(4, 42) = 14.31$, $p<.001$).

In **Study 2,** analyzing language use, differences in the communicational style emerged only in the blog group (64% on content, 26% socio-emotional context style and 10% on medium) – whereas the other sub-groups focused only on contents closely related to the task. Blog and computer use were the sub-group where the highest use of strategies in children was recorded (BC Group: 33%; CC: 45%).

Data derived from **Study 3** highlighted a strong use of coping strategies in blog users (42% of the total presence of self indicators), and more cognitively complex narrations in the experimental group: in the experimental group the length of the narration ($t(12)=13.44$; $p<.001$) and its level of complexity ($t(12)=8.40$; $p<.001$) were much higher than in the control group. Moreover, most of the experimental group reported in the post test to have followed a procedural strategy, while the control group followed a non sequential path to solve the task (χ^2 (5, $N=99)=16.92$; $p<.01$).

In **Study 4** the external evaluation of the narration pointed out more internal coherence in the blog group ($F(3,16)=3.25$; $p<.05$); while the interaction analysis highlighted how the task interdependence was more present in blog users (χ^2 $(20)= 46.60$; $p<.001$). Hence, blog clearly promotes strategy use and cooperation among users. Interdependence appears to be the aspect more influenced by blog structure.

Metacognition

In **Study 1**, coherence among blog contents and users' objectives could be found: writers of Political and Topic blogs declared to have as a main objective to give people clear and complete information, while the others tended more to entertain their readers (χ^2 $(4, N = 46) = 15.99$, $p < .05$).

No other significant relationship between users' answers and blog categories could be found, highlighting a lack of metacognitive awareness, concerning strategies that were actually found to be effectively used by blog writers. In addition, no coherence between cognitive style and any blog characteristic could be found.

Concerning data derived from **Study 2**, considering the use of mental verbs in the different texts, differences among sub-groups emerged. On the whole the blog group (BC) and the computer group (CC) seem to use more mental verbs (BC: 39%; CC: 36%). Analysing separately teacher's use and children's use of mental verbs – it is clear that in the blog group more mental verbs were used by children (57%), while in the CC teachers used them prevalently (43%). Exploring teachers' use of metacognitive strategies, BC seem to promote more metacognitive awareness (28%), while teachers of paper communication group (PC) seem to spend more time questioning (48%). CC appear to be focused on metacognitive control (44%). Moreover, BC seem to promote metacognitive awareness (35%) and control (31%) in children.

In **Study 3**, the experimental group reported more perceived utility in a cooperative task ($t(48)= -2.09$; $p<.05$) – highlighting how they became more aware of the role of each individual within the group, as required by the principle of the positive interdependence of cooperative learning. They also evaluated more realistically the effectiveness of group cooperation ($t(48)=2.06$; $p<.05$).

As for the metacognitive questionnaire, the control group did not find anything difficult in performing the task while the experimental group was able to identify specific and realistic difficulties at some stages of the procedure (χ^2 (3, N=99)=10.83; p<.01). This highlights how the pupils who have been working with the blog were able to reflect on their work and implement specific metacognitive strategies.

In **Study 4**, considering the answers to the *Metacognitive Awareness Inventory,* Blog users' scored significantly higher in the post test in the subscales regarding information management strategies (t(6)=2.07; p<.05) and conditional knowledge (t(6)=2.4; p<.05). Hence, writing cooperatively in a blog appears to promote the development of metacognition**.** The most influenced aspects are linked to regulation of cognition. Blog users also rated themselves better than others on each strategic and cognitive dimension (see Table 5). Yet, it is important to stress how, even if participants appear to be aware of the efficacy of their cooperation (forum users were aware of the failure of their team), they tend to underestimate their product (in comparison to external judgments) if the cooperation is not good (Forum and mail) and to overestimate it if they perceived the cooperation to be good (Blog).

Table 5. *Differences in participants' self evaluation*

Dimensions	F(df)	*p*
Time managing	4.12 (3,21)	<.05
Engagement	5.75 (3,21)	<.01
Result	45.82 (3,21)	<.001
Plot	5.95 (3,21)	<.01
Coherence	7.18 (3,21)	<.01
Humour	10.61 (3,21)	<.001
Narration	20.61 (3,21)	<.001

CONCLUSIONS

Differences between children and adults in SRL

Reflecting on the results derived from the four studies, we would like to point out the main differences which emerged between adults and children in the self-regulated environments, as a response to blog use.

In both sub-samples we noticed an improvement of metacognition due to the use of blogs, yet while adults improved metacognitive awareness, children improved metacognitive control.

Adults appear to be more open to social aspects promoted by Web 2.0, while children respond more promptly to empowerment of coping strategies. Adults may run the risk of idealizing social networks and their potential, including cognitive benefits. Children, by contrast, seem to become more realistic after working in a Web 2.0 environment - becoming more able at assessing objectively their competence in co-operation tasks.

When planning empowerment projects it will therefore be worthwhile to focus on the empowerment control when working with adults, and on metacognitive awareness when working with children.

Toward an effective empowerment of SRL

The four studies presented in this chapter were aimed at exploring the influence and role of different variables in promoting SRL while using new technologies in formal and informal learning environments. Several points worth of interest emerged from a comparison of these four works.

It is possible to draw an ideal continuum line defining the influence of different variables taken into account, putting into consecutive order the influence and interdependence of various factors. The first point of interest is the confirmation that the mere use of technology is not sufficient to promote cognitive and metacognitive benefits. The use of Web 2.0 environments such as blogs, which, as we have seen, have an optimal structure in terms of flexibility of multimedia and cognitive structure, seems to promote a spontaneous use of appropriate cognitive strategies. However, those strategies are not accompanied by any metacognitive skills. Hence, an appropriate metacognitive level support will be a useful first option to improve the effectiveness of SRL. However, to maximize the effectiveness of such a path of empowerment, our data pointed out how crucial the narrative role of the organization of content is, which is allowed and facilitated by blogs. Moreover, cooperation appears to be important, not only for the acquisition of cooperative skills but also to optimize the acquisition of metacognitive skills.

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GROUP AWARENESS IN TIME-ON-TASK REGULATION IN COMPUTER SUPPORTED COLLABORATIVE LEARNING (CSCL)

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KEY WORDS

Group awareness, Time-on-Task, Computer Supported Collaborative Learning, Computer Learning Environement, Online Learning, Computer Mediated Communication.

INTRODUCTION

Students engaged in online Computer Supported Collaborative Learning (CSCL) could collaborate from different locations worldwide. In this distance situation, the perception of their team mates' state and activities would be mediated by the Computer Learning Environment (CLE). In this mediated context, students need to regulate their time-on-task both individually and collectively, considering the different temporalities of the other group members. For this reason, they need to develop a group awareness about their team mates' temporalities. Group awareness is defined by Dourish and Bellotti (1992, p.107) as "an understanding of the activities of others, which provides a context for your own activity". The group awareness of the team mates' temporalities could then by defined in the context of CSCL activities by the students' understanding of the temporalities of the other team mates' of the group (time use and time-on-task patterns, temporal availabilities, morning / evening orientation...), which provides a context for the students' own time use and regulation. In the specific context of online CSCL situations, where students are distributed in different locations and even located in different time zones, the temporal group awareness, as the intersubjective perception of the team mates' temporalities, is essential for the regulation of the activity, both at the individual and the collective level. It allows to infer the team mates' information needed to develop the subjects' own activity and facilitates the coordination of tasks and behaviours at the collective level. In this chapter, we will discuss the relevance of the temporal group awareness information, and the way this intersubjective temporal understanding allows the students to better self regulate and co-regulated their temporalities within the CSCL task.

For developing this group awareness in a distance mediated situation, they should have enough

information about their team mates to have a correct perception of their temporalities. However, the use of computer supported tools limits the perception of the team mates' activities to those reflected by the CLE. Considering the need of supporting the group awareness development through the reflection of the students' activity, we designed a Collaboration Awareness Tool (EuroCAT). The EuroCAT aims to enhance the mirroring capabilities of the CLE by inviting the students to declare individually their present and prospective time use and activities, and then publishing this information in a collectively shared display for all the students of the same group. This shared display is intended to support the students' time-on-task regulation individually and collectively, by enhancing the students' group awareness about their team mates' temporalities.

TIME-ON-TASK REGULATION IN ONLINE CSCL

The time-on-task has been considered one of the essential factors to understand the learning process (Biderman, Nguyen & Sebren 2008; Crawford, 1990). In collaborative learning activities, the time-on-task includes not only the individual tasks but also the coordination of the individual and collective tasks at the group level and the regulation of each team mate's time-on-task according to the group organization. Time-on-task regulation in collaborative learning activities not only depends on individual decision making but involves a collective analysis of the activity's objectives, strategic planning and a collective decision making considering the interests of the group.

In online CSCL, the team mates collaborate together from different locations, even from different time zones worldwide. This Computer Mediated Communication (CMC) situation makes it impossible for students to perceive directly their team mates' time-on-task and their time zones. The information about their team mates' time-on-task and time zones comes then from inferences made on the basis of the information exchanged during the students' interactions and the awareness cues available on the interface of the CLE.

Following this, we analyze the development of the inter-subjective perception of the team mates under the term group awareness, and its relevance in the context of online CSCL.

GROUP AWARENESS

The term group awareness refers to the inter-subjective perception of the state and activity of the team mates, allowing the subject to have a context for his own activity (Dourish and Bellotti, 1992). The group awareness is essential for the regulation of the activity, both at the individual and the collective level. It allows to infer the team mates' information needed to develop the subjects' own activity and facilitates the coordination of tasks and behaviours at the collective level. This collective consciousness can help to identify, understand and anticipate the actions of the team mates, which facilitates the coordination of the group (Gutwin, Stark & Greenberg, 1995; Gutwin & Greenberg, 1996).

GROUP AWARENESS IN ONLINE CSCL

In online CSCL, the team mates can collaborate from different locations worldwide. In this distributed context there is a lack of shared context between them. In these situations, the understanding of the team mates' states and activities (the group awareness) is inferred through the interactions of the team mates' and the awareness cues (Oulasvirta, Petit, Raento & Tiitta, 2007) that could be perceived in the CLE. The mirroring capabilities of the CLE are based on the awareness cues available for the students to infer their team mates' state and activity. In that sense, the mirroring properties of the CLE are determined by the quantity, accessibility and relevance of the awareness cues with respect to the organization of the specific collective activity carry out by the students (Romero, 2010).

The lack of consideration of the principles of the group awareness development process in online CSCL allows understanding the weak support of the awareness cues that are, by default, considered in the CLE. Only a part of the team mates' previous states and activities is mirrored by the interface of the CLE. This lack of mirroring properties could lead to an underestimation of the team mates' contribution to the collaborative activity, but also a lack of coordination in their actions.

GROUP AWARENESS SUPPORT IN CSCL

Considering the importance of the group awareness development in online CSCL, we can consider different ways to support the development of the group awareness in online CSCL. According to

Schmidt (2002), there are two stages in support of group awareness. The first one is "displaying" the information that could allow the students' to develop their group awareness. The second one is "monitoring" which refers to the process of being aware of the other team mates' information. Although the CLE could display the awareness cues of the team mates, the students' should be able to perceive and interpret these awareness cues before using them for regulating this activity.

Group awareness support in CSCL leads to different strategies for increasing the quantity and quality of the awareness cues. The process starts by identifying the relevant awareness cues for the online CSCL activities. The relevant awareness cues are those that contributes to the inter-subjective understanding of the team mates' activities, providing context for the own activity (Dourish & Bellotti, 1992). Once these awareness cues are identified, the mechanism of displaying should be analyzed according to the CLE. Some of the CLE could be configured to provide a greater number of awareness cues, but in most cases an ad hoc development is required. The specific development of group awareness features had lead to the development of the Group Awareness Widgets (GAWs). Kreijns & Kirschner (2002, p.1) define the GAWs as "software tools which provide a learner with an awareness of other learners and which also enables him/her to initiate communication episode with them". The GAWs was mostly designed with a specific group awareness support purpose. During the last years, a considerable number of GAWs has been released and analyzed in the field of CSCL, such as the Radar and Reflector tools by Phielix, Prins & Kirschner. (2010) or the GKA tool (Dehler, Bodemer, Buder & Hesse, 2009). However, none of theme directly focus on temporal cues supporting team mates' time-on-task awareness. The development of such cues is the aim of the Euro-CAT.

DESIGN PRINCIPLES OF THE EURO-CAT FOR SUPPORTING THE GROUP AWARENESS

We consider the specific students' needs in online CSCL, including the information about the team mates' time-on-task and time zones. On the basis of these needs and the lack of support in current CLEs we considered the importance of developing and analyzing the impact of a GAWs supporting not only the awareness of the main states and activities of the students, but also a specific awareness based on time-on-task declaration and time zones differences. With this objective, the GAW EuroCAT was developed considering two phases in the creation of the temporal awareness cues for the students. The first one is the students' temporal patterns declaration and the second one is the displaying of the shared collaborative information in a timeline.

TEMPORAL PATTERNS DECLARATION

Students' temporal patterns refer to the activities' structures appearing periodically within a given temporal rhythm (Demeure, Romero & Lambropoulos, 2010; Romero, 2010; Valax, 1986). Temporal patterns facilitates the understanding of past events and the anticipation of future actions (Valax, 1986), allowing students to regulate their time-on-task individually and collectively according to their own temporal pattern and the perception of their team mates' ones. In the Euro-CAT, the temporal pattern declaration considers the distinction between the working days and the temporal patterns on week-end (Fraisse, 1963). For each day, students declare the time use according to a taxonomy of ten categories of activities, based on a simplification of the first-level activities of the International Classification of Activities for Time-Use Statistics (ICATUS, 2000). Only the activity coded as "Learning" in the ICATUS was split into two different categories corresponding to online learning and face-to-face learning. After adapting the ICATUS, the activities the students' could declare in the EuroCAT were (1) Online learning, (2) Face-to-face learning, (3) Work outside home, (4) Work at home, (5) Home & Family, (6) Personal & Free time, (7) Social activities, (8) Sleep & Relax, (9) Meals, (10) Travel & Commute. Those activities could be declared as the main activity or as a secondary activity in both the working day and week-end temporal patterns.

Figure 1. EuroCAT Time use declaration for the working days and week-ends

The initial temporal pattern declaration of a standard working day and week-end day is then duplicated to all working day and week-end day for the whole CSCL activity's duration. However, students are allowed to modify this time-line at any moment and for any day of the activity.

DISPLAYING OF THE COLLABORATIVE TIMELINE

Once the students have declared their individual temporal patterns for the working days and the week-end days in the Time Use screen, they can visualize the timeline screen.

Figure 2. Display of the collaborative time-lines on the Euro-CAT.

The timeline screen allows the collective visualisation of the temporal patterns of all the students of a group simultaneously. The reference time zone for the display of this shared information is the hosting university time zone. For the students situated in different time zones, the current time for each student in this country is displayed in the profile.

Figure 3. EuroCAT support and display of the time zones differences in the hosting university and the students' time zones.

The visualization of the time zones differences allows the students' to contextualize the temporal patterns differences. In the group displayed in the Figure 3, the current time for the first two students is 4:25am, for the third student 10:25am. The 6 hours of difference in their time zones is then displayed allowing the students to infer and interpret the awareness cues of their team mates' during the CSCL activity according to their time zone.

TIME-ON-TASK REGULATION IN EURO-CAT

We assume that, in CSCL activities, students should organize collectively their time-on-task according to the task requirements and their own temporalities. Despite the initial declaration of the students' temporal patterns, they can modify them during the whole activity at two levels. The first one is the modification of the temporal pattern of the working days and week-end days. A modification at the pattern level will produce a modification in the instances of all the days of duration of the CSCL activity. The second level of modification is the daily level, allowing the students' to adjust their time use declaration for each of the days of the activity regarding their actual time use. Those changes during the activity are time use regulations responding to individual or collective regulations. The evolution of the time use declaration along the duration of the CSCL activity is expected to represent the collective changes the students agree upon for the organisation of their collaborative activity. Further analysis based on the students' time use changes in the temporal pattern declaration at the activity level and the daily level are currently conducted with two main objectives. The first one is to understand the time-on-task regulation at both individual and collective level in online CSCL activities. The second one is to analyze the impact of the GAW EuroCAT in the facilitation of the perception of the team mates' temporal patterns and in the collective regulation of the time-on-task.

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SELF-REGULATED LEARNING AS A CONCEPTUAL FRAMEWORK FOR LEARNING WITH AN E-PORTFOLIO TOOL

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INTRODUCTION

The evolution of high performance computing and communication is shaping the global knowledge society. As technologies are cloud-based, resources are easily accessible, projects are structured in collaborative manner and people can work, learn and study whenever and wherever they want to (Johnson, Smith, Willis, Levine, and Haywood, 2011). This means that education should prepare students to become workers and citizens by providing and enhancing their skills and competencies[1] (Ross, Morrison & Lowther, 2010; OECD, 2009).

The 21st century workforce needs both "hard" skills (in traditional disciplines, such as, reading, mathematics, science) as well as "soft" skills (analyzing information, teamwork, digital media literacy and presentation skills) (Shute, Zapata, Kuntz, Levy, Baker, Beck & Christopher, 2009). From this point of view, education should support students to develop vital skills of high-technology world such as solving complex problems, inquiry reasoning, disciplined thinking and teamwork (Ross et al, 2010). An important issue is 'Which educational solutions should be proposed in order students to acquire these skills quickly, to engage in new learning approaches enthusiastically, to select the technologies and learning environments that best meet their needs and to understand how to transform these into knowledge to solve problems in their life?' (Conole & Creanor, 2007).
Especially, tertiary education should accommodate the growing diversity of qualifications and

[1] It is argued that the concept 'competence' is broader and may actually comprise skills (OECD, 2009), it involves the ability to meet complex demands (including skills, attitudes and values) in a particular context. In practice the concepts, competencies and skills, used depending on the importance attributed to them or interchangeably or with different definitions (Ananiadou & Claro, 2009; Voogt & Roblin, 2010). For the purpose of this paper, we select to use the term 'skill', as a fundamental concept of individual's attributes.

expectations of students (graduates, workers, citizens) (OECD, 2008) and follow the rapid proliferation of information, software tools and devices (Johnson et al., 2011).

Based on the emerging technologies, we introduce the electronic portfolio (e-portfolio) as an innovative tool in the e-learning armoury and as a monitoring tool of the learning process in order to support self-regulated learning skills to promote academic and professional progress.

We examine the potential of the e-portfolio as a learning tool which is supported by a pedagogical framework. Firstly, we highlight the advantages of the tool: e-portfolios are dynamic in nature (Barrett,2000), encourage learners to become active, set goals for learning, engage in self-reflections and assume responsibility for their own learning (Barrett,2004), promote learner self-evaluation (Bull, Montgomery, Overton, & Kimball, 1999), support students to make career decisions and promote themselves professionally (ePortConsortium, 2003). Secondly, e-portfolios appear as powerful instruments to monitor transversal competencies, which meet the 'soft' domains of the pedagogical framework of self-regulated learning (Carneiro, Lefrere & Steffens, 2007). We emphasize on this theory as helps learners to control their own learning experiences by organizing and rehearsing information, monitoring their thinking process, seeking help, holding positive motivational beliefs (Boekaerts, Pintrich & Zeidner, 2000; Schunk & Zimmerman, 1998).

According to the literature, the potential of e-portfolios for supporting lifelong professional learning is still being explored (Lamont, 2007). An open issue for further discussion and research is how individual gain institutional digital skills through the implementation of individual's e-portfolios (Jokinen, Kairamo & Rissanen, 2006). Furthermore, it is identified a gap in the research around the development of e-portfolios in tertiary education considering the integration of Web 2.0 technologies (Attwell, 2007; Roder &Brown, 2009) and in spite of the widespread use of blogs, e-portfolios and social software there is still the need for reports and analyses in order to validate the educational outcomes (Zdravkova, Ivanović & Putnik, 2009).

To sum up, the question is: 'How an innovative e-learning tool like e-portfolio could facilitate self-regulated learning skills in tertiary education empowering students as active learners to enhance their academic skills (such as hard and soft skills knowledge, problem solving skills, time management skills, communication skills etc)?' To this end, we propose an e-portfolio as a flexible (web 2.0) applied e-learning tool according to the self-regulated learning theory as a solid framework to enhance 21st century demands.

THEORETICAL BACKGROUND

Firstly, we analyze major aspects of e-portfolios such as definitions, purposes, implementation issues, technologies and pedagogies. Secondly, we emphasize on self-regulated learning as a vehicle for academic development. Thirdly, we highlight the potential of aligning self-regulated learning with the specifications of e-portfolios.

E-PORTFOLIOS: DEFINITIONS

Research on e-portfolios demonstrates diversity in the terms used for the definitions, the purposes, the processes and the implementation issues.

The European Institute for E-Learning (EifEL) defines e-portfolio as a personal digital collection of information that describes and illustrates learning, career, experience and achievements (Slaatto, 2005). In other words, e-portfolio uses technology and serves as a repository, which allows students / teachers to collect and to organize artifacts in many forms (audio, video, images, text), to use hyperlinks, to organize material and to connect elements with the appropriate outcomes, objectives or standards (Barrett, 2005). The aforementioned definitions of e-portfolio focus on the concept of digital collections of artifacts. Our intention is, to highlight the dynamic nature of e-portfolios and to explore their potentials as a flexible applied e-learning tool, in order to enhance hard and soft skills. To this direction, the IMS ePortfolio SIG specifies e-portfolio as a product, which is produced when individuals select, collect, reflect upon, interpret and provide personal evidence to support their learning, reflection or interpretations which are presented at an audience (Cambridge, 2003).

Based on the aforesaid definitions, we could summarize on our working definition: e-portfolio is a digital collection of information where individual collects, selects, creates, reflects upon, interprets, evaluates, targets on specific audiences and includes

accredited evidence for lifelong learning and skills of individuals in academic and professional context.

E-PORTFOLIOS: PURPOSES

E-portfolios are used to satisfy different requirements and emerge a number of issues such as: ownership, multimedia components, reflection, evidence and multiple representations, which determine their content (Barrett, 2005). In other words, there is a need to define the objectives of e-portfolios in order to enhance their effectiveness. IMS Global Learning Consortium, an organization that supports standards and good practices in learning and educational technology has identified 6 main types of e-portfolios (IMS, 2005): assessment, presentation, learning, personal development planning, multiple owner and working e-portfolio. This classification indicates that e-portfolios are used to satisfy different requirements and cover multiple purposes for the construction process.

E-portfolios can be utilized by learners (students, preservice teachers, educators) while studying (Sherry & Bartlett, 2005), by graduates who seek a position in the workplace (Milman & Kilbane, 2005) and institutions for programme assessment or accreditation purposes (Lorenzo & Ittleson, 2005).

Assessment e-portfolios

E-portfolio can be an instrument for recording authentic learning experiences since it allows students to collect different kinds of information (Stefani, Mason και Pegler, 2007), so it adjusts to the idea of authentic assessment and learning (Veugelers & Kemps, 2004; Elton & Johnston, 2002). It is argued that e-portfolio demonstrates the assessment process as a formative or authentic assessment (Barrett & Carney, 2005). For evaluating e-portfolios, the more common method is rubrics (Buzzetto-More & Alade, 2008).

Learning e-portfolios

Learning e-portfolios can be used in all educational levels. Encourage metacognition also support students to develop organization skills, to recognize how the skills developed over time, to take decisions, to present the required learning, to promote themselves properly (ePortConsortium,2003; IMS, 2005). The use of e-portfolios as a learning tool considers major issues: Engagement, Reflective Learning, Goal Setting, Peer and Self Assessment and Communication Skills (Stefani, Mason & Pegler, 2007).

Teaching e-portfolios

Teaching e-portfolio represents the means of demonstrating teaching skills and values of individuals in the context of teachers' training (Young & Lipczynski, 2007), facilitates reflective capabilities and supports the development of personal learning histories (Finger, 2005). It is a tool that creates opportunities for connection, collaboration, reflection and evaluation (Australian ePortfolio Project,2008; Sherry & Bartlett, 2005; Montgomery,2002). It is argued that the creation of e-portfolio can be a useful approach for authentic professional development (Milman&Kilbane,2005; Young& Lipczynski,2007).

Personal Development Planning E-portfolios

Generally, personal development planning (PDP) is a structured and supported process which is followed by the student so as to reflect on his learning, performance and / or design of training and professional development (QAA, 2009). Personal development planning e-portfolios combine the idea of informal learning, lifelong learning and personal learning environments (Attwell, 2007; DfES 2005). E-portfolios cover learning, performance and achievements records of individuals (IMS, 2005) also are considered as a powerful tool in the field of continuing professional development (Continuing Professional Development-CPD) especially in medical and educational professions (Attwell, 2007).

E-PORTFOLIOS: IMPLEMENTATION ISSUES

The implementation of an e-portfolio is very important and is directed by the purpose of e-portfolio and the decisions about the software, the platform or the tool. Specifically, e-portfolios in tertiary education are separated according to their uses and applications: course, programme and institutional e-portfolio (Stefani et al., 2007). The implementation of an e-portfolio is a multilateral process that relates to various stakeholders and results in the need for a common vision.

It is argued that e-portfolios need to find a balance between structured detailed plans, which support learning through the process of construction and as open, self-directed tools which encourage students to organize their learning (Barrett & Knezek, 2003). Challis (2005) suggests that e-portfolios should be integrated throughout the learning process. Students

should be introduced into the e-portfolios rationale and to understand the exact reasons of e-portfolios implementation (Chang, 2005; Klenowski, Askew, & Carnell, 2006). The purpose of the e-portfolio should be aligned to the curriculum and its objectives (Strudler & Wetzel, 2005). In the literature there is a lack of formal development methodology e-portfolio systems (Buzzetto-More & Alade, 2008). Academic institutions should provide and support electronic services, academic staff should be capable of integrating e-portfolios processes in the design of the course and students need a range of skills so as to develop an e-portfolio and to become successful in the workplace (Stefani et al., 2007).

Stefani, Mason and Pegler (2007) suggest a purposeful plan for the implementation of e-portfolios which includes specific issues:

- Stating the Purpose
- Determining the scope
- Relating e-portfolio implementation to the curriculum
- Selecting content
- Preparing the users

E-PORTFOLIOS: TECHNOLOGIES

Recent technological enhancements to e-portfolio software have broadened the available features (Strivens, 2007). It is argued that there are many strategies to implement and develop e-portfolios, depending on the choice of available software tools: Generic and Customized tools (Barrett, 2002; Gibson & Barrett, 2002) such as VLEs, stand-alone commercial products, open source products, university-designed software and Web 2.0 tools.

The emergence of Web 2.0 technologies guides the growth of user-control over content, where the groups of users can socialize and collaborate (O'Reilly, 2005). Furthermore, Web 2.0 has profound potential for inducing change in tertiary education due to web data-sharing and exchange mechanisms (Franklin & Van Harmelen, 2007; Bryant, 2007). A Web 2.0 technology like social networking systems allow people to create networks for various purposes. The review of the literature illustrates that the mix of e-portfolios with Web 2.0 technologies offers individuals educational opportunities, combining informal and formal education (Dysthe, 2007). In addition to, Web 2.0 technologies support participation, development, students' educational planning, collaboration, reflection that fit well with the purposes and specifications of e-portfolios (Ehlers, 2009; Roder & Brown, 2009).

In the context of an academic institution, the selection of an e-portfolio system should conform to the potential needs of the institution (Sweat-Guy & Buzzetto-More, 2007) and includes a set of issues: buying, constructing, configuring an open source system or implementing a hosted or non-hosted system. It is suggested that a successful implementation of an e-portfolio project needs several factors: ease of use, sustainable business plan, advanced features, robust integrated technology architecture, lifelong support, standards and transferability and factor 'X' (Jafari, 2004).

E-PORTFOLIOS: PEDAGOGIES

Students, who develop e-portfolios in the context of their institution, in order to demonstrate progress or to assess learning, fail to familiarize with the final outcome (Stefani et al., 2007). This means that, there is a need for students to feel that their e-portfolio belongs to them. To this direction, we emphasize on personalization of learning, in the context of e-portfolios. As, students have the opportunity to customize and configure their e-portfolios, which is a key to creating a sense of ownership of the end product (JISC, 2008). Research on e-portfolios has shown that in order to support learning effectively e-portfolios should be able to accommodate pedagogic models and different instructional designs (JISC, 2008; Abrami & Barrett, 2005). The pedagogical principles underpinning the rationale of e-portfolio draw on theories of constructivism (socio-cognitive dimensions), student-centered learning and authentic educational activities (Abrami & Barrett, 2005; Stefani et al., 2007). It is important to create e-portfolio pedagogy where students should be encouraged to become dynamic participants in their own learning (Kimball, 2005).

SELF-REGULATED LEARNING: DEFINITIONS

Self-regulation involves cognitive components, self-generated thoughts, feelings, and behaviours that are planned and adapted based on performance feedback to attain self-set goals (Zimmerman, 1986; Boekaerts, Pintrich & Zeidner, 2000). This broad concept of self-regulation has been embedded into the learning activity in order to support learners to plan, monitor and evaluate their learning processes (Steffens, 2008)

Self-Regulated Learning (SRL) is defined as 'self-generated thoughts, feelings, and actions, which are systematically oriented toward attainment of students' own goals' (Zimmerman& Schunk, 1989). Another definition illustrates SRL as an active, constructive process whereby learners set goals for their learning and then attempt to plan, monitor, regulate, and control their cognition, motivation, and behavior (Pintrich, 2000; Zimmerman, 2001). From the definitions of SRL emerges the fundamental role of student and its' characteristics: the use of self-regulated learning strategies, the responsiveness to feedback and the independent motivational processes (Zimmerman, 1990b).

SELF-REGULATED LEARNING: MODELS

Several models of SRL have been proposed, the majority of which derives from socio-cognitive theory of Bandura (1986). The comparison of fundamental SRL models in education illustrates that each model focus on slightly different components of SRL. For example, Corno indicates volitional features of SRL, whereas Winne indicates the cognitive features of SRL and McCaslin and Hickey focus on the sociocultural features of SRL (Pintrich, 2000). The important issue is that in all different models of SRL, it is shared the same assumption about students' actively regulation of cognition, motivation or behavior in order to perform better (Zimmerman, 1989).

A review that presents and compares the latest models of SRL, including those by Boekaerts (Boekaerts & Niemivirta, 2000), Borkowski (1996), Pintrich (2000), Winne (Winne & Hadwin, 1998) and Zimmerman (2000a) indicates that that theoretical background is an important differentiating feature (Puustinen & Pulkkinen, 2001). Only two authors (i.e. Pintrich and Zimmerman) based on the same background theory, the social cognitive theory and identify SRL as a goal-oriented process (Puustinen & Pulkkinen, 2001).

The SRL model by Pintrich (2000), consists of four phases, namely forethought; planning and activation; monitoring; control; and reaction and reflection. Each phase is autonomous and doesn't follow a linear path. Zimmerman (2000) developed a cyclical model of SRL which applied to education (Zimmerman & Martinez-Pons, 1992). Zimmerman's (2000) cyclical model of SRL includes three phases:

1. Forethought' phase consists of processes that precede any effort; they involve the beliefs and attitudes of students. Important aspects are goal setting and strategic planning.
2. Performance Control' phase represents processes that occurring during learning efforts. Important aspects are self-control and self-observation.
3. Self-Reflection' phase processes occurring after learning or performance involves reflecting on the self-monitored information to evaluate one's performance and to make adjustments during future learning attempts. The two general processes in this phase include self-judgments and self-reactions (Clearly & Zimmerman, 2004).

SELF-REGULATED LEARNING: THE STUDENT PERSPECTIVE

In the digital decade, learners are transformed from simple knowledge receptors into knowledge creators and users of new technologies, devices, and applications. To respond to this shift, learning environments should focus on building skills and competencies for life, increasing students' involvement in learning and adapting positively to rapidly changing environments (Tan, 2007). In order to fulfill this contemporary demand, we should support students in order to learn how to become self-regulated learners and engaged actively and constructively in a meaningful process of learning where they can proactively adapt their thoughts, feelings, and actions (Boakaerts & Corno, 2005; Boekaerts, Pintrich, & Zeidner, 2000). This statement is underpinned by the fact that SRL can be successfully taught to students of all grade levels and that the skills acquired through the process of SRL lead to academic development (Borkowski & Muthukrishna, 1995; Zimmerman & Schunk, 2001).

SELF-REGULATED LEARNING: TELEs APPROACH

The Technology Enhanced Learning Environments (TELEs) enable students to select their mode of learning, to use the appropriate technologies, and to obtain their knowledge so as to become successful (Wilen-Daugenti, 2007). It seems that in TELEs learners should develop and utilize SRL skills in order to eliminate factors such as familiar learning situation, and group pressure (Hodges, 2005). It is argued, that is difficult to find hard evidence for the

impact of the new technologies on learning outcomes and it is even harder to find research on the impact of TELEs on SRL (Steffens, 2008). Furthermore, research should focus on how students self-regulate when learning with TELEs in order to examine the underlying processes of SRL (Azevedo & Cromley, 2004; Azevedo, 2007; Greene & Azevedo, 2010)

SELF-REGULATED LEARNING AND E-PORTFOLIO

Researchers and educators suggest that SRL can be aligned with the purposes and processes of e-portfolios. It is argued that e-portfolios are connected with student's ability to self-regulate his own learning and to enhance competencies, skills and abilities (Wade, Abrami & Sclater, 2005). Furthermore, the process of e-portfolio implementation supports student as it assumes more responsibility, provides better understanding of strengths and limitations (Hillyer & Lye, 1996). Also, it is argued that the process of the e-portfolio allows students to think critically, and to act in an independent and self-regulated manner (Blackburn & Hakey 2006; Riedeinger 2006; Abrami et al., 2008). Researchers believe that teaching SRL skills within an e-portfolio tool requires commitment, purpose and strategies (Abrami et al., 2008).

Continued research is essential to explore e-portfolio and its potential to support and develop self-regulated learners with varied learning styles (Baharom, 2009) Further research is required to investigate the impact of the e-portfolio on scaffolding of reflection, feedback and goal-setting (Lamont, 2007). Also, another future direction of research is the precise mechanisms of SRL (Strijbos, Meeus & Libotton, 2007).

MYSELF E-PORTFOLIO: THE IMPLEMENTATION

Rationale of the study

This paper aims to examine the potential and identify 'How an innovative e-learning tool like e-portfolio could facilitate SRL skills in tertiary education empowering students as active learners to enhance their academic skills (such as hard and soft skills knowledge, problem solving skills, time management skills, communication skills etc)?' To this end, we propose an e-portfolio as a flexible (web 2.0) applied e-learning tool according to the self-regulated learning theory as a solid framework to enhance 21st century demands.

Context

The research was conducted within an undergraduate computer science programme in tertiary education, in a course titled "IT -Centric Professional Development". An e-portfolio was developed and integrated into the course as an emerging web 2.0 tool which encompasses the new technologies and services and enhances students' knowledge and academic skills.

One important aspect of the research design is the alignment of the e-portfolio purpose with the course objectives. This course introduces students to IT-Centric Professional Development as a part of the mission of institutions and organizational cultures. The course also reviews theories and skills necessary for the development of effective performance in the changing nature of IT working environment.

Another issue of the research design is the statement of the e-portfolio purpose. For this reason, we based the e-portfolio implementation on a learning scenario: '*You are a graduate student and you are invited to present your academic profile in a business environment. To this direction, you will implement an e-portfolio based on your academic achievements.*'

Participants

The participants in this study were 41 undergraduate students, who voluntarily signed up for acquiring new knowledge and enriched experiences through the implementation of e-portfolio. Since all participants had no experience of creating an e-portfolio, they attended a session of workshops in order to understand the fundamental characteristics of e-portfolios.

Setting and learning environment

In order to accomplish the objectives of the research we developed a 'Methodology for e-portfolio implementation in tertiary education' based on the purposeful plan of Stefani, Mason and Pegler (2007). This methodology is generated by our working definition for e-portfolio. The steps that evolve the methodology are:

- Step 1: Define the purpose of e-portfolio

We propose the type of 'Learning e-portfolios' as a vehicle so as to enhance engagement, reflective learning, goal setting, communication skills, self-

regulated competences, self-assessment and peer assessment.

- Step 2: Select Software and clarify the scope of e-portfolio

The process of selecting an e-portfolio system is driven by technological and pedagogical considerations. We emphasize on Web 2.0 technologies which are simple, flexible and open tools. Web 2.0 technologies create new directions for the design, access, distribution and representation of e-portfolios (Waters, 2007). For the e-portfolio implementation we select the social networking software 'Elgg'.

- Step 3: Connect the purpose of e-portfolio to the objectives of the course

The objectives of the course should be clearly defined and aligned to the purpose of the e-portfolio.

- Step 4: E-portfolio's Activities

A main argument for successful e-portfolios' implementation into the course programme, suggests that they should be fully embedded into the curriculum (Challis, 2005). On this basis, we emphasize on the need of implementing an e-portfolio based on an educational philosophy. We propose the development of an e-portfolio supported by self-regulated learning theory. This pedagogical framework can be combined with different activities that foster skills, competences, reflection and academic and professional development. Thus, we aim to cultivate a learning culture among learners.

- Step 5: Users' Preparation

Users' preparation should be an organized and well defined process. This means, that students should be encouraged to experience the new learning tool, 'the e-portfolio' in advance they will start to shape the e-portfolio philosophy and finally they will build a common learning culture.

- Step 6: Evaluation of e-portfolio

E-portfolio is a learner-centered activity and a rich learning experience, which should evaluated so as to produce learning outcomes. Authentic assessment is an important aspect of the e-portfolio implementation. Following the steps of the 'Methodology for e-portfolio implementation in tertiary education' we formulated 'MySelf e-Portfolio'.

E-portfolio tool

For the implementation of the e-portfolio, we selected, an open source social networking engine, Elgg (http://www.elgg.org). It is powered by Curverider Company. Elgg develops and updates continually through an active community of organizations, companies, developers and users around the world. In 2008, Elgg, was voted in InfoWorld as the 'best open-source platform for social networking'.

For the purpose of this research the e-portfolio tool was named 'MySelf e-Portfolio'. The interface of the tool has a simple interface with a horizontal menu with 5 sections profile, dashboard, tools, messages and settings. User can create, change, delete and update his profile and dashboard (Figure 1).

The initial idea is to provide users simple tools in order to support their learning and to help them realize their metacognitive strengths. Furthermore, we seek to highlight the benefits of a social networking tool for enhancing SRL skills and academic and professional development.

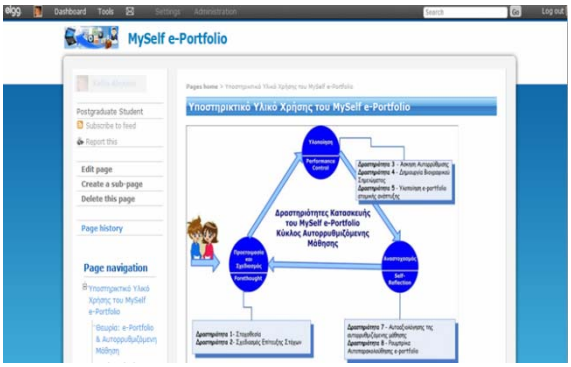

Figure 1: The e-portfolio tool 'MySelf e-Portfolio'

Myself E-Portfolio

The evolution of next generation e-portfolio supported by Web 2.0 technologies emphasizes on the need of re-establishing the approaches of teaching and learning. On this basis, we highlight the scientific area of SRL as the basic idea revolves around individuals' beliefs that they are able to perform a task and that they are responsible for their own performance.

Our aim is to describe the basic stages of the evolution of 'MySelf e-Portfolio' and to propose an innovative approach for constructing and implementing an e-portfolio. The development process of this approach was based on the ADDIE-model, in order to follow dynamic and flexible guidelines for implementing an effective tool. Decomposing the procedure:

On the *'analysis' stage*, we explore the potential of e-portfolio to support self-regulated learning. In this view, we suggest the e-portfolio as a tool for

constructing and managing individuals' own knowledge.

On the *'design' stage*, we frame the experimental procedure based on the three phases of Zimmerman's (2000) cyclical model of self-regulation: forethought, performance control and self-reflection phase.

On the *'development' stage*, we deploy a conceptual framework for the e-portfolio activities so as to enhance SRL skills and to promote academic and professional development. The implementation of MySelf e-Portfolio followed the phases of SRL where orchestrated by different activities. Students had to enter the cycle of self-regulated learning from forethought phase then pass to performance control phase, which in turn influences self-reflection phase (Zimmerman, 2000).

On the *'implementation' stage*, we conduct the experiment. Every student should register to 'MySelf e-Portfolio', then he creates and configures his own profile and every week he must implement and submit the programmed activities. All activities were individually assigned except one cooperative activity, but all the participants could interact in an asynchronous mode with their peers, through message boards and personal messaging. During the experimental procedure the administrator of the system scaffolds participants with private and public messages.
The *'evaluation' stage*, combined with the last phase of SRL cycle, where students had to complete rubrics of self-assessment.

MYSELF E-PORTFOLIO: EXPERIMENTAL PROCEDURE

The implementation of MySelf e-Portfolio was conducted during spring semester in order to approach the objectives of the course (IT -Centric Professional Development). Before the project, participants had to complete a questionnaire on learning strategies, and their prior domain-specific knowledge about e-portfolios.

We present the experimental procedure of the implementation of 'MySelf e-Portfolio' in order to facilitate SRL skills and to empower students to enhance their academic skills (such as hard and soft skills knowledge, problem solving skills, time management skills, communication skills).

MYSELF E-PORTFOLIO: THE CONCEPTUAL FRAMEWORK

This research supports the idea of implementing an e-portfolio tool following the principles of SRL. We suggest a conceptual framework based on SRL for the construction process of MySelf e-Portfolio. The major goal of the conceptual framework is to enhance SRL skills and to promote academic and professional progress.

It is suggested that e-portfolios can be a strong indicator of learner's growth and achievement (Popper, 2005). This idea can be combined with the fact that, the process of constructing an e-portfolio indicates complex thinking and creativity (Jonassen 1996) and encourages students to engage into productive practice and reflection (Chun, 2002).This process consists of several actions: collection, selection, reflection direction and presentation of e-portfolio's artifacts (DiBiase, 2002). But, in the high-technology world there are numerous stimulus which drive digital-age students to seek for active learning experiences that can be social, participatory and supported by rich media (CLEX, 2009). On the other hand, educational environment should provide learners with skills for self-regulating their academic and professional development. Considering that 'key competencies are learned, updated and maintained throughout life' (Tapio, 2004) we recommend the process of constructing an e-portfolio which is 'a tool that allows individuals to organize their learning and experience in a way they find natural and stimulating' (Chun, 2002).

We propose a conceptual framework based on SRL for the implementation of an e-portfolio (Table 1). We emphasize on Zimmerman's (2000) cyclical model of SRL, which includes three phases. In every phase of the model we propose several learner-centered activities in order to construct an e-portfolio for academic and professional development (Alexiou & Paraskeva, 2010). We determine specific activities that highlight the objectives of SRL and indicate a structured process for the implementation of an e-portfolio. The proposed activities intend to support learners with a twofold manner. Firstly, we attempt to scaffold students during the implementation of the e-portfolio and secondly to empower students as active learners in order to enhance their knowledge and academic skills. From this point of view, the proposed e-portfolio activities aim to strength individual's potentials in order to recognize his abilities and skills,

to be able to manage his time, to set demanding and meaningful goals, to design personal action plans, to create a curriculum vitae, to activate his prior knowledge, to develop communication skills, to reconsider his competences and to self-evaluate his actions in a digital environment.

Table 1: Conceptual Framework based on SRL for the implementation of MySelf e-Portfolio

Conceptual Framework based on SRL for the Implementation of MySelf e-Portfolio	
'Forethought' Phase.	
Activities	Objectives
Self-Presentation	A process of exploring personal characteristics (skills, values, attributes, needs) in order to broaden the awareness of self.
Time Management	A process of managing individual's time in order to successfully complete plans (individual, academic and professional level).
Goal Setting	A process of setting goals and priorities in order to succeed on developing smart goals.
Designing Goal Achievement	A process of developing a specific action plan in order to successfully accomplish the goals.
'Performance Control' Phase.	
SRL Assignment,	A process of self-reporting in order to understand and develop self-regulated learning skills.
Writing a Curriculum Vitae	A process of engaging in a specific career-related activity in order to train on building good curriculum vitae.
Exercise on experiential scenarios	A process of managing conflicts in order to learn how to communicate, to negotiate, to adopt positive attitudes and to develop strategic solutions.
'Self-Reflection' Phase.	
Self-Evaluation Rubric	A process of self-evaluation in order to assess the development of academic skills (such as hard and soft skills knowledge, problem solving skills, time management skills, communication skills).
Self-Monitoring Rubric	A process of self-monitoring in order to assess the quality of MySelf e-Portfolio, based on explicit criteria.

Zimmerman's (2000) cyclical model of SRL for the implementation of MySelf e-Portfolio, follows three phases (Figure 2):

1. 'Forethought' Phase.

Firstly, student had to enter the cycle of SRL (Zimmerman, 2000) from forethought phase which included several activities: self presentation, time management, goal setting and designing goal achievement.

2. 'Performance Control' Phase.

Secondly, student passes to performance control phase where he gathers information that will be used to evaluate the effectiveness of the strategic plan and to improve future learning attempts (Clearly & Zimmerman, 2004). The performance processes engage students in specific learning activities such as SRL assignment, writing a curriculum vitae and exercise on experiential scenarios in order to employ self-control and self-observation.

3. 'Self-Reflection' Phase.

Thirdly, student attains self-reflection phase where he should reflects on the self-monitored information to evaluate his performance (Clearly & Zimmerman, 2004). This phase includes self-judgements and self-reactions which performed with self-evaluation and self-monitoring rubrics.

All activities included reflective questions at the end of the process, so individuals could reflect on the process of learning (Alexiou & Paraskeva, 2010).

Figure 2: The cyclical model of SRL (Zimmerman, 2000) for the implementation of MySelf e-Portfolio

DISCUSION AND CONCLUSION

Acknowledging the fact that e-portfolios encourage learners to become active, set goals for learning, engage in self-reflections and assume responsibility for their own learning (Barrett, 2004) as well as they are connected with student's ability to self-regulate

his own learning and to enhance competences, skills and abilities (Wade, Abrami & Sclater, 2005), in this paper we suggested a conceptual framework based on SRL for the implementation of an e-portfolio. First, we analyzed major aspects of e-portfolios and emphasized on self-regulated learning as a vehicle for the implementation of e-portfolio. Second, we presented a 'Methodology for e-portfolio implementation in tertiary education' providing an analysis of the required steps for structuring an e-portfolio tool. Third, we proposed a conceptual framework based on Zimmerman's (2000) cyclical model of SRL for the implementation of an e-portfolio. Finally, we determined specific activities that highlight the objectives of SRL and indicate a structured process for the implementation of an e-portfolio.

The proposed conceptual framework is an innovative approach for constructing and implementing an e-portfolio in order to enhance SRL skills and to promote academic and professional progress.

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