

Self-regulated Learning in Technology Enhanced Learning Environments: A European Review

Antonio Bartolomé, Jos Beishuizen, Roberto Carneiro, Cecilie Hansen, Paul Lefrere, Dominique Lenné, Donatella Persico, Karl Steffens

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Self-regulated Learning in Technology Enhanced Learning Environments: A European Review

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Editors

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KALEIDOSCOPE seed project:
Self-regulated Learning in Technology Enhanced Learning Environments

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Self-regulated Learning in Technology Enhanced Learning Environments: A European Survey

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Introduction

In European societies, the growing need for more, and more effective, forms of lifelong learning (including informal learning), personalised to each citizen's needs, has become an important issue. The rate of change in all aspects of our lives has increased remarkably, making it necessary to adjust the way we learn to these new conditions. Lifelong learning implies that learning is likely to take place outside and beyond traditional schooling. In parallel to these developments, instructional paradigms are changing: teaching and training is becoming more student-oriented and less instructor-oriented, thus requiring a higher degree of Self-regulated Learning (SRL).

At the same time, recent developments in technology, coupled with the growing availability of low-cost or no-cost educational materials of high-quality (e.g., Open Content), have made it possible to develop powerful yet potentially widely available Technology Enhanced Learning Environments (TELEs). It therefore seems to be desirable to explore the potential of existing TELEs for supporting SRL in order to provide a framework for future research in the field of SRL in TELEs.

Self-regulated Learning, Metacognition, Self-directed Learning and Personalised Learning

In the Handbook of Self-regulation, (Boekaerts, Pintrich & Zeidner, 2000), Zeidner, Boekaerts & Pintrich (2000, p.751) state: "Self-regulation involves *cognitive*, *affective*,

motivational and *behavioural* components that provide the individual with the capacity to adjust his or her actions and goals to achieve the desired results in light of changing environmental conditions"

This concept of self-regulation has also been adapted to the field of learning. According to Zimmerman (2000) self-regulation of learning is achieved in cycles consisting of (1) forethought, (2) performance or volitional control, and (3) self-reflection. In recent years, self-regulated learning has been made the topic of a number of empirical studies and training programs, many of them based on the Zimmermann process model, augmented by the component model referred to by Zeidner et al. (see, for instance, Steffens, 2006).

One of the concepts which is related to that of self-regulated learning is the concept of metacognition (Flavel, 1971). While Flavell distinguished between metacognitive knowledge and metacognitive experience, it has become common to distinguish between (1) knowledge about one's cognitive processes and (2) monitoring and regulating these processes (Hacker, 1998). Metacognition can therefore be considered to be a component of self-regulation. However, self-regulation not only involves monitoring and regulating one's cognitive activities; emotional and motivational processes also need to be regulated.

It needs to be pointed out that the term self-regulated learning is being used in a wide and in a narrow sense. In the wide sense, a students is self-regulating his learning if he can choose what, when and where to learn. However, most of the time the term is applied to situations where students have been given a learning task and it is now up to them to self-regulate the learning processes involved in doing the task. This would be called self-regulated learning in a narrow sense.

Self-regulated learning in a wide sense seems to be equivalent to self-directed learning. "In self-directed learning (SDL), the individual takes the initiative and the responsibility for what occurs. Individuals select, manage, and assess their own learning activities, which can be pursued at any time, in any place, through any means, at any age." (http://www.selfdirectedlearning.com/index.html). In an educational setting, enhancing self-directed learning would require to customize schooling to the learning needs of individual students and to motivate them to take increasing responsibility for deciding what and how they should learn (Gibbons, 2002).

Another term that seems to have some overlap in meaning with that of self-regulated learning is that of personalised learning. According to Halm (2006), personalised learning “meets the needs of the individual learner providing the best method of learning based on their personal interests, learning style(s), motivation and learning objectives”. Personalised learning is a form of learning which takes place in a learning environment specifically customised to the individual learner. "Put simply, personalised learning and teaching means taking a highly structured and responsive approach to each child's and young person's learning, in order that all are able to progress, achieve and participate. It means strengthening the link between learning and teaching by engaging pupils - and their parents - as partners in learning." (The Standards site, 2007).

However, while the concept of self-regulated learning focuses on all those activities with which the learner plans, monitors and evaluates his learning processes, the concept of personalised learning seems to focus more on the learning environments and its “fit” to the student’s characteristics.

Technology Enhanced Learning Environments (TELEs) may facilitate self-regulated learning and may at the same time optimally fit a student’s strengths and weaknesses. While the primary focus in research on SRL has been on the cognitive component, the other components of SRL – motivational, emotional and social – have been recognised as also being of importance. Research on SRL has shown that SRL can be improved through traditional teaching and training, thus increasing academic achievement (Zimmerman & Schunk, 1998). Complementary research is needed to determine to what extent SRL can be improved by TELEs, particularly in policy-relevant contexts such as lifelong learning within small and medium enterprises, which typically lack the resources for any substantial formal work-based learning.

SRL and ePortfolios

SRL may be enhanced by the use of digital portfolios or ePortfolios; the intelligent use of digital portfolios will, however, also require a certain amount of SRL. According to the Europortfolio web site, “an ePortfolio is a personal digital collection of information describing and illustrating a person's learning, career, experience and achievements.

ePortfolios are privately owned and the owner has complete control over who has access to what and when" (http://www.europortfolio.org/). Carneiro and Simão in their Portuguese contribution to this review point out that the surge of interest in digital portfolios as a reliable tool to define and measure competencies was caused by recent policy changes, effected at both European and national levels,

According to these authors, digital portfolios appear as powerful instruments to monitor specialized skills and also transversal competencies. These key competencies touch upon 'soft' domains of SRL which address in particular meta-learning aptitudes such as 'learning to learn' and 'knowing to know'.

The European Institute for E-Learning (EIfEL, http://www.eife-l.org/publications/eportfolio/) is one of the European organisations which strongly advocate the use of digital portfolios; it is also one of the founding members of the European Foundation for Quality in eLearning (EFQUEL, http://www.qualityfoundation.org) and of Europortfolio. Europortfolio's mission is to involve European educational and corporate institutions to define, design, and develop digital portfolio systems the use of which is considered to be one of the foundations of a learning economy and society (http://www.europortfolio.org/).

In the TELEPEERS project we evaluated a portfolio system for university students at the Vrije Universiteit Amsterdam (http://www.lmi.ub.es/telepeers/ , see TELE Guide and TELE Report). It turned out that the portfolio system was evaluated as having a high potential for supporting SRL.

In this review, the Italian authors present three studies on digital portfolios in their contribution.

SRL in TELEs

SRL has been studied rather extensively on both sides of the Atlantic Ocean for three decades now. There is, however, remarkably little research on possible impact of TELEs on SRL – on both sides of the Atlantic Ocean. The present review was carried out to assess the present situation of research on SRL in TELEs in Europe.

The issue of evaluating TELEs for their potential to support SRL was addressed in a European project (TELEPEERS, Jan. 2004 to Jan. 2006)[1], six of whose nine partners were KALEIDOSCOPE members. The project partners were also the founding members of the Targeted Cooperative Network on SRL in TELEs[2]. Project results were disseminated and discussed at several KALEIDOSCOPE related events (KALEIDOSCOPE workshop at the EDEN conference in Vienna, June 2006; workshop at the ECTEL conference on Crete, October 2006) as well as at other international conferences and during two TACONET conferences (Barcelona, 2005; Lisbon, 2006). The proceedings of the Lisbon TACONET conference were published as a book (Carneiro et al., 2005); the topic of SRL in TELEs was also explored in depth in ten contributions to a special issue of the European Journal of Education (Carneiro & Steffens. 2006).

In order to continue to raise awareness of the importance of SRL in TELEs and to stimulate further research in this field, the KALEIDOSCOPE seed project on SRL in TELEs intends to

1. integrate research findings on SRL in TELES at a European level,
2. create a framework for further research on this topic with special emphasis on the effect of TELEs on SRL and learning outcome and
3. elicit the collaboration of European researchers in studying SRL in TELEs, preferably in a new project under the 7th Framework Programme.

The present review is the main deliverable of the seed project and also one of its milestones. Other milestones are an International KALEIDOSCOPE-TACONET conference on SRL in TELEs which was held at Vrije Universiteit Amsterdam on October 5th, 2007 (http://www.lmi.ub.es/taconet/amsterdam/index.php) and a contribution to the second KALEIDOSCOPE Symposium in Berlin, Nov.26-27, 2007.

A proposal for a European project on SRL in TELEs under the 7FP was handed in by the seed project members and was evaluated positively. Beyond KALEIDOSCOPE, we will continue to study SRL in TELEs in the context of TACONET network (http://www.lmi.ub.es/taconet/).

[1] "Self-regulated Learning in Technology Enhanced Learning Environments at University Level: a Peer Review" (TELEPEERS)".The project was carried out with the support of the European Commission (Grant agreement 2003-4710-/001-001 EDU-ELEARN). Project results are available at http://www.lmi.ub.es/telepeers.
[2] For more information, see http://www.lmi.ub.es/taconet.

A European Review

The present review contains contributions from KALEIDOSCOPE members from eight European countries (France, Germany, Italy, Netherlands, Norway, Portugal, Spain and the United Kingdom). It shows diversity in the methodological approaches and it reflects the cultural diversity which makes Europe alive and colourful. At the same time, it shows that there are significant communalities between European researchers.

We talk about SRL in TELEs in very general terms, but the learning that takes place is always the learning of an individual learner, even if the learning is technology enhanced and is carried out in a collaborative setting. Research on SRL in TELEs should therefore bear in mind the differences that exist between different learners. Europe with its multicultural societies should be a privileged laboratory to study this issue.

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Self-regulated Learning in Technology Enhanced Learning Environments:
A European Review

FRANCE

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Introduction

The concept of Self-Regulated learning (SRL) seems to be much more developed in Anglo-Saxon countries than in France (and probably in Latin Countries). The French expression for SRL is “apprentissage auto-régulé” and it is hard to find research work using this expression. Apart from some domain-specific work (e. g. in sport education : Famose, 1999), only translations or quotations of major articles (Zimmerman et al, 2000, Zimmerman 1998, 2001, Boekaerts 1998, Boekaerts et al 2000) can be easily found on digital libraries. However, it should be noted that work has been carried out in France on related concepts such as self-education (“autoformation”) or autonomous learning (“apprentissage autonome”), see for example Portine (1998), Albero (2000, 2003), Linard (2003). Other keywords like metacognition or constructivism could also lead to research work pertinent for SRL (Noury et al, 2007). The whole corpus would be quite large even if limited to Technology Enhanced Learning Environments (TELEs). Furthermore, several disciplines are involved: psychology of education, sociology, computer science, artificial intelligence and education (AIED or in French EIAH “Environnement Informatiques pour l’Apprentissage Humain), etc. These disciplines are not always connected but the necessity of adopting a multi-disciplinary approach is often stressed. Many practical studies can also be found in the field of ICT for education (in french TICE: “Technonologies de l’information et de la communication pour l’éducation”). In other words the corpus of this study would be either very small if strictly limited to self-regulated learning, or too big if extended to closely related concepts.

We chose consequently to draw a picture of research work about SRL in “Technology Enhanced Learning Environments” from our point of view, which is grounded by computer science and learning environments for education. We will focus on technological artefacts that can foster SRL. Following Boullier (2001), we think that technical and pedagogical choices

are closely related. In the following, we first present some technological tools and environments that can support SRL, either in standalone or in collaboration, particularly in the context of open and distance learning. Then we pay a special attention to recent work on activity tracing and interaction analysis that can provide metacognitive support, and finally we describe a study that evaluated the potential of a TELE in the framework of the Telepeers project (Steffens 2006).

Tools and environments for supporting SRL

The French vision of education often involves the presence of a teacher or a tutor in the environment. SRL is seen as reserved to a small part of the students in higher education. Even with Information and Communication Technologies the role of the tutor is often stressed. However, things are changing with the need of life-long learning and with the development of open and distance learning. A high degree of autonomy is required from the learners, and this often leads to difficulties or failures.

Many propositions have been made to address this problem. On a technological point of view, some tools have been proposed to help the tutor to get information on the progress and activity of the learner. These tools provide indicators that can be helpful to enhance the learners' autonomy and their self-regulation. In collaborative environments, "dashboards" can be used to facilitate awareness among learners. Structuring forums can also contribute to foster SRL. Another direction is to provide learners with a "learning memory". This kind of memory can contain personal information added by the learner. It can also contain the notions to learn, relying on an ontology of the learning domain, and more generally it can be an image of the learning organisation.

In the following we describe some research projects related to these four directions: progress indicators, awareness tools, structuring of forums and learning memories.

Progress indicators

Learning management systems (LMS) usually include learners' follow-up functionalities regarding consultation and access to pages. They can provide indicators such as: connection

time, types of consulted or downloaded documents, number of exchanged messages, etc. All these indicators do not constitute by themselves a pertinent view of the learner progress. In order to address this problem, Després and Coffinet (2004) propose a tool, called “Reflet”, that intends to visualize the learner progress state in open and distant learning. This tool is based on the model MAT (for Module, Activity, Task), which has a tree structure: a module is composed of (sub)modules and activities, an activity is composed of tasks (associated with weights). The learner has to indicate when a task is completed. The tool gives a percent of achievement of the activities and modules, relying on the information given by the learner. An informal experimentation showed that this kind of tool can be useful for students. It has been integrated into the WebCT learning management system and would be easily integrated into other LMS. However this tool is quite simple and the authors mention in the paper that they plan to design a dashboard in order to foster awareness (Dourish and Belloti 1992) in collaborative situations.

Awareness Tools

Temperman, Depover and Delievre (2007) from the university of Mons-Hainaut in Belgium propose such a dashboard and analyse its usage in a collaborative distance learning environment. The dashboard is based on the history of learners’ activity. Learners can visualise their progress by means of a double-entry table. Each cell of the table is associated with one learner and one activity of the pedagogical scenario. A row gives information on the progress of a learner (or a group of learners), a column informs on the progress of an activity for all learners. In this environment, the authors study two variables: the first one is related to the application or not of a procedure inciting learners to access the awareness tool (the table), the second one represents the type of planning with three possible values: imposed planning, negotiated planning or no planning.

The study shows that the awareness tool is more used in the first part of the training in order to coordinate individual tasks and prepare collaborative tasks. It is useful to give the learners a global view of the learning progress in the training environment. There is a kind of compensation between the two variables: the dashboard is more useful in non-planned activities. The imposition or the negotiation of an initial planning helps the students to build their own referential and, by this way, to get a better awareness of the work to achieve.

Structuring of forums

George (2006) studies context-aware computer-mediated communication for distance learning systems. He relates his work to the paradigm of "Cognitively Informed Systems", which defines systems that utilize, as a basis for their design, some form of cognitive findings to enhance the effectiveness of the systems in achieving their goals. He argues that linking deeply communication to learning activities offers an interesting approach to develop the efficiency of systems in facilitating the emergence of learners' communities. Indeed, in a socio-constructivist approach (Doise & Mugny, 1984), interactions between learners play a dynamic role regarding individual learning. George advances the idea of contextual display of forum messages. He proposes a forum model, named CONFOR (CONtextual FORum), including two ways for contextualization. The first one is based on structuring forums according to the on-line course structure. The second one takes into account the cognitive structure of the course. The result is a discussion tool which displays to the learner an "activity topic" and several "knowledge topics" linked to the current learning resource.

Learning memories

Learning memories can be used to support SRL by helping students to remember what they have done before and plan what they will do next (Azouaou and al, 2003). They can also be used to store documents and resources potentially useful for a given course. Of course these resources have to be structured in order to be usable. It is likely that letting students directly access to unstructured resources would not lead to efficient learning, even if they had good self-regulated learning abilities. In the MEMORAe project (Abel et al 2006), the structuring of resources is made thanks to two ontologies: the first one contains general concepts relative to learning and the second one contains the notions to learn in a specific course. This approach allows to index resources by the concepts of the two ontologies and to provide students with an access by notions. Notions are organised in a graph that is presented to students. They can access the resources via this graph (Figure 1).

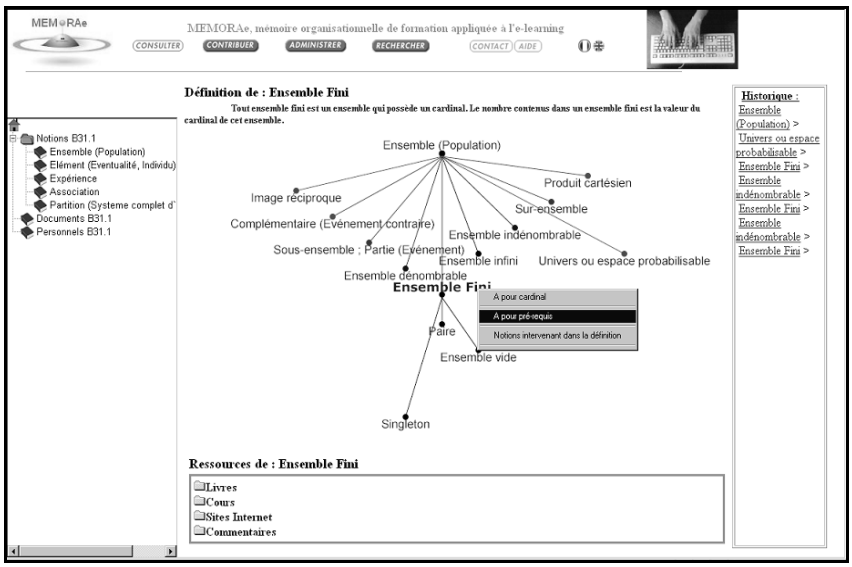


Figure 1: Navigation in the memory.

In MEMORAe, a course or a training unit is considered as being an organization. Indeed, it is based on actors (learners, trainers, course designers, administrators, etc.), on resources of different types (definitions, exercises, case studies, etc.), and different forms (reports, books, web sites, etc.), and on knowledge and skills it should provide. Following a knowledge engineering approach, the resources and knowledge of this particular organization are managed by means of a "learning organizational memory" based on ontologies. Learners as well as teachers have access to this memory, which is different from a classical organizational memory (used in the domain of knowledge management) because its goal is to provide users with content and more precisely pedagogical content. This content is the result of the capitalization of knowledge, information and resources relating to the training or course unit.

A prototype of TELE relying on this approach has been developed for a course on applied mathematics at the university of Picardy. The general principle is to propose to the learner, at each step, either accurate information on what (s)he is searching for, or graphically displayed links that allow him/her to continue to navigate in the memory. (S)he has no need to use the keyboard in order to formulate a request, even if the environment allows to do it.

The user interface (Figure 1) offers:

- Entry points (left of the screen) allowing to start the navigation with a given concept: an entry point provides a direct access to a concept of the memory and consequently to the

part of the memory dedicated to notions. The person who is in charge of the course has to define the notions that (s)he considers as essential.

- Resources (bottom of the screen) which contents are related to the current concept: they are ordered by type (books, course notes, sites, examples, comments, etc.). Starting from a notion, an entry point or a notion reached by the means of the ontology, the user can directly access to associated resources. Descriptions of these resources help the user to choose among them.
- A short definition of the current notion: it allows the learner to get a preview of the notion and allows him (her) to decide if (s)he has to work it or not.
- An history of the navigation: it allows the learner to remind and to be aware of the path he followed before. Of course, (s)he can get back to a previously studied notion if (s)he wants to.
- Last but not least, the part of the ontology describing the current resource is displayed at the centre of the screen.

Navigation among notions is not only hierarchical. It can also be “horizontal” following links such as “is-a-prerequisite-of” or “suggests” (Figure 2).

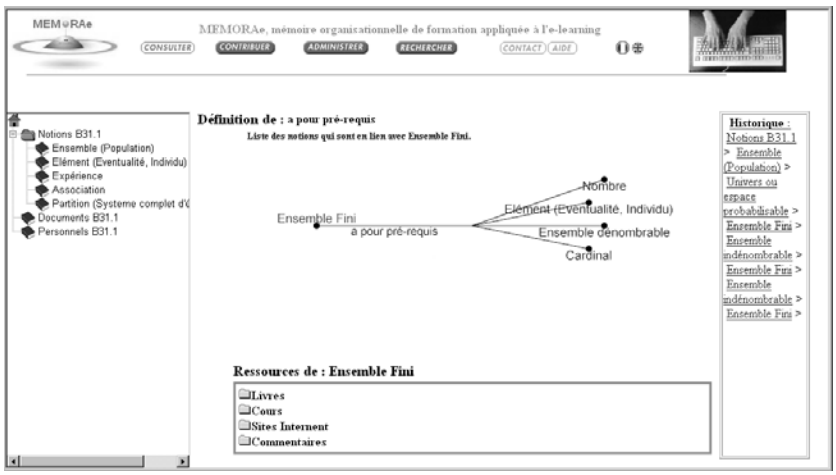


Figure 2: Horizontal navigation

This work is now continued through the extension of this environment to web 2.0 capabilities.

A new TELE, named E-MEMORAe2.0, has been realised on the basis of the first one. It enhances social aspects by enabling learners to work at an individual, group, or course level,

and allow to structure communication resources such as forums by using the concepts of the ontologies.

The environment seems to have interesting features to support SRL. Students can choose their entry points in the domain and are free to deepen a notion thanks to the various documents contained in the memory. They can reflect on what they are doing by means of the navigation history and can get new ideas through the graphical representation of the domain ontology. A first experience with students in the context of the applied mathematics course at the university of Picardie has confirmed these potentialities for SRL but more precise experiments still need to be done.

Activity tracing and interaction analysis

In this section we pay a special attention to new directions that have recently emerged in order to personalise learning environments: interaction analysis and learners' activity tracing. These two approaches can both be pertinent for supporting SRL.

Interaction Analysis for Metacognitive Support and Diagnosis

Dimitracopoulou[1] (2004) developed this theme in collaboration with other European researchers in two work packages of the Kaleidoscope network of excellence. The study focuses on interactions that occur via TELEs designed for stand alone use or collaborative use. Special emphasis is given on Interactions Analysis outputs that could support learning activities' participants in cognitive and metacognitive reflection and thus in self-regulatory operations. Additionally, the analysis pays special attention to enriched learning environments and contexts designed or used under constructivist and socio-constructivist theoretical considerations, implying multidimensional and complex interactions.

The interaction analysis results are shown to the participants of the learning activities and displayed in an appropriate format (usually graphical, but also numerical or literal). It is

[1] A. Dimitracopoulo is a Greek researcher, we mention her work here because she has been involved in several activities in France.

argued that the corresponding information provides an "insight" on their own current or previous activity allowing them to reflect at a cognitive or metacognitive level, and basing on this reflection or co-reflection output, to acquire the possibility to self-regulate their activities.

A link between Interaction Analysis source fields and SRL is proposed:

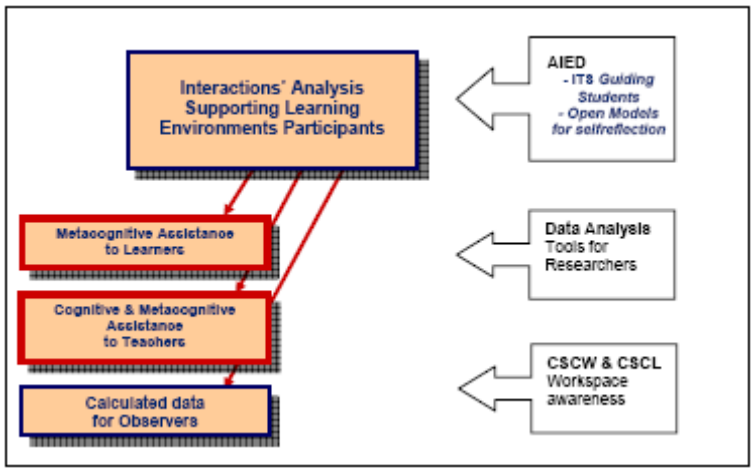


Figure 3: Interaction Analysis source fields and SRL field

In the same way, Dimitracopoulou and Bruillard (2006) present several indicators related to cognitive, social and affective dimensions in order to facilitate discussion forums users' activities.

Learners' Activity Tracing

Learners' activity tracing is presently a major concern for research on TELEs in France. A summer school has been organised on this theme this year. Activity tracing is primarily aimed at helping experimentation or personalization of TELEs (Settouti et al 2006). It can also help to facilitate the activity of learners. Ollagnier-Beldame and Mille (2007) think that self appropriating TELEs is mandatory for learners, both to understand their computer environment and to learn what they are supposed to learn. They consider interactions traces as potential sources for facilitating self-understanding of both environment and lessons. Appropriation is seen as linked to the vygotskian process of self-development.

They define "traces" as information sequences inscribed by, or in, the environment, linked to the way a subject (a learner) has used this environment. They argue that raw information

collected by the environment is not sufficient. The TELE has to offer tools associated to interaction traces in order to facilitate user's activity. In particular it would be useful to offer to the learner:

- a feedback on her interaction history in real time, relying on "viewpoints", that could lead to a reflection on her activity and associated human development process.
- means to re-present to herself what she is doing, which supposes to create interaction modes with traces, and
- means to compare her traces with ancient traces or with other learners traces, in order to argument and negotiate a common sense.

Assessment of TELEs that provide SRL support

In the context of the TELEPEERS project (http://www.lmi.ub.es/telepeers) that aimed at identifying the potential support to SRL provided by TELEs, Trigano (2006) reports an experience at the University of Technology of Compiegne, which was one of the partners of the project. The experience is related to an environment on Algorithms and Programming. Its potential to foster SRL is analysed by means of two evaluation tools (questionnaires) developed during the Telepeers project: TELE-SRL for teachers and TELESTUDENTS-SRL for students. The TELE-SRL is devoted to teachers and/or SRL experts for an *a priori* evaluation of the TELE's potential, while the TELESTUDENTS-SRL is addressed to the TELE's users and allows *a posteriori* assessment of the tool and its use.

The goal of the study is to see if a course including SRL aspects gives better results than traditional teaching. The course is an 'Introduction to Algorithms and Programming', taught during the 2004 fall semester and the 2005 spring semester at the University of Technology of Compiègne using different pedagogical methods. In the first case, SRL was firmly encouraged by various means, in the second case the pedagogy was more traditional. In both cases, students had access to a website including a lot of tools: simulation, exercises, quizzes, electronic notes, link to other notes, etc.

In accordance with other participants of the Telepeers project, four dimensions were mainly evaluated: cognitive, motivational, social and emotional aspects. Here are some features of the TELE relating to these four dimensions that have been positively appreciated by learners:

Cognitive aspects

- switch to a new learning strategy if necessary
- help the student to find out to what extent he is achieving his learning goals
- possibility to choose which skills to self-assess

Motivational aspects

- personalize the user interface
- give feedback reminding the student of knowledge and skills relevant to solve tasks
- suggest to the student how problems might be solved
- increase his confidence in his own abilities

Emotional aspects

- restore a positive working attitude at points where he was experiencing

Social aspects

- possibility to contact and receive help from my tutor/instructor

The results also showed that the same TELE was more appreciated in the first case (SRL encouraged) than in the second case (traditional teaching). The study concludes that if technological tools (web sites, hypermedia, LMS etc.) are useful to support SRL, they cannot be used alone. They have to be integrated into pedagogy and need human interventions (tutors, teachers, discussions), and social aspects.

In accordance with what was said at the beginning of this review, the role of teachers is again stressed in this study.

Conclusion

From our point of view, the interest for SRL and TELEs has not been very high in France by now. It may be because the role of human tutors is often stressed. Indeed, SRL requires capabilities that are not very widespread among students and actual uses of TELEs often include tutors interventions. Of course the development of open and distance learning leads to a growing interest for SRL and it should be noted that autonomous learning have already been studied in France, mainly from a sociological point of view. We do not claim to be exhaustive and it would certainly be necessary to go deeper in this direction.

In this short review, we tried to show that there is a growing research interest in France on technological tools that could enhance SRL. Students activity traces can be easily captured by the environment, but these traces by themselves are likely to be of no use. They need to be modelled and worked in order to provide students with images of their activity. Furthermore static images may not be sufficient. Interaction means need also to be defined to allow students to have different points of view on their activity and on the activity of other students.

We can guess that this trend to design tools that can not only support learners' cognitive and metacognitive activities but also reflect their motivational and emotional states, either in collaborative or individual situations, will be confirmed in the future. However we have to mention that there is still a lack of experimentations regarding their potential to facilitate SRL.

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GERMANY

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Introduction

This contribution aims at presenting a survey of publications on Self-Regulated Learning in Technology Enhanced Learning Environments (SRL in TELEs) in Germany. Although research is conducted on this topic in Germany, German researchers are in general well aware of similar research being done in the Anglophone parts of the world, particularly of works published in the US. Friedrich & Mandl (1997) for instance, in their contribution to the German Encyclopaedia of Psychology on of the analysis and fostering of self-regulated learning list 280 publications; 200 of them are written in English, one in Dutch and the rest (79) in German.

There is considerably less awareness of contributions from our European neighbours notwithstanding the fact that in recent year, the topic of SRL in TELEs was also made a topic of research on a European scale, e.g. in the TELEPEERS project (2005; Carneiro, Steffens & Underwood, 2005; Steffens, 2006; Bartolomé & Steffens, 20006) which also involved members of the KALEIDOSCOPE network of excellence.

Self-regulated learning

A short history

Self-regulated learning or learning to learn seems to have a long tradition in Germany pedagogy. Johann Amos Comenius (1592 – 1679), one of the founding fathers of German and European pedagogy, may have been thinking of self-regulated learning when he wrote in his Didactica magna “Erstes und letztes Ziel unserer Didaktik soll es sein, die Unterrichtsweise aufzuspüren, bei welcher die Lehrer weniger zu lehren brauchen, die Schüler aber dennoch mehr lernen; und bei der in den Schulen weniger Lärm, Überdruss und unnütze Mühe zugunsten von mehr Freiheit, Vergnügen und wahrhaftem Fortschritt herrscht.(The first and

foremost goal of our didactics should be to explore teaching methods which enable teachers to teach less and students to learn more and which will lead to less noise, disenchantment and and frustration and to more freedom, enjoyment and true progress in school]" (Greif & Kurtz, 1996, p.22). Classical German pedagogy propagated the idea that education (Bildung) is to a large extent self-education (Selbstbildung). To educate one-self meant to develop one's own personality, one's own capacities. According to Wilhelm von Humboldt (1767 – 1835), an individual's goal should be the most proportional development of his potentials (die wohlproportionierlichste Ausbildung aller seiner Kräfte).

An idea akin to that of self-regulated learning was developed in Reform Pedagogy (Reformpädagogik), a movement that started in the last decades of the 19th century and extended until the early 30ties . The movement opposed the old and authoritarian drill school; "education beginning from the child" (Pädagogik von Kinde aus), the "natural curiosity of the child" (natürliche Neugier des Kindes), "free work" (freies Arbeiten) and "self-activity" (Selbsttätigkeit) were the buzzwords of the time . While the movement was international (John Dewey, 1859 – 1952 in the U.S.A., Maria Montessori, 1870 – 1952 in Italy), it also had quite some impact on German educational thinking and practicing. Georg Kerschensteiner (1854 – 1932) proposed the working school (Arbeitsschule), a school which placed much emphasis on practical activities. Unlike the previous text book and drill schools, it resembled a vocational training institution. Self-activity, i.e. an activity that had its origin in the interests and needs of a child, was an important concept for him. It did not only refer to manual activities, but also to mental activities, and Kerschensteiner considered self-activity to be a means of helping children and young people to develop their personality (Kerschensteiner, 1942).

The idea of self-regulated learning re-appeared in Germany in the late 70ties and early 80ties (Neber et al., 1978; Weltner, 1978, Fischer & Mandl, 1980). In 1982, the German journal "Unterrichtswissenschaft" (Instructional Science) published a special issue on self-regulated learning which was introduced by Weinert, the leading researcher in the field of educational psychology, with an article on self-regulated learning as a prerequisite, method and objective of instruction (Weinert, 1982). While he cites publications of Anne Brown and Campione on metacognition and learning to learn and of Jean Piaget who may be considered a truly European researcher, the majority of authors he refers to are German.

In the same issue, Mandl & Fischer (1982) discuss theoretical approaches on the development and enhancement of self-regulated learning. They present a number of German contributions regarding theoretical thinking and empirical investigations in the field of self-regulated learning. The theoretical frame for discussion is, however, taken from Brown, Campione and Day (1981) and as examples of intervention programs that support self-regulated learning, their work as well as that of Weltner (1978) is cited. The issue continues with a presentation by Wang from Pittsburg University of the "Adaptive Learning Environments Model – ALEM" (Wang, 1982) and with a critical discussion by Issing and Hannemann (1982) of self-regulated learning as search for information.

Since then, the literature on self-regulated learning has grown almost exponentially. After almost two decades of research on self-regulated learning in Germany, Friedrich & Mandl (1997) revisited the state of the art and presented a thorough analysis of factors that facilitate self-regulated learning, reviewing American as well as German approaches in one of the volumes of the Encyclopaedia of Psychology. One of their main conclusions was that self-regulated learning not only involves cognitive, but also motivational and emotional factors.

Results from research on self-regulated learning have also been implemented in study guides (cf. Metzig & Schuster, 2003; Metzger, 2004). Metzger's (2004) book on strategies for learning and working contains chapters on motivating oneself, time management, concentrating, coping with anxiety and stress, identifying the essential, processing information, coping with examinations, self-regulation, writing an essay and presenting convincingly. The most recent textbook on learning and instruction (Klauer & Leutner, 2007) dedicates a complete chapter to the problem of teaching how to learn to learn.

The concept of self-regulated learning

It is acknowledged that in our European societies, which are often characterised as knowledge societies, life long learning is becoming increasingly important. It is also expected that the self-regulation of learning will become increasingly important, one reason for this being that learning will take place more and more outside the traditional teaching and training institutions.

The concept of self-regulated learning is, however, far from being clearly defined. In discussing self-regulated learning, it is helpful to distinguish between broad and narrow conceptions. In a broad sense, learning is self-regulated if the learner is free to decide what, when, where and how to learn (Weinert, 1982). This implies that most of the learning in academic settings – in schools and universities – is only partly self-regulated and partly teacher/instructor regulated or regulated by the affordances and requirements of the learning environment of which the teacher/instructor may be a part. In a narrow sense, self-regulation of learning refers to a learner's competence to plan, monitor and evaluate his learning activities where the learning goals are usually set by a teacher/instructor or at least arise from an instructional setting. Although many authors refer to self-regulated learning in this narrow sense, from a constructivist point of view it could be argued than even in an instructional setting, learning is self-regulated: "Aus konstruktivistischer Sicht ist Lernen eine selbstgesteuerte, konstruktive, biographisch geprägte, überlebensdienliche, kognitive und emotionale Tätigkeit [From a constructivist point of view, learning is a self-regulated, constructive, cognitive and emotional activity, determined by a person's biography and serving her survival]" (Siebert, 2003, p.13).

Another problem is - as Friedrich and Mandl (1977) already pointed out - that there are a number of terms similar to that of self-regulated learning: independent study, individual study, self-directed learning, self-education, self-guided learning, self-instruction, self-planned learning, self-teaching, and it is difficult to clearly distinguish between these terms.

But even if we focus on concepts of self-regulation in the narrow sense, there are still very different points of view (Weinert & Schrader, 1997, p.305; Schreiber, 1998, p.15). Many authors assume that self-regulated learning is a domain-general competency (e.g. Baumert et al.,) while others (a minority) consider self-regulation a domain-specific competence (Weinert & Schrader, 1997, p.306).

Viewing self-regulated learning as a domain-general competency, a distinction can be made between self-regulation as a process and components of self-regulation. As far as the process of self-regulated learning is concerned, a number of German authors make reference to the cyclic model of Zimmermann (1989, 2000) who considers the self-regulation of learning a

process of planning, executing and monitoring and evaluating one's learning activities (e.g. Simmons, 1992; Brunstein & Spörer, 2001; Sindler, 2004; Götz, 2006; Schreblowski & Hasselborn, 2006). With respect to components of self-regulation, some authors refer to variants of Boekart's (1999) model of self-regulation who distinguishes between the regulation of the self, of the learning processes and of the information processing activities (e.g. Baumert at al. in their PISA studies; Götz, 2006).

The Austrian authors Ziegler et al. (2003) present an overview of models of self-regulated learning. Of the twelve models they describe, four were developed by German authors (Friedrich & Mandl, 1997; Leutner, 1999; Rheinberg et al., 2000; Nenninger & Wosnitza, 2001). These models are also described by the Austrian author Sindler (2004) who in addition presents a model of knowledge management proposed by Reinmann-Rothmeier & Mandl (2000).

Nothwithstanding the differences these models exhibit, there are also some communalities. As Ziegler et al. (2003, p. 35) point out, all models assume

- Self-regulated learning involves regulating cognitive as well as motivational strategies,
- Self-regulated learning builds on domain-specific knowledge,
- For self-regulated to be successful, it needs to be applied in specific learning environments,
- Self-regulated learning involves three steps: (1) planning (including goal setting, assessment of own resources, selection of appropriate strategies), (2) execution and monitoring (implementation of strategies, monitoring their success, possibly choosing a different strategy) and (3) evaluation (of the learning outcome).

There seems, however, to be a need for further differentiation in concept building and empirical research on self-regulated learning. Friedrich & Mandl (1997), for example, suggest to distinguish between (1) structure and processes on the part of the learner and (2) aspects of the learning environment. As for the learner aspects, they refer to a large number of studies that explore structural and process components in the realms of motivation and cognition with respect to self-regulated learning. With respect to learning environments, they discuss a

number of studies which investigate the potential of specific learning environments to foster self-regulated learning. We will take up this topic in the next section.

Research on self-regulated learning has not gone without criticism, however. Friedrich & Mandl (1997, pp. 274-276) observe the following:

- The theoretical concept of self-regulated learning is not a unitary concept, rather it is many-facetted, with some of the facets not clearly distinguishable;
- In many studies, self-regulated learning is considered to be a disposition or personality trait; little is know about the processes that are involved when a person actually self-regulates her learning;
- There is little research considering gender differences;
- There are hardly any long-time studies on self-regulated learning;
- Most studies on self-regulated learning were conducted with high school or university students; little is known about the self-regulation of grown-up learners in out-of-school and professional environments;
- There is still a need to pay attention to the development of diagnostic instruments,
- Little is known about learning environments that support self-regulated learning.

A more recent criticism was voiced by Leutner & Leopold (2003, 2006). They point out that in empirical studies, correlations between reported cognitive and metacognitve strategies on the one hand and learning outcomes on the other tend to be low (Baumert, 1993; Baumert & Köller, 1996; Blickle, 1996; Schreiber, 1998).

Learning with the new media

In recent years, a number of books were published on learning with the new media (Issing & Klimsa, 1995; Niegemann, 1995; Leutner & Brünken, 2000; Arnold, 2001; Kerres, 2001; Röll, 2003; Carell, 2006) all of which address the question of self-regulated learning in technology enhanced learning environments, but in varying degrees.

The new media

New media is a term whose meaning is not exactly defined although when using this term, reference is often made to the digital media or to the use of the new Information and Communication Technologies (Klauer & Leutner, 2007, p.304), or, more precisely, to the use of digital media to present information (Klimsa, 2002) or for communication purposes (Dörr & Strittmatter, 2002). The phrase "learning with the new media" is often considered to be synonymous with expressions like "multimedia learning", "computer-based learning", "telematic learning" and "telemedial learning". Klauer & Leutner (2007, p.304) suggest that if we speak of the new media in the context of learning and instruction, we refer to the use of the Information and Communication Technologies (ICTs) for the purpose of learning and teaching. From their point of view, the new media share at least one of the following characteristics:

- They use multiple forms of representation (multimedia),
- They allow the learner to interact with the system (interactivity),
- They are capable to adapt to the individual learner (adaptability),
- They provide the learner with the opportunity to communicate with peers and instructors (communication) (Klauer & Leutner, 2007, pp.304-305).

Technology Enhanced Learning Environments (TELEs)

Basically speaking, a learning environment is the environment that surrounds the learner while he is involved in learning. Somewhat more formally, Friedrich & Mandl (1997, p.258) define a learning environment as a specific arrangement of personal (teacher, peers), material (location, learning material, media) and instructional (learning tasks) factors. Technology Enhanced Learning Environments would then refer to learning environments which make use of the new ICTs. It should be pointed out that the term TELEs applies to a wide variety of ICT-based learning environments: a computer pool where students do their homework, a classroom where students are shown a DVD, a person's private room where she works with a CD-based multimedia program to improve her Spanish, all these are examples of TELEs, or, in a somewhat different parlance: all these are examples of learning with the new media.

I prefer, however, to speak of learning in TELEs. To talk of learning with the new media puts a great deal of emphasis on the media; these are, however, only part of a learning environment. Indeed, it is rather questionable whether learning outcomes can be attributed to

one single medium, independent of the learning environment in which it is used. And it certainly does not make sense to ask "Do the new media support learning?". I wonder if anyone ever asked "Do books support learning?". As Mandl, Gruber & Renkl remark (1997, p.459), learning with a specific medium does not exhibit unique characteristics which learning with other media does not possess.

Self-regulated Learning in TELEs

As mentioned in the introduction to the previous section, in recent years a number of books were published on learning with the new media all of which address the question of self-regulated learning in TELEs, but in varying degrees. I will discuss these books according to the degree to which they deal with the topic of self-regulated learning, those with the least relationship to self-regulated learning coming first.

Detlev Leutner & Roland Brünken (2000): New media in school and vocational training

Leutner & Brünken (2000) collected a number of papers that were presented at a workshop on the new media in school and vocational training held at the 57th meeting of the workgroup empirical educational research (Arbeitsgruppe empirische pädagogische Forschung – AEPF) which took place in Erfurt in 1999. However, of the 15 contributions, none refers to self-regulated learning in TELEs.

Ludwig J. Issing & Paul Klimsa (1995): Information and learning with multimedia

The book edited by Issing & Klimsa (1995) on learning with multimedia presents 27 contributions on (1) basic aspects, (2) multimedia learning, (3) development, application and evaluation of multimedia and (4) perspectives. The only contribution which explicitly refers to self-regulated learning is the one by Zimmer (1995) on the role of multimedia in the development from distance learning to open distance learning. In his opinion, traditional distance learning is largely instructor-driven, while open distance learning is learner-driven. Open learning includes all forms of learning which provide the learner with the opportunity to self-regulate his learning (Zimmer, 1995, p.341).

Michael Kerres (2001). Multimedia and telemedia learning environments

Kerres (2001), in his book on multimedia- and telemedia-supported learning environments, discusses (1) the didactical aspects of teaching with digital media, (2) theoretical approaches to teaching with digital media, (3) conceptual aspects of multimedia- and telemedia-based teaching and (4) the development of digital media content. Kerres refers to self-regulated learning in the context of talking about the logical structure of learning contents. While in traditional teaching, the learning content is organised by the teacher/instructor with respect to its logical structure as well as with respect to its delivery in time, much of this organising has to be done by the learner who uses the digital media. Kerres believes that digital media have a high potential for motivating explorative learning, and it is this kind of learning that needs a great deal of self-regulation. In Kerres' opinion, TELEs should, by helping the learner to logically structure the learning contents, facilitate the self-regulation of his learning activities and thus increase his motivation to explore the learning contents. Consequently, he offers a number of suggestions from the point of view of instructional design how the media presentation of learning contents should be organised to support self-regulated learning. Basically, these are design elements that facilitate the learner's orientation and help him control his learning activities.

Helmut M. Niegemann (1995): Computer-supported instruction in school and vocational training

Niegemann's (1995) book on computer-based instruction in school and vocational training explicitly addresses the topic of self-regulated learning in TELEs. While in the first four chapters of his book, he discusses theoretical foundations of and findings from empirical studies on self-regulated learning in computer-based instruction, he reports the results of five pilot studies on self-regulated learning in TELEs which he conducted in the context of vocational training at BASF in Ludwigshafen. Subjects participated in a five day training on economics. For some of the topics, computer programs had been developed. The basic question was therefore if these programs were preferred to traditional instruction and if help options implemented in the programs were used for the self-regulation of learning. The five studies investigated (1) learners' perceptions of help options, (2) acceptance and efficiency of help for time management, (3) use of help to structure the learning material, (4) impact of the

use of help for learning strategies and (5) differences in learning outcomes between individual and cooperative learning. The author concludes that there was a high degree of acceptance of the computer-based instruction; this form of instruction was generally preferred to traditional forms of instruction. Help for the self-regulation of learning was also accepted in general. The author and his research team were, however, not allowed to take measures of learning outcomes. It was therefore impossible to assess the impact of self-regulated learning on learning achievements.

In evaluating his own studies, Niegemann (1995) suggests that the computer programs used may have been much too simple. In his opinion, computer programs that support self-regulated learning need to be sufficiently complex, with a rich offer of help functions. Based on these insights, he developed a computer program to help people acquire knowledge in the field of calculating costs in companies. First evaluations show there was a high degree of acceptance among subjects. There were, however, no differences between experimental and control group with respect to errors made and time on task. Also, there was only an infrequent use of the various help options.

Franz Josef Röll (2003): The pedagogy of navigation

Röll's (2003) book on the "Pedagogy of Navigation" directly addresses the question of support for self-regulated learning through the new media, however, in a more general and abstract way than the other books. According to Röll, the pedagogy of navigation aims at enabling learners to self-regulate their learning, and in his opinion, the new media are the means for achieving this aim, provided they allow the learner to experience autonomy, competence and social attachment (Röll, 2003, p.14). His term navigation does not, however, primarily allude to a learner navigating in a specific computer program. Rather, the idea is that the teacher should be a navigator, like a pilot who helps ship to find their way through shallow or dangerous water.

To give you an idea of the breadth of his approach, these are his chapter titles: (1) from information society to knowledge society, (2) changes in perception and thinking, (3) identity and learning in the media age, (4) learning in the knowledge society, (5) computer projects with children, (6) learning in school with the new media: some examples of best practice, (7)

learning with multimedia, (8) the aesthetics of the Internet, (9) youth and the Internet, (10) electronic learning: a challenge for vocational training, (11) learning in networks, (12) from pedagogy to navigation.

As can be seen, Röll covers a lot of ground in his book, providing an abundance of "best practices", i.e. descriptions of TELEs in which children, young people and adults work with great enthusiasm. Basically, it is a call for a new pedagogy and for new didactics. He talks in very positive terms about Reform pedagogy which he thinks places much more emphasis on the learner and his self-activity than the traditional pedagogy of that time. He would therefore like to re-activate the ideas of Reform pedagogy and adapt them to today's ICT-based teaching because he believes the new media will help learners to become more self-regulated in their learning activities. "High-Tech-Reformpädagogik bedeutet die Gestaltung von offenen und prozessuralen Lerngefügen, die vernetztes und kooperatives Lernen ermöglichen und ästhetisches und kontextuelles Denken fördern [High tech Reform pedagogy aims at creating open and process-based learning structures which facilitate network-based cooperative learning and foster aesthetic and contextual thinking]" (Röll, 2003, p. 365).

Patricia Arnold (2001): Didactics and methods of telematic teaching and learning.

The book by Arnold (2001) is a report on the didactics and methods of telematic learning and instruction, a study which was part of a project on a "Virtual college for Technology, Information and Economics" (Virtuelle Fachhochschule für Technik, Information und Wirtschaft) financed by the German Ministry of Education and Research. Broadly speaking, telematic learning alludes to any kind of learning that involves the Internet. More specifically, the term telematic learning refers to ways of learning which are based on the new ICTs and which make use of these through networks of multimedia computers (Zimmer, 1997, p.111). Examples from distance learning are therefore the instances of telematic learning which Arnolds want to describe and analyse.

In order to be able to analyse different examples of telematic learning, Arnold suggests to distinguish between learning space (Lernraum), learning scenario (Lernszenario), learning unit (Lerneinheit) and media representation of learning units (mediale Repräsentation). The learning space is a virtual space (a Learning Management System, for instance) where

learners can work and communicate with their peers and their instructors. The term learning scenario is used to describe the specific temporal and structural organisation of a distance learning course while the term media representation relates to the question of what media are used to represent the content of a specific learning unit. In Arnold's terminology, learning space, learning scenario and media representation are the constituents of what she calls the educational infrastructure. In my opinion, they are different perspectives which focus on different aspects of distance learning courses.

For the three different perspectives, Arnold suggests criteria which she uses to evaluate specific instances of telematic learning. In the context of our survey, the examples of telematic learning that she analyses from the perspective of the learning space are most promising because the corresponding evaluation criteria are strongly related to the potential of the learning space in question to foster self-regulated learning.

As "best examples" of learning spaces she selects two Learning Management Systems: ILIAS (http://www.ilias.uni-koeln.de/) from Germany and LUVIT (http://www.luvit.com) from Sweden. For the evaluation of these learning spaces, she suggests the following criteria (Arnold, 2001, p.39-40):

1. Negotiation of learning resources: How does the system handle the management and distribution of learning resources?
2. Coordination: How does the system support collaborative learning?
3. Monitoring: To what extent does the system provide the learner with feedback which allows him to monitor his learning activities?
4. Individualisation: What means does the system offer to the learner to customise it to his needs?
5. Self-regulation: What support does the system give the learner to organise his learning activities?
6. Adaptivity: Is the system easily adaptable to changes in learning concept and learning content?

Since ILIAS was developed at my university (Universität zu Köln) and since I happen to have access to evaluations that were made of the system from different points of view, I will

present it later on as a German TELE that has some potential for fostering self-regulated learning.

While Arnold also evaluates a number of learning scenarios (distance learning courses) and instances of media presentations, the evaluation criteria she suggests are not related to self-regulated learning; I will therefore not consider these.

Karin Ziegler, Franz Hofmann & Hermann Astleitner (2003): Self-regulated Learning and the Internet

The Austrian authors (University of Salzburg) believe that although training of strategies for self-regulated learning should be a promising endeavour it does not occur in the normal classroom very often because teachers simply do not have sufficient time to do so. They therefore suggest that web-based training for self-regulated learning might be the solution because it can be conducted much more flexibly and even outside the classroom.

Ziegler et al. propose the idea that students (aged 10 to 14) should obtain a “driver’s licence” for learning and they suggest that part of a corresponding web-based learning environment should be a module to help students acquire and improve strategies for self-regulated learning. The design they develop for such a web-based module is based on a review of existing models of self-regulated learning (see above) and empirical research on the topic; it also takes into consideration findings from the field of quality management in eLearning. More specifically, the module incorporates variables that have been found to be of importance in empirical research on self-regulated learning:

1. Constructive self-monitoring related to specific goals or standards,
2. An open learning environment providing support for the learners,
3. Small group work,
4. Fostering motivational and emotional processes,
5. Self-instructive study material,
6. High-level criteria for mastery,
7. Integration of subject-specific information,
8. Multiple modes of intervention (Ziegler et al., 2003, p.104).

A first version of the module was implemented using Blackboard (https://elearn.sbg.ac); the site is, however, only accessible to University staff and students and Ziegler et al. do not report any empirical data on the use of the module.

Alexandra Sindler (2004): Establishing a new culture of learning

This book is Sindler's dissertation in which she aims at analysing media-based learning environments with respect to their potential of fostering self-regulated learning. She explicitly states that she intends to carry out this analysis bearing in mind that the learning environments she is studying are embedded in the learning cultures of specific organisations and that she wants to study the impact of the organisational embedding on the implementation and use of media-based learning environments and on the learning processes that take place in these environments. Her analyses are based on interviews she conducted with teaching staff at the university of Graz (Austria) who had been working with the new media for at least a year (N=43).

This is not the place to report the detailed results of her analysis, but I would like to mention the suggestions she makes to encourage the use of the new media to foster self-regulated learning. These are basically addressing the teaching staff and the organisation in which they work (Sindler, 2004, pp.288-290).

1. Going beyond the status of nice to have. The new media should not just be something nice to have; their potential for improving teaching and facilitating self-regulated learning needs to be recognised.
2. New models for organisation and financing teaching. Traditional forms of teaching cannot simply be implemented in media-based teaching. New forms of teaching need a different organisation and different financing.
3. Revalurisation of teaching. Teaching needs to be made more important. At the moment, dedication to teaching is sometimes considered to inhibit progress in one's career.
4. Improving the competences of teachers. Media competences of teachers could be improved using the new media.
5. Integrated content management systems. Content management systems should integrate teaching and administrative tasks.

6. Integration of research and teaching. Integrating research and teaching in the field of the new media will improve teaching.
7. Changing funding resources. The use of the new media should not only be funded by external financial resources, but also the funds from the university.
8. Improving the infrastructure. The implementation and maintenance of a good infrastructure facilitates the use of the new media in teaching.
9. Using the infrastructure. Instead of discussing technical details, the everyday use of the new media should be encouraged.
10. Organisation of services. The different services of the university should be interlinked.
11. New media in teaching as a marketing instrument. Teaching using the new media should be advertised to show the high quality of teaching at the university.

From my point of view, the strength of Sindler's analysis lies in the fact that she points out that TELEs are not islands, entire of themselves, but part of a larger institutional structure whose impact should not be neglected.

Angela Carell (2006): Self-regulation and participation in computer-supported collaborative learning

Carell's (2006) book is her dissertation on "Self-regulation and participation in computer-supported collaborative learning". While in the first part of her book, she presents an overview of research results on computer-supported collaborative learning (CSCL), self-regulated learning in CSCL and participation in self-regulated CSCL, in the second part she presents and discussed results from her own empirical study.

In her study, she explored participation and self-regulation of a small group of students who took part in an online class at the University of Dortmund from November 2001 until February 2002. The online class was given by Carell herself. In the course of the class, students were supposed to develop criteria for the evaluation of virtual learning environments and to actually evaluate a few selected virtual learning environments using these criteria. Teamwave (http://www.markroseman.com/teamwave/) was used as a platform for communication and learning. The participating students (N=20) formed three study groups.

Space does not permit me to go into the details of her very elaborate and sophisticated research design. I will try to summarise the main results. As concerns participation, she found four types of participation patterns:

(1) Students with a fair degree of participation (N=7, 5 male, 2 female),
(2) Students with a constantly high degree of participation (N=5, 1 male, 4 female),
(3) Students who dropped out (N=7, 4 male, 3 female)
(4) Students whose degree of participation varied a great deal (N=1, male)

Results show that study group membership and participation patterns are not independent. A majority of study group 1 (N=8) members exhibit a pattern of constantly high participation. Most students in study group 2 (N=7) show a pattern of fair participation, while study group 3 (N=5) has most of the drop outs and consequently breaks up in the course of the class and is continued by just two students

While Carell reports very detailed analyses of the structure and the social processes within the different group, I would like to focus on her results on self-regulated learning. In her study, self-regulated learning was assessed by the LIST questionnaire (Lernstrategien im Studium [learning strategies of university students], Wild, 2000). The questionnaire comprises 3 scales: (1) cognitive strategies, (2) metacognitive strategies and (3) resource-oriented strategies. Resource orientation basically refers to management of own resources such as effort, attention and time.

When comparing students with different patterns of participation, one of the most interesting results is that they hardly differ with respect to their metacognitive strategies. In fact, the mean value for self-assessment of metacognitive strategies for students with the drop-out pattern is slightly higher than for all the other participation patterns. They even do best in some of the resource-oriented strategies (time management and effort). All the differences are, however, very small and probably statistically not significant (because of the small group size, Carell decided not to apply tests of significance).

Nonetheless, the fact that the drop outs exceed the other groups, although only slightly, with respect to their metacognitive and resource-oriented strategies remains an interesting finding.

Carell assumes that his might be due to the fact that the drop outs may not have perceived the class to be sufficiently challenging. My own interpretation is a bit different: of the 7 students who initially exhibited this participation pattern, only 2 stayed in the class until the end. These two students also belonged to study group 3 which fell apart in the course of the class. If these two students decided to continue in spite of the difficulties facing them, they must have been particularly persistent. Now wonder they show slightly higher values in the self-assessment of their metacognitive and resource-oriented strategies.

Apart from that, it is a bit surprising that differences in self-regulation between the different groups turned out to be relatively small. Maybe it would have helped to apply non-parametric test to find out which of the differences were statistically significant and which were not. It would certainly be worthwhile to repeat the study with a larger number of participants before generalisations of the results are made.

ILIAS – an example of a TELE that supports SRL

ILIAS basically is a Learning Management System which I would like to present as an example of a TELE that has some potential to support self-regulated learning, not only because the platform was developed in Germany, in fact, even at my university, but also because I found several sources which presented evaluations of the TELE with respect to its potential to foster self-regulated learning.

ILIAS (Integrated System for Learning, Information Seeking and Cooperative Working - **I**ntegriertes **L**ern-, **I**nformations- und **A**rbeitskooperations**s**ystem) was developed at the University of Cologne in the framework of the VIRTUS project. The VIRTUS project of the Department of Business Administrations, Economics and Social Sciences at the University of Cologne (1997 – 2001) aimed at the development of **virt**ual **uni**versity systems (see http://www.virtus.uni-koeln.de). It was intended to supplement traditional learning environments in higher education with a web-based working environment - the ILIAS learning platform. After termination of the project, it was decided to make ILIAS an open source system.

ILIAS open source was supported by the Ministry of Science and Research

(http://www.innovation.nrw.de/) of the State of Northrhine-Westphalia and by several foundations: the Bertelsmann Foundation (http://www.big-internet.de), the Heinz Nixdorf Foundation (http://www.heinz-nixdorf-stiftung.de/) , and the Sal. Oppenheim Foundation (http://www.oppenheim.de/gb2004de/02_maezenatentum/03_historischer_ueberblick/02_03.htm).

ILIAS is an Internet-based authoring environment for course designers as well as an Internet-based learning environment for students at university level. As such it qualifies as a Computer Mediated Communication Systems (CMCS) as well as a Learning Management System (LMS). The system was developed with the explicit goal of enhancing self-regulated and collaborative learning. The authors believe that these skills will become increasingly important in the future, particularly in the context of life-long learning (which demands high skills in self-regulated learning) and virtual enterprises (which demand high cooperative working skills). ILIAS is used at Cologne university (http://www.ilias.uni-koeln.de) as well as at a number of other German, French, Italian and Swiss educational institutions.

ILIAS provides the user with a number of features that might help them to self-regulate their learning (see Table 1).



Course Management

ILIAS allows efficient creation of courses and course materials. It offers standardized tools and templates for the learning and working process including integrated navigation and administration.



Groups

Groups in ILIAS allow cooperative learning and working on the platform without additional tools. Learning groups, working groups or groups for certain fields of interest could be constructed. Groups can use all ILIAS tools like forums or file sharing. Users can create groups that are open for everyone or have specially defined access restrictions, e.g. access with a password.



Learning Content

ILIAS offers multiple ways to deliver learning content. All types of document files can be



Personal Desktop

Every user in ILIAS has his or her own Personal Desktop. It collects all resources that are needed by the learner to fulfill the daily learning tasks. The personal desktop features News, Personal Messages, Learning Resources, Personal Notes, Bookmarks, External Web Feeds and other information. The learner can re-arrange these blocks of information according to his needs.



Test & Assessment

ILIAS offers an integrated environment for the creation and enforcement of tests & assessments. This can be used for the monitoring of learning progress by the users as well as the tutors and examiners. ILIAS Test & Assessment supports multiple choice, single choice, allocation questions, cloze questions (free text, select box), ordering, matching, hot spot and more question types.

Standard Compliance

ILIAS accomplishes the e-learning-standard

uploaded, SCORM 1.2 and AICC are supported. ILIAS includes an internal authoring environment to create XML-based learning modules that can include images, flash, applets and other web media files. It is possible to create glossaries and reuse term definitions within other learning modules.



Communication

ILIAS supports standard ways of communication as chats, forums and mails. The personal desktop includes an awareness function which shows the users who are currently online. ILIAS also sends information via RSS to the user and displays external RSS feeds in the system.



Webcasting

Beside RSS support, ILIAS offers the ability to manage podcasts. To create a podcast is as easy as uploading a audio file to the web. The author decides whether items are available through the web, or within the LMS only.

SCORM 1.2 and first of all open-source-LMS, it achieves the maximum conformance level LMS-RTE3. It also supports LOM metadata standard, AICC and IMS-QTI.



Authentication

ILIAS supports a number of different authentication methods: Standard Login/Password Authentication (Database), LDAP, Shibboleth, CAS, Radius and SOAP based Authentication.



SOAP Interface

Today learning management systems are integrated into a larger environment of institutional administrative systems. To enable information exchange with these systems, ILIAS offers a SOAP interface, that allows to control almost everything in ILIAS with an external application.



Online Surveys

In ILIAS you can use surveys to easily collect information from a large number of users, for example to evaluate courses or other events. ILIAS surveys are easy to create and administer, even for non-experienced users. With a sufficient basis of survey questions, teachers could create their own evaluations fast and efficient.



Google Maps

A learning management system is a virtual meeting place for your teachers and learners. But in ILIAS users may also share their real locations to meet each other. ILIAS supports Google Maps for user profiles and adds maps of all members to groups and courses.

Table1: ILIAS features (taken from the ILIAS web site http://www.ilias.de and slightly modified)

As mentioned above, Arnold (2001) developed a set of criteria with which to evaluate TELEs with respect to their potential to support self-regulated learning. On the basis of her own evaluation of ILIAS, she came to the following conclusions:

1. Negotiation of learning resources: How does the system handle the management and distribution of learning resources?

Students can only enter information (learning resources) into the ILIAS system using the fora. Learning content is entered by the tutor.

2. Coordination: How does the system support collaborative learning?

The only mode of collaborative learning which is supported by ILIAS is through the use of asynchronous fora.

3. Monitoring: To what extent does the system provide the learner with feedback which allows him to monitor his learning activities?

The user is given information concerning the degree to which he has studied different study units and completed his study tasks. There are also exercises which are automatically evaluated. The learner will also receive feedback from the tutor through personal messages or in group discussions.

4. Individualisation: What means does the system offer to the learner to customise it to his needs?

The user is able to individualise his navigation. He can also comment study resources and take notes.

5. Self-regulation: What support does the system give the learner to organise his learning activities?

The system helps the user to get his bearing by offering a good structure for navigation, context-sensitive help and context information that is easily available. Options for administrating external resources and links to web searching machines support the user in self-regulating his learning activities.

6. Adaptivity: Is the system easily adaptable to changes in learning concept and learning content?

Changes can easily be implemented at the author level.

It should be pointed out that Arnold did her evaluation of ILIAS in 2000; the system has been updated many times since then.

ILIAS was also one of the TELEs which were evaluated in the context of the TELEPEERS project (see http://www.lmi.ub.es/telepeers/) . For the evaluation, we had developed a questionnaire which assessed procedural (planning, execution and monitoring, evaluating) as well as componential aspects (cognitive, motivational, emotional social component). The questionnaire is available for researchers and instructors (TELE-SRL) as well as for students (TELESTUDENTS-SRL). Both forms are available in the nine languages of the TELEPEERS consortium (see http://www.lmi.ub.es/taconet/ where they can be downloaded from resources); there also exist online versions in English.

The TELE-SRL form consists of 43 statements that describe details of a TELE which would make the TELE supportive of self-regulated learning. For each statement, the evaluator is to assess the degree to which he agrees with the statement on a six-point scale (0 to 5). A high over-all score therefore indicate that the evaluator considers the TELE to have a high potential for fostering self-regulated learning. In the TELEPEERS project, 12 TELEs were evaluated on a peer review basis, i.e. each TELE was evaluated at the institution where it was in use and by at least one other partner. To make results comparable, total scores were divided by the

number of items, for the overall total score as well as for the different subdimensions. Results are shown in table 2 (see Steffens, 2006; Bartolome & Steffens, 2006).

TELE/home	Total	Cognitive component	Motivational component	Emotional component	Social component
Container systems with tutor					
Digital Portfolio / Amsterdam	**4.0**	**4.1**	**3.5**	**3.8**	**4.5**
DiViDU / Amsterdam	**3.9**	**4.0**	**3.6**	**3.5**	**4.5**
ILIAS / Cologne	**4.2**	**3.7**	**3.7**	**4.0**	**4.8**
Weblogs / Bergen	**3.1**	**2.8**	3.4	2.7	**3.4**
Content systems with tutor					
ICT-based Teacher Training / Lisbon	**3.2**	2.3	**3.0**	**3.5**	**4.6**
Cognitive Psychology Course / Nottingham Trent	1.4	1.7	1.8	1.1	0.8
Digital Video Course / Barcelona	**3.1**	2.3	2.7	**3.2**	**4.5**
Teacher Training Course on ET / Genoa	**3.3**	2.6	**3.1**	**3.3**	**4.5**
Content systems without tutor					
Sunpower / Cologne	2.4	**3.2**	**3.0**	1.9	0.6
Databases / Compiègne	**3.0**	**3.8**	2.6	2.9	2.4
Programming Tutorial / Compiègne	**3.0**	**3.6**	**3.6**	2.9	1.6
SWIM / Aalborg	**3.0**	2.4	**3.6**	**3.2**	**3.3**

Table 2: TELE evaluations from the TELEPEERS project (value range 0.0 – 5.0)

ILIAS had been evaluated by a member of the teaching staff of the University of Cologne who had made it a topic of one of her classes. As can be seen, ILIAS does very well; it is, in fact, the TELE with the highest total score for its potential to foster self-regulated learning.

Unfortunately, we did not have peer review data on this TELE. However, we received data from teaching staff members at the University of Leipzig (table 3).

ILIAS	Total	Cognitive component	Motivational component	Emotional component	Social component
Köln	**4.2**	**3.7**	**3.7**	**4.0**	**4.8**
Leipzig 1: online students	**3.2**	**1.6**	**3.4**	**4.2**	**5.0**
Leipzig 2: online designers	1.5	0.9	0.1	0.2	**5.0**
Leipzig 3: online tutors	**3.1**	2.5	2.4	**3.7**	**3.1**

Table 3: ILIAS evaluations

Much to our surprise, the three evaluations we received turned out to be quite different. The first two courses (Leipzig 1 and Leipzig 2) were part of a three semester on-line course on media literacy offered at the University of Leipzig (Frank & Dommaschk, 2005; Brüggen, 2005). In the first semester, students (50 on the average) are acquainted with the basic concepts relating to media literacy (online students). In the second semester those students who continue (10 on the average) develop course material for another online course (online designers). In the second semester, the students who remain implement the course they designed and accompany students of this course as tutors. In all of these courses, ILIAS plays a crucial role as information and learning management system.

One possibility to explain the differences in evaluation between the online students and the online designers is to assume that the online designers are on their way to become experts. They have a more profound knowledge of the possibilities of virtual learning platforms in general and as designers of an online course, may be more acutely aware of the limitations of ILIAS.

The third evaluation comes from participants of a workshop on educational media where ILIAS also plays a central role. This course if offered by Leipzig University as part of a Bachelor and Master programme. It is a reduced version of the three-semester online course, with emphasis on the second phase. The workshop course, however, comprises only six weeks. I would argue then that students of this course are more like the students in the first semester of the online course; they are still novices and evaluate ILIAS more from a user perspective than from a designer perspective.

Conclusions

There is a vast amount of literature on the topic of SRL; this may be due to the fact that SRL has a long tradition in German pedagogy, albeit in the more fundamental sense of developing one's own personality. There are significantly fewer books on learning and the new media, and there are only very few book on TELEs that support SRL.

From the review of books and articles on SRL, the following conclusions may be drawn:

- The theoretical concept of self-regulated learning is not a unitary concept, rather it is many-facetted, with some of the facets not clearly distinguishable;
- In many studies, self-regulated learning is considered to be a disposition or personality trait; little is know about the processes that are involved when a person actually self-regulates her learning;
- There are hardly any long-time studies on self-regulated learning;
- Most studies on self-regulated learning were conducted with high school or university students; little is known about the self-regulation of grown-up learners in out-of-school and professional environments;
- correlations between reported cognitive and metacognitve strategies on the one hand and learning outcomes on the other tend to be low;
- Little is known about learning environments that support self-regulated learning.

It therefore seems to be highly desirable to research SRL in TELEs much more in depth.

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ITALY

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Introduction

What is the Italian for Self-Regulated Learning? The Italian for the expression "self-regulated learning", in the following SRL, is "autoregolazione dell'apprendimento". A quick search of this phrase in inverted commas with Google produces "only" 256 results[1], among which we find the translation of seminal papers on SRL; the syllabuses of courses of the psychology departments of several Italian Universities, articles and research programmes of the Institute for Educational Technology, documents concerning the OCSE/PISA Project[2], etc. All in all, very few are scholarly articles on SRL by Italian researchers, let alone papers concerning SRL and Technology Enhanced Learning Environments (TELEs).

What does this mean? Perhaps there is no such thing as research on SRL and TELEs in Italy? We'll come back to this point later on.

We live in an era of very fast technological change, and these changes are not affecting only the sphere of work, but also (and very much indeed!) our social lives, our way to obtain information, our security, our learning. Learning has never been something that could be done once and for all in human life, and the ability to cope with innovation and change has always been very important, not only to succeed, but even to survive. So, what's new? The news is the speed of change, and the fact that major changes are taking place not only in what we learn, but also in the tools for learning, and we don't mean merely the technical tools, but the conceptual tools too. In other words, Life-Long Learning is now a need, not an option. The way we learn is also becoming more and more important, as well as the extent to which we

[1] If we try the same query on Google Scholar, we only get 5 answers, none of which are scholarly works produced by Italian researchers. These searches have been done on the 25th of July, 2007.
[2] Italian researchers were involved in the international programs that preceded the OECD-PISA – Programme for International Student Assessment, examining the scientific literature on SRL and conducting pre-tests with the aim to establish indicators for Cross-Curricular Competences (Scalera, 1999; INVALSI, 2000).

are aware of the strategies we use, we control our learning and are flexible about it. No wonder, therefore, if the cross-curricular skills and competences that are needed to adapt to the changing nature of learning and knowledge management are regarded as vital by illuminated teachers and school policy makers, by scientists and by enterprise managers. These competences are not mere cognitive abilities, such as good memory or cleverness, they have to do with personal initiative, self-control, flexibility, intuition, endurance, method and determination. They do not belong to any disciplinary syllabus, they even include aspects that, in the past, were not regarded as concerning the scholastic sphere, because they touch the emotions. But their importance has been recognised by many teachers[3], and it has now been taken into account (even!) into the last Italian school reform, dating 2003. In recent years the Italian educational system has been substantially reformed. The last reform, the so-called Moratti reform, after the name of the former Minister of education, enacted new laws concerning the first cycle of studies (i.e., primary and lower-secondary school), aiming to[4]:

- "guarantee equal opportunities and a personalised path to achieve a high cultural level and to develop abilities and skills suitable for social and professional integration;
- promote the achievement of spiritual and moral development for younger generations, also inspired by the principles of the Constitution;
- guarantee equal educational and training opportunities for young people through the right/obligation to education and training for at least 12 years;
- encourage families' educational choices;
- promote lifelong learning;
- capitalise fully on the independence of schools;
- motivate and raise the standards of teachers of all kinds and grades".

This reform also introduced the National Guidelines for Individualised Plans of Educational Activities, which consist in a description of the performance that each school should ensure. Even if at the moment these guidelines are being revised, they witness a new sensitivity to ideas concerning students empowerment, among which they explicitly mention the stimulation of self-regulated learning attitudes, self awareness and self-evaluation capabilities.

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[3] Some of them have developed websites devoted to the problem of the problems: how to help students to learn how to learn? A very rich website addressing teachers and students, children and adult learners, can be found at http://www.learningpaths.org/. Luciano Mariani, English teacher, is updating it constantly with conference papers, learning material, tips and practical examples for colleagues, as well as interesting activities for students. The website also reports the authors' reflections of the role of new technologies in this respect (Mariani, 2000).

[4] Extracted from http://rome.angloinfo.com/countries/italy/life6.asp, reproduction authorised.

Sensitivity towards the need to develop SRL among Italian learners of all ages was already quite widespread among teachers and researchers before the reform. However, this interest in SRL is mostly witnessed by practical activities rather than by theoretical or experimental research[5]. This is why our search for the keyword "self-regulated learning" mentioned at the beginning of this section, was not so successful. Much of the work done in Italy in the field of SRL and TELEs is quite pragmatically oriented, and often does not assume as theoretical standpoint the work of Zimmerman (1998; 2001) , Boekaerts (1999), Boekaerts et al (2000), Bandura (1997). Rather, it addresses aspects of SRL, sometimes without even using the "classical" terminology of the field. However, if one looks for expressions such as "motivation", "learning to learn", "metacognition", "problem solving", then a wealth of experiences emerge that may be regarded as concerning SRL and TELEs.

In the following, we have grouped the most significant studies considered for this review in three categories: the study of the metacognitive abilities involved with the use of Information and Communication Technology, the studies aiming to design and implement systems that support the development of SRL and the studies aiming to assess and evaluate the potential for SRL development of different kinds of learning environments.

Investigations of the metacognitive competences involved in the use of ICT

The studies mentioned in this section have a sometimes weak, sometimes strong bond with SRL. They represent a quite large range of educational applications of ICT, and all of them are inspired to a constructivist view of learning. This is not a coincidence, of course. In fact, constructivist theories of learning claim that individuals are active agents and build their own knowledge by assimilating and accommodating[6] new information into their own mental schemas. Knowledge construction is the result of the continuous attempt to make sense of experience, and meaningful experience can only take place by interacting with a (learning) environment. A direct consequence of these ideas is that students should, at least, be involved in the decisions pertaining to their learning objectives, in planning and assessing their

[5] There are, of course, some notable exceptions. See, for example the work of Pastorelli et al (2001); Albanese et al (1995), Albanese et al (2005), Cornoldi et al (2001), just to mention few.
[6] These are the terms used by Piaget (1972), who is considered one of the fathers of constructivism.

learning, in choosing which learning strategies to use and what tools to employ. In other words, students should be at the centre of the learning process, while the role of the teachers is to provide guidance and support whenever necessary. If these are the principles of constructivist theories, then it appears quite obvious that SRL development goes hand in hand with the application of these principles.

The studies mentioned in this section refer to different kinds of learning environments, which in turn are often associated to different applications of constructivist ideas. The first environment is the web, a relatively new environment, powerful though dangerous and difficult to explore, requiring higher order strategies and distinct evaluation abilities to extract information from in an effective way. Information problem solving in the web is often associated with informal learning contexts. The second is, instead, an example of formal learning. It is an online collaborative course aiming to train online tutors. Needless to say, SRL is among the skills involved and addressed in this course, because being self-regulated in an online course is an important prerequisite for becoming fully aware of the potential of different tools and different modes of communication and therefore act effectively as an online tutor. The third kind of environment are simulation tools. Simulations are virtual environments where the learners interact with a scenario incorporating a model (usually, a model of a reality, but sometimes it can be a model of something that doesn't exists in real world). These environments allow students to conduct experiments to study the laws that are behind the model by manipulating variables and parameters, making deductions and inferences, testing their hypothesis and drawing conclusions. Simulations therefore allow experiential learning,. encourage planning, execution, monitoring and self-evaluation of learning of learning, which are the basis of SRL.

Web information problem solving

Caviglia and Ferraris (2006) carried out a preliminary study aimed at investigating the process of Web information problem solving with special focus on the analysis of cognitive skills and attitudes which play a key role in intentional learning. To this aim, they set up an experiment where seven allegedly proficient Web-users were recorded and observed while solving the same simple information problem. Although almost all the subjects produced acceptable

solutions, these solutions differed widely with regard to the cognitive strategies adopted, the attitudes they revealed and the effectiveness of the problem solving process.

The theoretical foundations of this work are rooted in research on web-searching strategies (Ferraris, 2003), that suggests that information problem solving on the web is a complex process requiring integration of ICT-specific skills and cognitive and metacognitive skills generally associated with knowledge building (Scardamalia and Bereiter, 2006) and problem solving (Mayer, 1998).

The basic hypothesis is that, by observing people while they solve information problems on the web and by analyzing the differences in the way they go about it, it is possible to gain a better understanding of some cognitive mechanisms which play a key role in the effectiveness of autonomous knowledge construction process (e.g., reading strategies, abductive reasoning, question asking, etc.).

This exploratory experiment was carried out with a small number of subjects in order to assess whether the method chosen was promising and to identify any elements and problems which might deserve a closer look when carrying out a larger scale experiment. The results revealed that among the factors that influence the effectiveness of the problem solving process learning styles, metacognitive skills and self-efficacy have a relevant role. Furthermore, it turned out that it is worth further investigating how people use the Web to solve information problems with this approach.

Metacognition in online learning

Self-regulation was explicitly required and addressed by a blended course addressed to future online tutors at the University of Macerata in the years 2004 and 2005. The model chosen for the course is the topic of a contribution by Rossi et al (2007).

Among the characteristics of the course are: the short duration; the activity modular structure; four virtual classrooms of about 25 students; the key-role of interactivity; the coherence between the model and the tools used.

The target competences were the following:

- social and relational competences, to enhance the development of an online community;
- technological competences, to manage a working group in its environment;
- planning and organizational competences, to manage online activities;
- linguistic (i.e., reading and writing) competences, to foster knowledge construction through activities based on written communication.

The learning path planned for the students was organized in four phases: first, a welcoming phase; second, a virtual classroom negotiation aimed to produce a common artefact; third, an instructional design activity in small groups; fourth, a concluding activity where the whole group carried out a final review in order to share objectives and to discuss open issues. The last phase also aimed to bridge the gap between individual reflection and the collaborative dimension of the course.

The course evaluation was based both on individual assessment results (course effectiveness) and on qualitative and quantitative data concerning course acceptance. According to the authors, the model applied was successful since students learnt to be flexible in the choice of the communication tools (forum, chat, personal postings) based on fit-to-purpose criteria, to alternate individual and collaborative work; to share with others their reflections on the learning experience. In other words, they learnt how to self-regulate and also how to regulate together the learning processes.

Simulations

Traditional ways of teaching generally make exclusive use of the ordinary verbal language and/or mathematical symbols. Even if the introduction of new technologies reinforced the role of multi-media - thus giving a major role to audio, video, pictures, graphs etc. - yet language keeps maintaining its primacy as the main vehicle of knowledge and comprehension. What appears on the computer screen are, above all, linguistic materials.

Cristina Delogu and Domenico Parisi (2006) reflect on two ways of learning, knowing and understanding reality: while in the first way we reach learning through language (i.e.,

listening, reading and studying the accounts and explanations by other people), in the second we can understand and learn through experience (i.e., through observation and interaction with reality). In the first case learning is mediated by words, in the second case learning mostly happens through senses and actions.

According to the authors, technology has a great potential for learning through experience. To maintain this point, they highlight some examples where technology helps people to do things and gain experience through online interactions.

In particular, simulations, intended as a way of expressing a scientific theory, a model or a hypothesis, allow their users to manipulate (and possibly change) that theory, interact with the model, test the hypothesis. Simulations are expressed as *active* computer programs: (a) they (re)produce the empirical facts that the theory intends to explain, (b) they function as virtual experimental laboratories in which the user can control and manipulate variables and parameter values (Parisi, 2000). In other words, by definition, simulations put the learner in control of his/her own learning. Promoting the use of simulations in the learning of several, very different disciplines, therefore means to maintain that learners should be put in control of their learning process, favouring the gradual acquisition of the required skills through an experiential approach.

Development of TELEs supporting SRL

This section is devoted to a number of studies that take a very pragmatic approach, by aiming to develop learning environments that support the practice and the development of SRL. Usually, this approach moves from a working definition of SRL (that is, one that specifies what a learner should do to be self regulated) to implement a software system that embodies features that allow or encourage the learners to carry out such actions. The aim is to experiment with functions that might become standards for learning environments of the future. In the following, some examples are provided where different aspects of SRL are the focus of attention. In the DID@Browser, meta-cognitive questions are posed to students while they navigate a hypertext or a website in the attempt to foster meta-reflection and therefore improve the cognitive strategies adopted while navigating. The did@browser metacognitive questions therefore raise awareness of the users searching abilities. The LEARNING TUTOR,

instead, mostly focuses on enhancing students' control by providing planning, monitoring and evaluation functions in an e-learning system. Learning to learn from colleagues is one of the aims of the LODE system, a collaborative environment that combines the socio-constructivist ideas behind the communities of practice with an extension of the concept of Learning Object that takes into consideration the need to share competence and experience, not just physical resources. The last example embraces a whole category of systems, i.e. the e-portfolios. Be them of the "developmental" type, or the "reflective" or "showcase", these digital archives of multimedia documents concerning its authors achievements are not only a major incentive for self-evaluation, but also a useful tool for planning and monitoring.

The DID@Browser system

The ability to surf the web in order to look for specific pieces of information, satisfy a curiosity, solve a problem or at least identify its relevant features seem to be related to a set of skills that have always been important but have now become fundamental to live in the so-called knowledge society. Learning in the knowledge society doesn't mean merely accumulating information, but rather being able to find them, process them and build new knowledge on their bases. To do so, the ability to pose questions is more important that the ability to answer them, and the metacognitive skills that drive the search for an answer should become the overriding aim of a teacher who really wants to empower his/her students. Such metacognitive skills include how to carry out a web search, how to choose the "right" keywords, how to make and assess hypotheses, how to learn from experience and use skimming and scanning techniques to make sense of what one is reading. If these are the priorities, then the problem is how to support the achievement of these skills and the development of a high degree of awareness in their application. An answer to this problem is provided by the Did@Browser system, developed by a group of researchers of the Palermo branch of the Institute for Educational Technology of the Italian National Research Council (Chiazzese et al, 2006a; Chiazzese et al, 2006b). In particular, the Did@Browser is based on the hypothesis that students should be supported in the development of metacognitive skills related to web search by posing to them suitable questions while they navigate. Such questions are supposed to stimulate reflection on the method used to search the web and they belong to two distinct categories. The first category contains questions related to monitoring the surfing strategy, such as "Why have you clicked this link?", "What information do you

expect to find?", "Have you explored the other links on this page?", "Do you intend to return to this page? Why?", etc. The second category contains questions aiming to motivate students to evaluate the results of their activities and the related cognitive strategies, such as "What have you learnt from surfing this site?", "Has your surfing strategy succeeded?", etc. The system records both the students answers and their surfing paths, and allows a graphical visualisation of the latter. A pilot study of the effects of the Did@Browser was carried out with 27 students of a lower secondary school, who used DID@Browser for a total of 24 hours, working on websites and tasks built ad-hoc by the researchers. Besides the tracking facilities embedded in the system, the main tools used to investigate the system effectiveness were a final questionnaire and an assessment test. The aim was to shed light on learning results both in terms of contents and in terms of students awareness of the effectiveness of their own surfing behaviour. The results of the study showed that the strategy of posing questions during surfing didn't hinder the learning of contents and facilitated self-monitoring by raising awareness of metacognitive strategies adopted. One of the drawbacks mentioned by the authors is that the questions related to surfing methods sometimes irritated the subjects because their relevance was not easily understood.

The Learning Tutor

Based on the assumption that online students must face not only cognitive but also methodological, organisational and emotional problems to regulate their learning process, Pettenati et al (2000) have developed and tested a web-based authoring system, called the Learning Tutor, that aims to support both tutors and students in an online course on broadband communications. As a matter of fact, the freedom that learners gain when they choose distance learning programs risks to be outweighed by a number of difficulties, such as the need to elaborate and fine tune effective working plans, to self-evaluate and monitor progress, to cope with stress and anxiety, to keep up motivation. The Learning Tutor comprises "several complementary and interconnected web-based tools: the 'Course description, Guiding Thread and Agenda', the 'Work Plan and Themes Reviewer' and the 'Quizzes'" and it has been developed through the MEDIT Environment[7]. The first tool (Course description, Guiding Thread and Agenda) allows the tutor to provide students with a

[7] MEDIT (Multimedia Environment for Distributed Interactive Teaching) is an authoring system for the creation and management of web-based courses.

"guiding Thread", a sort of work plan proposal, consisting in learning objectives, estimated study time and exercises related to each learning phase. In addition, the tutor usually fills in a facility called Agenda, with the schedule of possible meetings with his/her students, where they will be able to book their place to meet the tutor face-to-face. The second tool (Work Plan and Themes Reviewer), instead, is meant to be used by students to organise their own study time on the bases of the tutor's proposal. It is interesting to note that access to the individual work plan and to the results of the self-evaluation tests is restricted to the student unless otherwise specified. As a consequence, the teachers can keep track of students progress through the different course stages only for those students who allowed it. The third tool, the Quizzes, allows the teacher to create a set of multiple choice questions, each of which belong to a category and features a difficulty level. Tests can be generated manually by the teacher or automatically, by the system, given the desired difficulty level for each question category.

The Learning Tutor addresses the problem of striking a balance between what the authors consider the main advantages and disadvantages of online education. Among the strengths, we can mention the students freedom in organising their own learning. This freedom makes learning compatible with other occupations. Among the weaknesses, there is the risk to loose control of the learning process, from a cognitive, metacognitive, emotional and motivational point of view. This risk can be regarded as one of the most important causes of drop-outs in Italy[8].

The LODE system

The LODE system is a collaborative environment aiming to stimulate the birth of a community of practice (CoP) of teachers around a database of Learning Objects (LOs) embodying not only educational resources but also the pedagogical experience developed through their use. According to its developers (Dettori et al, 2007), "In a CoP based on such approach to re-use, peers learn from each other and with each other, without external guidance or scaffold. In order for such community to function effectively and autonomously, therefore, their members should be able to self-regulate their own activity and learning within

[8] Italy is, under this point of view, one of the worst performers among developed countries (Cingano and Cipollone, 2007).

this context". LODE was therefore designed to encourage SRL and it has been tested in a pre-service teacher training course.

LODE is specifically oriented to share pedagogical experience. To do so, it allows its users to create, modify, search and retrieve LOs, create links among them, share reflections about their use, discuss pedagogical and usability issues. The system encourages both individual activity and collaboration with peers, by providing a personalised, easy-to-use interface, endowed with a rich help facility, aiming to maximise the users autonomy. Facilities encouraging teachers to plan, monitor and evaluate their own learning, as well as provide feedback to peers are also provided.

The LODE system underwent a two-stages evaluation process. Before its use with trainee teachers, it was in fact evaluated by a team of experts on the bases of a questionnaire called TELE-SRL, produced within the TELEPEERS project.[9]. The results of their evaluation informed a first revision of the system, and the new release of LODE was then used for about one month with 120 trainee teachers. The evaluation of this experience was based on qualitative and quantitative data. Qualitative data were obtained from the observation of the trainees activity and the analysis of their productions. Other qualitative and quantitative data were elicited through an end-of-course questionnaire, aimed to assess appreciation of SRL related features of the system. The results of the study revealed that students appreciated such features, with particular regard to those that supported communication and feedback exchange among peers. Paradoxically, most of the suggestions brought forward by the trainees to improve the system concerned these features. The suggestions included the need to implement automatic notification of the insertion of links and comments to one's LOs, the need to improve the visualisation of one's work; the desirability of ad hoc forums for planning and evaluation purposes, the need to make the search mechanisms more powerful and able to find comments as well as LOs.

In conclusion, the LODE system seems to be a very powerful environment not only for pre-service training of teachers, but also, and perhaps even more, for in-service training. In fact, even if practicing teachers do not seem to be able yet to fully exploit the power of CoPs for

[9] For a short description of the TELEPEERS project and its results, including the TELE-SRL questionnaire, see the next section of this document.

their professional development, it is widely recognised that they do need to learn how to learn in such an environment because that's a very powerful way to develop non-procedural, ill defined, empirical competences such as those that experienced teachers have.

E-portfolio systems

In Italy the use of portfolios has a long tradition in education, the roots of which can be found in the artistic and advertising sectors and in professional training. As a matter of fact, these contexts share the importance given to planning, production, analysis, monitoring, evaluation and improvement of tangible and visible artefacts or services that presumably will be judged also by customers, users and consumers. Despite this tradition the term *portfolio* is relatively new: on one side because other words were used to define portable cases for holding materials representative of a person's work (e.g., *cartella*, *album*, *book* [using the English term], etc.), on the other its diffusion in the field of education was delayed due to other meanings associated to the word *portfolio* and to its Italian etymology[10].

If the word gradually gained visibility at national level when the Language Policy Division of the Council of Europe in Strasbourg developed and piloted – from 1998 until 2000 - the *European Language Portfolio* as a tool to support the development of plurilingualism and pluriculturalism[11], it became popular after the laws approved by the Italian parliament in 2002/2003, as part of the reform of the schools and educational system. In that context the portfolio was described as a competence portfolio, an object that includes the description of the progress of the student and the documents (assessment test, projects, etc) he/she produced during the school year. The laws also indicated that the student's portfolio should be compiled and updated by the student's family and teachers (in accordance with the working team – head teacher) (Balanskat, 2006).

[10] Even if the word *portfolio* is derived from the Anglo-Saxon languages, it is a calque of the Italian *portafoglio*, whose first contemporary meaning is "wallet" and etymologically means "to carry paper" (`porta-`, *to carry*, from Latin `portāre`; - `foglio`, *sheet*, from Latin *`folium`*, *leaf*) - http://www.yourdictionary.com/ahd/p/p0457700.html (consulted on 18th July 2007).
[11] http://www.coe.int/t/dg4/portfolio/Default.asp?L=E&M=/main_pages/welcome.html.

This definition of portfolio, as an object to be used by students, teachers, and students' families, emphasized its role in the learning process and, in particular, its importance in the assessment and self-assessment procedures.

In the years after 2003 many books written by Italian researchers and teachers were published on the theme of educational portfolios (e.g., Castoldi, 2005; Pasciuti, 2005; Pellerey, 2004; Spinosi, 2004; Varisco, 2004; Comoglio, 2003). As it is shown in Table 1, only a minority of these (e.g., Ajello and Belardi, 2007; Rossi and Giannandrea, 2006) focused on *digital* portfolios (e-portfolios).

In the following three different studies on e-portfolios are presented, where the emphasis is on their ability to enhance the positive features of portfolios, while reducing their limits.

	Books on educational portfolios	Books on language portfolios	Books on e-portfolio	Books in which the word portfolio was used with a different acceptation (e.g., indicating a group of investments; or books showing paintings, photographs etc.)
2000	1 (translation of an English book)			2
2001				
2002				
2003	2			
2004	5	1		2
2005	10	2		2
2006	5	1	1	5
2007	1		1	1

Table 1 - Occurrences of the word *portfolio* in the title field of books printed in Italy. Data were retrieved from the Italian InternetBookShop site http://www.ibs.it/ (on the 19th July 2007)

E-portfolio, from theory to practice

The first is a study carried out at the University of Udine (Rossi et al, 2004) in the field of e-learning, assessment and evaluation. At the Italian annual conference "Didamatica 2004", addressed to teachers on the themes of educational technology, these authors presented a paper with a twofold aim: (1) to describe different e-portfolios types, objectives, structures and models; (2) to present a two-years case-study on the planning and the technological and teaching effects that the use of e-portfolios had in a university course.

According to the authors there are at least six types of portfolio, the aims and structure of which differ from one another: the documentation portfolio; the showcase portfolio, the record keeping, the school portfolio, the class portfolio and the teacher portfolio. Their usefulness lies in the opportunity they give not only to document the competences achieved, but also to produce a personal and evolving interpretation of the learning process, emphasizing the student's role in knowledge construction.

Technology development has supported the development of tools to create, organize and implement online portfolios, the characteristic of which is to demonstrate the learning growth over time not only through the hoard of artefacts, goals and achievements, but most of all through the creation of hyperlinks. Their advantages lie in easy access (that they guarantee over time), in their portability, visibility and flexibility, in the personalisation opportunities they offers, as well as in the fact that they can be shared with other people.

The second part of the paper details the role that e-portfolios had during the course on "Theories and methods of instructional design" held for the university of Udine in the academic years 2002-2003 and 2003-2004, in which students were asked to develop their portfolios according to the model of Danielson and Abrutym (1997) revised by Helen Barrett (2000). This model requires a five-step process for e-portfolio development: collection, selection, reflection, projection/direction and connection.

While during the first year e-portfolios were part of a public space within the online learning environment developed to support face-to-face lessons, in the second year they were placed in a personal space. In both cases they have been used by teachers as the starting point of the discussion during the students final summative assessment.

Introducing e-portfolios at institutional level

The second study on e-portfolios was carried out in 2005 at the University of Milano Bicocca. The project was carried out in collaboration with the Vrije University of Amsterdam, and it entailed the implementation of a digital portfolio and a pilot experiment with a small group of post-graduate students in Sociology (Dal Fiore and Gui, 2005). The goal was to obtain indications (such as best and worst practices) to extend the innovation on a large-scale.

The main activities for students who decided to implement the Digital Portfolio in their career were: writing an initial Personal Development Plan, exchanging feedback and suggestions with peers and tutors, creating a personal archive of relevant materials and, finally, reflecting on their development in a Self Reflection Report.

The outcomes of the pilot courses showed the need for a significant investment to introduce and use the Digital Portfolio. The high costs were related to culture, politics, economics, technology and organization. For this reason in the following year - even if the Digital Portfolio was extended to all the students enrolled in the faculty - it was decided to offer a "minimal" version of the service (Gui and Pozzi, 2006). Objective of this new Digital Portfolio was to keep the advantages given by self-reflection. In order to set their learning goals, to integrate development scenarios and to keep track of their progress and study at university, students were asked to write a Personal Development Plan, structured in three phases on a period of time of two years, in which they were given an online personal repository. All the documents, the artefacts and materials were exported at the end of their courses, thus emphasizing the idea that their university career was part of their life-long learning.

E-portfolio from the learner point of view

A different perspective is offered by Catherine Blanchard (2006a; 2006b) whose contributions highlights how the author – an apprentice e-tutor - became aware of her professional and personal growth through the analysis of her experience, recorded during its progress in the form of an e-portfolio.

The context of the study is the Master in "Distance Learning Tutoring" held by the University of Padova in the academic year 2004-2005. Students were asked to keep track of their learning process in an e-portfolio, the aim of which was twofold: to report the achievements of the assigned tasks, and to reflect on the learning process as it happened. The paper, in fact, is not only a product of the reflections *on* the reflections exposed in the e-portfolio, but its structure is modelled on the e-portfolio's structure, with a descriptive narration organized according to the three parts of the tutoring training process.

The first part concerned the reflection on the process of construction and description of the competences to be acquired regarding tutoring styles, contents comprehension and mediation, choice of tools and resources, online communication. The second part was compiled during a stage in which the students e-tutors were involved in tutoring practice during an online course. In this phase the considerations on the tutoring process were based also on the "carnet de bord", a reflection tool compiled by their students. The third part aimed to support the process of construction and definition of the e-tutor profession, reaching a personal point of view on the tutor's roles, methods, tasks and styles.

The e-portfolio was used in a very personal way to carry out the self-evaluation process and accomplish the gradual transition from the role of a higher-education student to the role of an e-tutor. It was also used as a basis to share and discuss with others (i.e., peers, teachers and evaluators) the learning experience, on the assumption that the tutoring profession requires a continuous reflection on the online tutoring practice.

Assessment of TELEs that provide SRL support

This section is devoted to studies aiming to analyse one particular type of TELEs, or sometimes one specific TELE, in order to understand whether, and to what extent, they support SRL development. These studies usually also aim to identify what features of such

environments are relevant from this point of view. The methods used vary a lot. Some studies employed a combination of techniques, in order to obtain different types of data and therefore consolidate their findings. In particular, Computer-Supported Collaborative Learning environments were investigated quite deeply, and the results of these studies are reported in the next section. The subsequent section is, instead, dedicated to studies that analysed systems for individual use. Most of the studies of this type were carried out within the framework of the TELEPEERS Project[12]. For this reason, before we discuss the individual studies selected for this review, it is useful to recall a few points about this project.

Aim of TELEPEERS was to evaluate the potential support to SRL provided by TELEs by analysing their features and the way they are used. To this end, the team produced tools that are in use even after the end of the project. The TELEPEERS partners belonged to 9 European countries (Germany, The Netherlands, Portugal, Denmark, Italy, United Kingdom, Spain, France and Norway) and focused on TELEs of various kinds, from offline self-instructional programs to online collaborative courses. To guide the analysis of the TELEs, the TELEPEERS team identified a set of features (listed in table 1) that, according to the literature, are desirable when SRL practice and development are among the learning objectives.

General features that support all the phases of SRL
• Intuitiveness and homogeneity of the interface. • Possibility to personalize the interface. • Help functions about how to use the software. • Tools to facilitate navigation in the environment. • Functions that support interaction with peers, teachers, tutors, and virtual agents present in the environment.
Features that Support planning

[12] TELEPEERS: "Self-regulated Learning in Technology Enhanced Learning Environments at University Level: a Peer Review", Grant agreement 2003-4710-/001-001 EDU-ELEARN, http://www.lmi.ub.es/telepeers/

• Planning tools like calendars, activity plans, etc. • Explicit indications of the prerequisites for the assigned tasks. • Suitability of the organization and layout of the internal or external resources available to tackle a task. • Functions that keep track of one's activity within the environment.
Features that support task execution and activity monitoring
• Multimedia educational material in different formats. • Possibility to chose between different learning paths within the environment. • Possibility to chose between various difficulty levels for the proposed tasks. • Formative feedback. • Tools to exchange materials and collaborate with other students. • Help functions about how to carry out the task.
Features that support SELF-ASSESSMENT
• Availability of models of correct task execution. • Possibility to compare one's own work with that of peers. • Self-evaluation tools.

Table 1. Aspects of TELEs which potentially support the practice of SRL.

The standpoint of this project was that the analysis should focus not only on the software component but also on its mode of use, since these two aspects are so strictly intertwined that their effects are too difficult to separate. Based on the above mentioned features, TELEPEERS also produced and tested two questionnaires, called TELE-SRL and TELESTUDENTS-SRL[13].. The TELE-SRL is meant to be used by teachers and/or SRL experts for an *a priori* evaluation of the TELE's potential, while the TELESTUDENTS-SRL is addressed to the TELE's users and allows *a posteriori* assessment of the tool and its use. In the following we briefly report the results of the studies carried out by the Italian partner of TELEPEERS, that is the Institute for Educational Technology of the National Research Council. In addition, we briefly summarise the outcomes of another Italian study, aiming to identify the role of the tutor in a blended course, with particular attention to what a tutor can do to foster SRL among trainees.

[13] Both questionnaires can be downloaded from the web site of TACONET (http://www.lmi.ub.es/telepeers/), an international association of teachers, scholars and researchers interested in themes stemming from TELEPEERS.

SRL potential of Computer Supported Collaborative Learning (CSCL)

The relationship between SRL and online collaborative learning is rather complex, since the latter appears to both support and require the former. The studies described in the following take two different standpoints: the first focuses on CSCL environments, their features and the way they are used (or can be used), and try to understand what aspects of SRL are better developed by such environments, the second analyses the role of the tutor in fostering SRL, the third is an experiment aiming to investigate the effect of online collaboration among primary school children on their self- efficacy.

Aspects of SRL developed by CSCL environments

Within the TELEPEERS project, a team of ITD researchers carried out a number of studies (Dettori and Giannetti, 2005c; Dettori et al, 2005a; 2005b; 2006) aiming to understand better the relationship between SRL and CSCL environments. Some of these studies used the TELE-SRL and TELESTUDENTS_SRL questionnaires to analyse online or blended courses employing a collaborative learning approach. Others used multiple methods, including interaction analysis, in search for evidence of SRL practice and/or development.

The methods used were also object of study. Firstly, the SRL indicators that have been used were drown from the literature of the field (Zimmermann, 1998; 2001; Steffens, 2006) but they were tested and fine tuned through use. Secondly, quantitative and qualitative methods have been combined and sometimes used to compare results. The context of these studies was higher education and the courses analysed usually entailed online collaborative learning and/or blended learning. The results suggest that CSCL techniques, if adequately designed, can encourage and support both SRL practice and its development. In particular, they seem to foster autonomy, both in individual activities and in collaborative activities, encourage social support, help seeking and reciprocal teaching; control and personalisation of the individual workspace, reflection and meta-cognition, development of individual initiative and understanding of different learning styles, planning, motoring and self-assessment both as individual and team activities. Among the techniques that seem to exploit this potential to its

best, role-play appear to be the most effective, but also peer tutoring and peer reviews hold promise.

Another type of result consists in a series of indications on how to equip CSCL environments in order to support learners and tutors in monitoring and evaluation tasks. Just to make an example, some researchers suggest to use the so called "thinking types" to tag messages in forums. Thinking types are tools present in a variety of online platforms developed after the socio-constructivist paradigm (e.g., Synergeia, Knowledge Forum) to sustain the metacognitive processes and to foster reflection and online discussion.

The use of thinking types entail that participants can tag their postings with a label indicating the posting linguistic pragmatic function within the structure of the discourse. Even if thinking types are usually chosen from a teacher-defined closed set, they encourage the postings' authors not only to reflect on their online exchanges, but also to situate them in the messages flow, guiding the readers through the visualization of their labels. Furthermore thinking types can be useful to analyze the effectiveness of the role taken by the participants (Calvani et al, 2006; Ligorio and Spadaro, 2005).

The role of the tutor in supporting SRL

La Marca and La Monica (2006) analysed a blended course on "Educational technology" addressed to 60 students of the university of Palermo. The aim of their paper is to draw attention on the e-tutor's role in fostering the metacognitive abilities necessary to students at the beginning of their university experience.

Objectives of the course were to enhance collaborative experiential learning experiences; to strengthen problem solving competences; to encourage self-regulation and self-evaluation capabilities by means of active seeking of meaning, reciprocal learning, critical reflection and progressive mastery. E-tutors were asked to coordinate the online and face-to-face activities, guiding students in choosing their personal paths in order to acquire a valuable method to learn and to solve problems within a community.

The activity presented to students and coordinated by e-tutors was based on case-studies where students were asked to: 1) analyze complex situations, trying to draw distinctions between facts and personal opinions; 2) detect the main problem(s) and the relevant facts object of the study; 3) formulate and suggest possible solutions, possibly through collaboration with other students,; 4) take motivated decisions and discuss with others their possible effects; 5) evaluate the decisions taken and reflect on the global situation. Furthermore, students have also been asked to express to e-tutors the problems encountered during the activity, in order to find new solutions or think to better alternatives. In this phase e-tutors may help students by observing, listening, communicating, analyzing, reflecting, giving a sense of responsibility, synthesizing and evaluating. Their methodological tools reside in their ability a) to identify areas of disagreement, unsolved questions, neglected aspects, b) to involve silent students, c) to direct the group's efforts towards a common field, d) to uphold the rules and meet the deadlines.

The paper concludes by emphasizing the importance of self-regulation capabilities, that are required also of e-tutors in order to help their students in becoming self-regulated in their turn.

Children online collaboration and self-efficacy

Ottaviano et al (2004) carried out a study aiming to investigate the effects of online synchronous communication on perceived self-efficacy of primary school children. The study also meant to test improvement of reading comprehension skills and was based on a comparison between an experimental group and a control group that carried out the same learning activity except for the use of online communication tools to collaborate in pairs. The distribution of data seems to show a dispersion towards the extremes of perceived self-efficacy for the control group of children. In other words, it looks as if perceived self-efficacy becomes either very high or very low after the activity. The authors of the study attribute these results to the fact that teachers could, with the experimental group, devote more attention to each dyad but they also express some doubts about the research design of the experiment.

SRL potential of TELEs for individual use

The TELE-SRL questionnaire was also used to analyse a couple of TELEs for individualised learning: the first is a commercial software called Story Maker 2 and the second is a software environment called Ecolandia (Dettori and Giannetti, 2005a; 2005b).

StoryMaker 2[14] is a Narrative Learning Environment allowing its users (typically, primary school children) to create multimedia stories starting from a rich menu of thematically organised backgrounds, characters, props, sound effects, etc. Storymaker suits children with very different degrees of cognitive development and technological abilities in that it allows the creation of simple, linear stories but also hyper-media narratives with animations.

Ecolandia[15] is a hypermedia system addressing lower secondary school children. It was developed by Donatella Cesareni in 1994. Its basic assumptions and the evaluation process it underwent are discussed in its author's book concerning Hypertexts and learning (Cesareni, 1995).

The use of the TELE-SRL with these two software environments produced two types of results. The first is a subjective assessment of the software potential for SRL development, yielded by an expert with the guidance of the questionnaire. The results of the evaluation are usually arranged along two dimensions: the "process" dimension, where support provided is analysed in terms of planning, execution and monitoring, and evaluation, and the "component" dimension, where SRL is seen as consisting of cognitive, motivational, emotional and social aspects.

So, for example, Storymaker turned out to be very powerful from the cognitive point of view, but it was judged to be weaker from the emotional and social point of view. As for the process dimension, Storymaker appeared to support planning activities much more than execution, monitoring and evaluation. Similarly, Ecolandia's strengths consisted in support to planning, execution and monitoring, while self-evaluation was deemed to be poorly supported. The social, emotional and cognitive aspects were also considered to be fostered more than the motivational aspects.

[14] http://www.spasoft.co.uk/demostorymaker.html
[15] Ecolandia is a software package published in Italy by Opera Multimedia in 1994

The second type of results produced by this type of studies is strictly related to the outcomes of the analysis, and in particular to the weaknesses it revealed. In fact, the TELE-SRL includes a final section entitled "Suggestions for improving the TELE" requiring the evaluator to advise the software developers and/or the teachers/users on how to make up for such drawbacks. In the case of Storymaker and Ecolandia, the suggestions provided were very interesting, down-to-earth points that could inform further development of the software and/or instructional design entailing its use. So, in spite of the subjectivity of these evaluations and of the fact that many of the software packages analysed were not developed with the aim to encourage SRL, a number of good pieces of advise came out of this work that could definitely lead both developers and teachers towards a higher degree of awareness of the importance of SRL at all stages of learning development and therefore to better teaching and learning processes.

Conclusions

Italy is witnessing of an increasing interest for SRL and for the contribution that technology can give to the development of the related abilities. The studies analysed in this review cover a very wide range and differ a lot in terms of research objectives, methods and tools used, educational contexts.

The objectives include:

- the investigation of the very nature of SRL and its relationship with technology, notably the Web and its potential for information seeking and interpersonal communication;
- the design and implementation of new TELEs that are truly innovative from an SRL point of view;
- the evaluation of the SRL potential of some important types of TELEs (CSCL Environments, Narrative Learning Environments, offline software for individual use, etc).

The research methods are also very different. As mentioned in the introduction, there is a preponderance of pragmatic approaches, such as case studies and pilot experiments in controlled or real life environments. The evaluation approaches adopted to assess SRL

development are usually based on a combination of quantitative and qualitative methods, and data collection techniques range from tracking the learning process in hypermedia systems to content analysis of interactions in CSCL environments. A good deal of the studies have taken place within the framework of the TELEPEERS project or have taken advantage of its results. In particular, the two questionnaires produced by this project have been adapted and used to assess the SRL affordances of TELEs before and after use.

Last but not least, the educational contexts the analysed studies refer to have to do with both formal and informal learning. While much of the research in the SRL field focuses on academic learning and on adult students, some of the studies examined here concern the skills needed for informal learning and Life Long Learning and others deal with the development of SRL skills in school children.

So, the scope of the picture provided by this review is quite wide. However, each of the studies analysed is only a tiny little spot in the three-dimensional space where the x-axis is the research aim, the y-axis is the research method and the z-axis is the educational context. We need to go deeper with each study, and we also need to be able to draw a painting out of our scattered set of isolated dots. Very likely, if we juxtapose this picture to what has been done outside Italy, we might find out that the picture is much clearer and, even if there will still be areas that need further investigation, something much more meaningful will come out of it.

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NETHERLANDS

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Introduction

In the Netherlands, computers have been used in education since 1970. Two research projects, funded by the Dutch Foundation for Educational Research, provided a major stimulus. At Leiden University, a project focused on Computer Managed Instruction for primary education and secondary vocational education (Van de Perel, 1979). At the Vrije Universiteit Amsterdam, a research group developed Computer Assisted Instruction, also for primary education and secondary (vocational) education (Dirkzwager, Fokkema, Van der Veer, & Beishuizen, 1984). The latter project included research on the differential effects of learner controlled and program controlled instruction, in which the concept of self-regulated learning already showed up. Bernaert (1977) showed that students tended to adopt a more risky learning strategy, skipping explanations and immediately jumping to assignments and exercises, when they have the freedom to find their own way. They performed worse on learning and transfer tests than students for whom the learning path had been determined by the program in advance. This detrimental effect of learner control turned out more striking for students with low cognitive abilities.

These pioneering projects were soon followed by a lot of various research projects, especially after the introduction of the desktop computer in 1975. The switch from “mainframe” to “microcomputer” meant a major change in the potentials and functionalities of computers. Fokkema, Van der Veer, Beishuizen, and Dirkzwager observed in 1984 that microcomputers were cheap. For less than 5000 Dutch guilders (approx. 2300 Euros) microcomputers with limited capacity were available. For less than 10000 Dutch guilders one could purchase a microcomputer with standard characteristics like 64 kB internal memory, a conventional microprocessor like the Z80 and two external drives for floppy disks. Like other governments, the Dutch Ministry of Education started to provide money to schools to buy equipment and

train the teachers. This led once again to large scale research projects, like the Technology-Enriched School Projects (Beishuizen & Moonen, 1993; Beishuizen & Versteegh, 1993). Gradually, computers became less expensive and more advanced, which exponentially increased their use in education. Since 1995, research into the use of computers in education became more specific, focusing on various applications, like simulation and gaming, and integrating the computer as an instrument in a larger learning environment, the Technology Enriched Learning Environment.

In this review, we focus on research into the development of self-regulation strategies and skills in technology enhanced learning environments. Steffens (2006) defined three steps in self-regulation: '(1) planning the learning activity, (2) executing and monitoring the execution of the learning activities and (3) evaluating the outcome of the learning activity' (Steffens, 2006). Technology enhanced learning environments can be arranged and equipped in such a way that students are supported to actively regulate their own learning processes. Planning can be supported by providing instruments to choose and sequence learning activities out of a list of learning objectives, assignments to be completed or subjects to be studied. Monitoring the execution of learning activities can be facilitated by keeping a log of all activities to be opened for inspection and review, by displaying progress indicators showing what has been done and what lies ahead of the student, or by checking the assignments completed on a list of all tasks to be done.

In order to describe and characterize recent developments in Dutch educational research into self-regulated learning in technology enhanced learning environment, we distinguished four factors influencing the process of self regulated learning in technology enhanced learning environments: (1) the student, (2) the teacher, (3) the community of learners, (4) the learning environment.

The student. We were interested in the effect of learning styles, expertise, prior knowledge, interest, motivation, age, and cognitive abilities on self-regulated learning.

The teacher. The role of the teacher in technology enhanced learning environments is often underestimated. In this review, we wanted to explore whether Dutch research clarified the contributions of teachers to self-regulated learning in technology enhanced learning environments.

The learning environment. Technology is part of the physical learning environment. Computer programs provide learning tools to support self regulation. In a hypermedia environment, an interactive map or table of contents may serve such a purpose. Another example is a progress indicator in an exercise with a number of tasks to complete. However, many programs offer more sophisticated support. Students may use a hypothesis scratchpad to formulate their expectations in a simulation environment. An interactive decision tool may help them to develop a particular learning strategy. These examples have all in common that the learner is in control of the learning process. The learning tools help the learner to regulate the learning process. However, in an environment where the program or the teacher is in charge of learning process, the learning materials may be arranged in such a way that students are supported to develop their own regulation strategies. Assignments may be arranged in an order of progressive complexity to keep the cognitive load of each task at a level which is optimal for this particular student in this particular stage of learning. Various subskills may be trained in a consecutive order to enable the student to gradually compose the target skill.
The community of learners. Recent views on learning as a social and constructive process make clear that peers influence the learning of individual students and that learning itself is often the result of a joint effort to solve a problem or to complete an assignment. Therefore, we explored the results of Dutch research into computer supported collaborative learning in which self-regulation (both individually and group wise) was taken into account.

In this review, we were interested in collecting samples of Dutch research on the role of learning tools and learning materials in fostering self-regulated learning in technology enhanced learning environments.
This review had two general questions as its main focus:
Which research programs have been carried out in the Netherlands during the period of 1997 – 2007 in the area of self-regulated learning in technology enhanced learning environments?
What are the major outcomes of recent Dutch research into self-regulated learning in technology enhanced learning environments?

These research questions were answered by collecting a number of 20 representative articles from international and national scientific journals in which empirical studies were reported into self-regulated learning in technology enhanced learning environments. We did not include theoretical contributions or review studies. Only original empirical research was

included in the sample. We took into account that three major research institutes in the Netherlands are active in the area: (1) the Department of Instructional Technology of the University of Twente (Ton de Jong, Jules Pieters, Tjeerd Plomp, Ard Lazonder, Pascal Wilhelm); (2) the Educational Technology Expertise Centre of the Open University of the Netherlands (Jeroen van Merrienboer, Paul Kirschner, Tamara van Gog, Frans Prins), and (3) the Department of Educational Sciences of Utrecht University (Gellof Kanselaar, Jerry Andriessen, Gijsbert Erkens, Paul Kirschner, Frans Prins). We wanted these three research group to be included in our sample. Therefore, we actively sought for publications from these groups and added them to our sample. We used the four factors influencing the process of self regulated learning in technology enhanced learning environments as a framework to describe and interpret the findings reported in the sample.

Method

Sample

In order to compose a representative sample of recent Dutch research papers on self regulated learning in technology enhanced learning environments, we chose six journals to extract the papers from:
Instructional Science (impact factor 2006: 1.81)
Learning and Instruction (impact factor 2006: 1.72)
Journal of Computer Assisted Learning (impact factor 2006: 0.53)
Computers and Education (impact factor 2006: 1.09)
Interactive Learning Environments (impact factor 2006: 0.30)
Computers in Human Behavior (impact factor 2006: 0.81)
Pedagogische Studiën (Pedagogical Sciences, Dutch journal)
Tijdschrijft voor Hoger Onderwijs (Journal of Higher Education, Dutch journal)

These journals were chosen because of either their relevance (Journal of Computer Assisted Learning, Interactive Learning Environments, Computers in Human Behavior), impact factor(Instructional Science, Learning and Instruction, Computers and Education) or local significance (Pedagogische Studiën, Tijdschrift voor Hoger Onderwijs). Our aim was to find 20 papers which reported empirical research, and shed light on the topic of this review, self

regulated learning in technology enhanced learning environments. We were also careful to include some contributions from each of the three major research institutes on the use of computers in education in the Netherlands: (1) the Department of Instructional Technology of the University of Twente; (2) the Educational Technology Expertise Centre of the Open University of the Netherlands, and (3) the Department of Educational Sciences of Utrecht University. Eventually, 20 papers were selected. Table 1 provides a list of the papers.

#	Reference	Factor
1	Lazonder, A.W. (2000). Exploring novice users' training needs in searching information on the WWW. Journal of Computer Assisted Learning, 16, 326-335.	The Learner: Level of Expertise
2	Martens, R.L., Gulikers, J. & Bastiaens, T. (2004). The impact of intrinsic motivation on e-learning in authentic computer tasks. Journal of Computer Assisted Learning, 20, 368–376.	The Learner: Level of Intrinsic Motivation
3	Prins, F.J., Veenman, M.V.J., & Elshout, J.J. (2006). The impact of intellectual ability and metacognition on learning: New support for the threshold of problematicity theory. Learning and Instruction, 16, 374-387.	The Learner: Self-regulative Skills versus Intellectual Ability
4	Veenman, M.V.J., Wilhelm, P., & Beishuizen, J.J. (2004). The relation between intellectual and metacognitive skills from a development perspective. Learning and Instruction, 14, 89-109.	The Learner: Development of Self-regulative Skills
5	De Laat, M., Lally, V., Lipponen. L., & Simons, R.-J. (2007). Online teaching in networked learning communities: A multi-method approach to studying the role of the teacher. Instructional Science, 35, 257-286.	The Teacher: Role in the Community of Learners
6	Smeets, E., (2005). Does ICT contribute to powerful learning environments in primary education? Computers & Education, 44, 343-355.	The Teacher: Attitudes and Skills
7	De Jong, T., Van Joolingen, W.R., Swaak, J., Veermans, K., Limbach, R., King, S., & Gureghian, D. (1998). Self-directed learning in simulation-based discovery environments. Journal of Computer Assisted Learning, 14, 235-246.	The Teacher: Authoring Tools The Learning Environment:

#	Reference	Factor
		Learning Tools
8	Fisser, P., & De Boer, W. (1999). A decision support tool for web-supported course design. Journal of Computer Assisted Learning 15, 255-256.	The Teacher: Authoring Tools
9	Martens, R., Bastiaens, Th., & Gulikers, J. (2002). Leren met computergebaseerde authentieke taken: motivatie, gedrag en resultaten van studenten [Learning with computer based authentic tasks: Motivation, behaviour and learning outcomes of students]. Pedagogische Studiën, 79, 469-482.	The Learning Environment: Students' Appreciation of Authenticity
10	Karassavvidis, I., Pieters, J.M., & Plomp, T. (2003). Exploring the mechanisms through which computers contribute to learning. Journal of Computer Assisted Learning, 19, 115-128.	The Learning Environment: Effect of Computer Support
11	Van der Meij, H. (2000). The role and design of screen images in software documentation. Journal of Computer Assisted Learning, 16, 294-306.	The Learning Environment: Learning Materials
12	De Jong, T., & Van der Hulst, A. (2002). The effects of graphical overviews on knowledge acquisition in hypertext. Journal of Computer Assisted Learning, 18, 219-231.	The Learning Environment: Learning Tools
13	Van Drie, J., Van Boxtel, C., Jaspers, J., & Kanselaar, G. (2005). Effects of representational guidance on domain specific reasoning in CSCL. Computers in Human Behavior, 21, 575-602.	The Learning Environment: Learning Tools
14	Van Gog, T., Paas, F., & Van Merrienboer, J., (2004). Process-oriented worked examples: improving transfer performance through enhanced understanding. Instructional Science, 32, 83-98.	The Learning Environment: Learning Materials
15	Swaak, J., De Jong, T., Van Joolingen, W. (2004). The effects of discovery learning and expository instruction on the acquisition of definitional and intuitive knowledge. Journal of Computer Assisted Learning, 20, 225–234.	The Learning Environment: Learning Tools versus Assignments
16	Veermans, K., De Jong, T., & Van Joolingen, W.R. (2000).	The Learning

#	Reference	Factor
	Promoting self-directed learning in simulation-based discovery learning environments through intelligent support. Interactive Learning Environments, 8, 3, 229-255.	Environment: Learning Tools
17	De Laat, M. & Lally, V. (2004). It's not so easy: researching the complexity of emergent participant roles and awareness in asynchronous networked learning discussions. Journal of Computer Assisted Learning, 20, 165-171.	The Community of Learners: Analysis Tools
18	Van Eijl, P., Pilot, A., De Voogd, P., & Thoolen (2002). Samenwerkend leren of individueel leren met ICT [Collaborative or individual learning with ICT]? Pedagogische Studiën, 79, 482-494.	The Community of Learners: Students' Preferences
19	Janssen, J., Erkens, G., Kanselaar, G., & Jaspers, J. (2007). Visualization of participation: does it contribute to successful computer-supported collaborative learning? Computers & Education, 49, 1037-1065.	The Community of Learners: Learning Tools
20	Saab, N., Van Joolingen, W.R., & Van Hout-Wolters, B.H.A.M. (2006). Supporting communication in a collaborative discovery learning environment: the effect of instruction. Instructional Science, 35, 73-98.	The Community of Learners: Learning Materials

Results

The Learner

Various learner characteristics have been related to learning processes and outcomes in technology enhanced learning environments. In the sample of 20 studies we found four relevant studies: Lazonder (2000) on the influence of level of expertise, Martens, Gulikers, and Bastiaens (2004) on the influence of intrinsic motivation, and Prins, Veenman, and Elshout (2006) and Veenman, Wilhelm, and Beishuizen (2004) on the relationship between self-regulation skills and intellectual ability.

Lazonder (2000) compared the search behavior of 7 novice and 7 expert users of the World Wide Web. Fourteen fourth graders had to locate particular sites and specific information on those sites. Differences between both groups did show up during the phase of locating sites, not during the phase of locating information on sites. Lazonder (2000) concluded that novice users could be supported by training them to improve their monitoring skills, evaluating the quality of the information on sites, and by supporting them to use advanced search tools, like boolean operators.

Martens, Gulikers, and Bastiaens (2004) compared the behavior of 33 higher education students with high and low levels of intrinsic motivation in game-like realistic simulation. Unexpectedly, high intrinsic motivation did not show greater effort or persistence than low intrinsic motivation students. Rather, high intrinsic motivation students displayed more variation in exploratory behavior. For instance, they more often consulted senior advisers (in the simulation environment) or traced information in the archive or the mailbox. This more diversified exploration behavior did not pay off in increased level of knowledge on a posttest. Both high and low intrinsic motivation students performed equally well on the knowledge test.

The extent to which self-regulation skills and/or intellectual ability determine the learning process and outcomes of novice and advanced learners who explore a computer simulated inductive-learning environment was studied by Prins, Veenman, & Elshout (2006). First year psychology students with low or advanced levels of domain related knowledge explored an optics lab and, following a series of three assignments, tried to find out underlying rules. The authors concluded that when learners operate at the boundary of knowledge, metacognitive skillfulness is more essential for learning than intellectual ability.

By presenting inductive learning tasks in a computer supported simulation environment to fourth-, sixth-, and eighth-graders and to university students, Veenman, Wilhelm, & Beishuizen (2004) showed that metacognitive skills are domain-independent characteristics which develop partly independent of intelligence. According to the authors, training of metacognitive skills across domains may be successful, as long as the same approach is chosen across disciplines.

The studies reported all showed that student characteristics are an important source of differences in learning processes and learning outcomes in technology enhanced learning environments. Novices differ from experts, children differ from adults, high intrinsically motivated students differ from low intrinsically motivated students. The better equipped the students is, the more he or she can choose between strategies, particularly when the constraints are tight. This calls for fostering diversity in cognitive strategies, whenever instruction can be invoked to promote students' ability to cope with complex learning environments.

The teacher

Dutch research into the role of the teacher in technology enhanced learning environments relates to the various roles of novice and experienced teachers (De Laat, Lally, Lipponen, & Simons, 2007) , the relevant expertise of Dutch teachers (Smeets, 2005), the development of authoring tools for teachers (De Jong et al., 1998; Fisser & De Boer, 1999).

De Laat, Lally, Lipponen, and Simons (2007) studied the behavior of an experienced and a novice teacher in networked learning community with mid career professionals working on their Masters in Education. The students participated in five on-line workshops during a period of two years aimed at establishing a research learning community. The teachers tried to coach and support the groups, carefully seeking a balance between too much control and too much freedom. The experienced teacher allowed the group to gradually create a mode of collaboration which was in tune with the group's character. The teacher made use of advance organizers to create a zone of proximal development for the group. This teacher was successful in providing appropriate scaffolding and fading tuned to the development of the group. The novice teacher was insecure about her role and did not consider herself able to cope with the complex technology enhanced learning environment. She did not anticipate the specific needs of the learning group. The project showed that the role of the teacher in establishing a virtual learning community is very important and demanding, requiring specific teaching and pedagogic skills.

Smeets (2005) asked more than 300 upper primary school teachers about their pedagogical views in relation to the use of ICT in education. Although more than 70% of the teachers

regularly or often paid special attention to information handling skills, discussed recent events during the lessons, or referred to the application of acquired knowledge and skills outside the school, and 93% of the teachers reported that they did apply ICT in their classrooms, the use was in general restricted to skill-based applications, which matched traditional views on teaching and learning. In this way, existing pedagogical practices were confirmed, not changed. Smeets (2005) advocated fostering the awareness and skills of teachers with respect of the use of ICT to enhance learning environments.

De Jong et al. (1998) developed an authoring tool for designing and creating simulation-based learning environments, SimQuest. Finding a proper balance between guiding students in the process of discovery learning and providing them with enough tools to regulate their own learning process was an important aim of the design. Teachers can prepare various types of assignments to guide the students. Students are asked to explore or investigate a simulation, to formulate rules or predict phenomena, or to optimize a certain process. The actual characteristics of the learning environment are determined by a set of rules, based on students' behavior and their preferences. One of the problems the authors have experienced during the process of implementing SimQuest is students' general tendency to follow the assignments without developing an independent and self-regulated way of discovery learning. Because feedback is connected to assignments students need complete assignments in order to receive feedback on their work. Currently, the authors are developing feedback procedures which can be used to coach students during free exploration of the environment.

Fisser and De Boer (1999) developed a decision support tool for university teachers to re-design courses and curricula on the basis of the seven principles of good education, as proposed by Chickering and Gamsom (1987). Good education encourages contacts between students and faculty, develops reciprocity and co-operation among students, uses active learning techniques, gives prompt feedback, emphasizes time on task, communicates high expectations and diverse talents and ways of learning. Fisser and De Boer's (1999) decision support tool comprises three major decisions about the feedback the teacher provides to the student: (1) Is the feedback structured or open? (2) Is the focus of the feedback the process or product of learning? (3) What is the extent of the feedback (short, long)? Teacher are able to use the instrument on-line and can compare their choices with those of other teachers.

Both De Laat, Lally, Lipponen, and Simons (2007) and De Jong et al. (1998) emphasized the importance for teachers to find a proper balance between guidance and support. The fact that De Jong et al. (1998) found that students tend to rely on assignments makes the task of finding the balance even more crucial. Too much guidance makes students dependent, too much freedom prevents the students from making progress. This balance problem is not new, but the introduction of technology in the learning environment makes the dilemma more articulate (see also Karassavvidis, Pieters, & Plomp, 2003). The balance problem pertains to both the level of cognitive operations and self-regulative control. Both De Jong et al., (1998) and Fisser and De Boer (1999) offered guidelines for teachers to structure the technology enhanced learning environment in accordance with their teaching strategy. Smeets' (2005) rather alarming findings that there exists a large gap between Dutch primary school teachers' views on learning and their ability to give concrete form to these views in computer supported learning environments underlines the need to both train teachers and provide them with on-line authoring tools to establish an efficient and effective technology enhanced learning environment.

The Learning Environment

Although the learning environment as a domain of study encompasses a rather wide scope of potential research questions, two issues stand out in our sample of Dutch studies into fostering self-regulated learning in technology enhanced learning environments. The first issue is complexity. Martens, Bastiaens, and Gulikers (2002) questioned the need for authenticity in technology enhanced learning environments. Karassavvides, Pieters, and Plomp (2003) compared a traditional environment with a technology enhanced learning environment. Van der Meij (2000) studied the effects of various arrangements of text and images in a computer supported learning environment. De Jong and Van der Hulst (2002) manipulated the representation of the content of a hypertext in order to reduce complexity and Van Drie, Van Boxtel, Jaspers, and Kanselaar (2005) provided various tools to represent historical arguments. Task complexity causes a high cognitive load. Van Gog, Paas, and Van Merrienboer (2004) argued that the transfer value of worked examples could be enhanced by adding explanations. The second issue is interactivity, the extent to which the technology enhanced learning environment can be adapted to students' learning processes. Swaak, De Jong, and Van Joolingen (2004) compared the effects of providing assignments versus

providing learning tools. Veermans, De Jong, and Van Joolingen (2000) designed computer generated feedback procedures to support discovery learning in a technology enhanced learning environment.

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 are often 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. They also 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 the 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.

A fine-grained analysis of teaching and learning protocols in a computer supported and a paper and pencil learning environment was conducted by Karassavidis, Pieters, and Plomp (2003). Participants were two groups of 10 15 years-old secondary school students. They learned to solve correlational problems in the domain of geography, either with paper and pencil or by using a spreadsheet program. All lessons were videotaped, transcribed and analyzed. The most important finding was that both the teacher and the students set more explicit goals in the computer supported environment than in the paper and pencil environment. The authors attributed this difference to the increased opportunities for making task relevant decisions which a computer supported environment offers.

Van der Meij (2000) carefully compared three design formats for software documentation. The manuals differed on the use of full screen versus partial screen images, and on the layout of the text: a two-column layout, in which instructions were located either in the left column and images in the right column, or a layout with images in the left column and instructions in the right column. Participants were 48 inexperienced adult users. Participants read the manual,

carried out the assignments, and were tested afterwards. The use of full screen images (instead of partial screen images) which were located in the right column of the page (instead of in the left column) produced shortest training times and best retention outcomes. The author interpreted the results in terms of cognitive load theory (Sweller, 1994; Van Merrienboer, Kirschner, & Kester, 2003).

The often documented "lost in hyperspace" phenomenon was tackled by De Jong and Van der Hulst (2002). They created a "visual" layout of a hypertext on fuel supply systems, in which the basic structure of the domain was presented in such a way that learners were "unobtrusively encouraged" to follow a predesigned path through the text. Left-to-right ordering of nodes indicated either a temporal or a causal relationship between the nodes. Vertical ordering indicated specification relationships, in which lower nodes specified upper nodes. This layout was compared with two random arrangements of nodes. In the hints condition highlighting was used to indicate a proper reading path through the text. In the control condition, no help was offered at all, student simply received the random layout of the nodes in the text. Assignments were completed by 46 first year undergraduate psychology students. After having been trained students worked in the experimental hypertext environment and received three posttests: a propositional test which assessed the relations between the concepts, a definitional test which tapped knowledge of the individual nodes, and a configural test which measured the extent to which students had grasped the structure of the text. The data showed that students in the enriched conditions used the information provided and followed the paths which were suggested by the layout of the overview. There were no differences in exploration routes between students in both enriched conditions, but only in the visual condition did students produce a significantly better representation of the structure of the text and better knowledge of the propositional relations between the nodes than students in the control condition. As expected, there were no differences in knowledge of the individual nodes between the three conditions. De Jong and Van der Hulst (2002) concluded that presenting an overview of a hypertext which displays the relationships between nodes adds important informant to the content of the text, from which readers take advantage.

Van Drie, Van Boxtel, Jaspers, and Kanselaar (2005) compared three representational formats in a CSCL environment, in which 65 pairs of secondary school students had to complete a historical writing assignment. The participants had to collect information from textbooks,

photos, views of historians, tables, and interviews and had to prepare a 1000 words essay on the issue whether the changes in the behavior of Dutch youth in the nineteen sixties were revolutionary or not. The pairs worked in separate rooms and had to communicate through the CSCL environment. Three tools were compared: an argumentative diagram, in which students could place and arrange arguments to be included in the essay, a simple linear list of arguments to be used in the essay, or a matrix in which arguments can ordered on various characteristics like the source from which the argument was taken or the domain (e.g., sports, economy, culture) to which the argument belonged. Chat interactions were analyzed, as well as the quality of the constructed representations, the final essay, and the outcomes on an individually taken knowledge test. The various tools facilitated various reasoning structures. Using the matrix produced more interactions about historical changes, whereas the diagram focused students more on the balance of arguments. However, these differences did not result in different essay or leaning outcomes. Students in the matrix condition and students in the control condition (no tools available) spend more interactions on discussing the approach to be taken to carry out the task. The authors attributed this lack of effect on the outcome variables to the cognitive load which the task imposed on the students.

In the domain of cognitive load theory (Sweller, 1994) the worked example effect has often been reported: novice student learn more from studying worked examples than from solving problems, because of the heavy cognitive load of solving these problems. Van Gog, Paas, and Van Merrienboer (2004) argued that worked examples might function better when they are accompanied by an explanation which clarifies why and how the steps to solve the problem were taken.

The question whether inquiry learning in a simulation learning environment leads to quantitatively and qualitative better learning outcomes than expository instruction in a hypertext environment was studied by Swaak, De Jong and Van Joolingen (2004). They tested the performance on various posttests by 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 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. 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.

Veermans, De Jong, and Van Joolingen (2000) compared to methods of providing computer-generated feedback in a simulation-based discovery environment. The first method was based on the current hypothesis of the learner and the current experiment in which the hypothesis was put to the test. According to the second method, students received predefined feedback on the basis of the student's hypothesis, without taking the student's experiment into account. Secondary school students, 15 to 16 years of age, experimented in a simulation environment on collisions. Students' experimenting behavior was recorded, as well as their performance on various knowledge tests. Both groups performed equally on the posttest. However, participants who received feedback according to the first method developed a more inquiry-based learning strategy than students who received predefined feedback. The authors conclude that relating hypotheses to experiments is a powerful form of feedback which fosters the development of inquiry skills, rather than encouraging students to complete given assignments.

The Dutch research into complexity in technology enhanced learning environments showed that complexity as such does not exist. Rather, complexity is related to the students level of expertise or available self-regulation and/or cognitive strategies. As Martens, Bastiaens, and Gulikers (2002) showed, authenticity is not always functional. Again, the level of expertise of the student determines the educational value of authenticity. Novice learners should be supported by worked examples, as Van Gog, Paas, and Van Merrienboer (2004) underlined. In general, complexity should be tuned to the level of expertise of the learner. Studies into the characteristics of interactivity in simulation based learning environments showed that feedback should be based upon both the students' hypotheses and his or her experiments (Veermans, De Jong, & Van Joolingen, 2000).

The Community of Learners

We have collected four studies under the heading of community of learners, because in these studies the relationships between students in a technology enhanced learning environment played an important role. To a certain extent, the factors highlighted above, the learner, the teacher, and the learning environment, all return in research into the community of learners. Apart from De Laat and Lally (2004), who developed an analysis tool for studying group dynamic processes, Van Eijl, Pilot, De Voogd, and Thoolen (2002) paid attention to the learner's preferences, Janssen, Erkens, Kanselaar, and Jaspers (2007) studied a particular learning tool in an environment for collaborative learning, and Saab, Van Joolingen, and Van Hout-Wolters (2007) focused on the effect of providing guidelines to foster collaboration.

De Laat and Lally (2004) asked mid career professionals, working on their masters in education, to join asynchronous Networked Learning discussions, and applied content analysis to the recorded interactions to explore emergent role development and group awareness processes. Three individual student participants were interviewed to analyze critical events, a "task-focused completer/finisher", a "group-focused facilitator", and a "task-focused ideas contributor". The authors concluded that their methods of observing and analyzing role development and group awareness processes has helped them to understand the processes of teaching and learning of professionals in a community.

Van Eijl, Pilot, De Voogd, and Thoolen (2002) asked university students, enrolled in a course on 19th century English literature how they preferred to work in the course's electronic learning environment: alone or in groups of two to four students. High achieving students preferred to work in groups. Collaborating students benefited from group work.

Janssen, Erkens, Kanselaar, and Jaspers (2007) developed a software tool to visualize participation in a computer supported collaborative learning environment. Each participant was represented by a sphere, connected to a central circle, the size of which reflected the length of the messages sent by the group. The distance between a sphere and the central circle was an indicator of the number of messages sent by the participant. The tool was actively used by small groups (3 or 4 students) of 16 years old secondary school students in a collaborative learning task. Groups in which the tool was available more actively engaged in collaborative work and issued many planning messages through which the social activities of the group were coordinated and regulated. Although the group awareness and the quality of the group

product were not higher in the experimental group as compared with the control group, the authors concluded that visualization of participation can contribute to successful CSCL.

Saab, Van Joolingen, and Van Hout-Wolters (2007) 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.

The studies on collaboration in a technology enhanced learning environment showed that not all students equally prefer to work in a collaborative learning environment (De Laat & Lally, 2004). Therefore, freedom of choice is appreciated by students and may in fact add to the beneficial effect of computer supported collaborative learning environments. Collaboration can be actively fostered by providing tools and or guidelines. The good news is that the quality of the collaborative processes increases. The disappointing news is that these process-oriented measures do not enhance learning outcomes.

Discussion

Recent Dutch research into self-regulated learning in technology enhanced learning environments has disclosed important relationships between the arrangement of the learning environment, the learning process and the learning outcomes. The conclusions can be arranged under five beneficial characteristics of technology enhanced learning environments: adaptability, complexity, interactivity, articulation, and balance. Although self-regulated

learning is in many studies not explicitly mentioned, the issue is often unexplicitly addressed or implied.

Adaptability

In many ways students display different learner characteristics. In the studies reported here, we have encountered differences in search skills (Lazonder, 2000), in domain-specific knowledge (Prins, Veenman, & Elshout, 2006), in motivation (Martens, Gulikers, & Bastiaens, 2004), in metacognitive skillfulness and in intelligence (Veenman, Wilhelm, & Beishuizen, 2004). The existence of technological support creates opportunities for adapting the learning environment to learner differences, both in complexity and in interactivity. Moreover, by adapting instruction in a technology enhanced learning environment to varying learner characteristics, a proper balance may be found between structure and freedom to learn in a self-regulated way (Martens, Gulikers, & Bastiaens, 2004; Van Eijl, Pilot, De Voogd, & Thoolen, 2002; Veermans, De Jong, & Van Joolingen, 2006).

Complexity

The complexity of technology enhanced learning environments can be adapted by properly arranging learning materials and by providing various learning tools (Lazonder, 2000; Veenman, Wilhelm, & Beishuizen, 2004; Fisser & De Boer, 1999; De Jong & Van der Hulst, 2002). As explained above, complexity as such does not exist. The concept of cognitive load relates the objective complexity of the learning environment to the learner's processing capacity. Reducing the cognitive load of the learning environment enables the student to focus on the learning process by deploying and further developing self-regulation skills (Martens, Bastiaens, & Gulikers, 2002; Van der Meij, 2000; Van Gog, Paas, & Van Merrienboer, 2004).

Interactivity

Increasing the interactivity of the learning environment by means of technological support is a successful way to foster learning processes (Karassavides, Pieters, & Plomp, 2003; Swaak, De Jong & Van Joolingen, 2004). However, time and again it has been shown that fostering learning processes does not necessarily lead to improved learning outcomes (Martens,

Gulikers, & Bastiaens, 2004; De Jong et al., 1998; Van Drie, Van Boxtel, Jaspers, & Kanselaar, 2005; Swaak, De Jong, & Van Joolingen, 2004; Veermans, De Jong, & Van Joolingen, 2006).

Articulation

An important beneficial effect of technology enhanced learning environment is that often the structure of the learning task and the learning process is made transparent by visual tools. This was illustrated in two recent studies on collaboration between students in a Community of Learners (Janssen, Erkens, Kanselaar, and Jaspers, 2007; Saab, Van Joolingen, & Van Hout-Wolters, 2007). As Van Drie, Van Boxtel, Jaspers, and Kanselaar (2005) and De Jong and Van der Hulst (2002) made clear, various visual tools have various effects on the learning process, but the articulation characteristic is itself an important asset of technology enhanced learning environments, fostering both learning processes and regulative behavior.

Balance

Too much structure in the technology enhanced learning environment creates dependent learning behavior (De Laat, Lally, Lipponen, & Simons, 2007; De Jong, et al., 1998; Fisser & De Boer, 1999; Swaak, De Jong, & Van Joolingen, 2004). Therefore, teachers play an indispensable role in technology enhanced learning environment. They should develop and apply a powerful repertoire of design and support strategies to enrich the learning environment with both technological tools and personal support and feedback (De Laat, Lally, Lipponen, Simons, 2007; Smeets, 2005; De Jong, et al., 1998; Fisser & De Boer, 1999). The principal role of teachers in a technology enriched learning environment is establishing a balance between structure and freedom to learn in self-regulated way.

Together, the 20 studies reported in this paper provide a realistic evidence based account of the effects of technology enhanced learning environments. Teachers, learning tools and appropriate assignments all help to improve the quality of learning and self-regulation. Further research is necessary to explore the relationship between quality of learning and self-regulation on the one hand and learning outcomes on the other.

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NORWAY

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Introduction

This article outlines the state of the art in Norway regarding the field of self-regulated learning (SRL) and the impact of Technology Enhanced Learning Environments (TELEs).

The first part of the article gives an overview of the theoretical background of self-regulated learning and highlights some Norwegian studies within this field. Self-regulated learning in general is a well known term within Norwegian as well as international literature within pedagogic and psychology. SLR deals with processes of developing strategies for achieving learning goals to reach these and having a positive belief in mastering and finding motivation for this task. This process may be important if learners are intended to master educational systems and if one think able to build up knowledge needed for future education and profession.

The last part covers how stimulation, motivation, evaluation and the interaction between other students through technology are intrinsic aspects of technology that enables various forms of self-regulated learning and outlines how this is documented in Norwegian self-regulation studies.

Theoretical background

First of all it is important to see how self-regulation exists as a term in Norwegian literature concerning this field. Finding the term *selvregulert læring* this is directly translated and it is not difficult to find Norwegian literature using this term. Further findings in Norwegian articles show the most used definition to be Zimmerman's definition of self-regulation (Løland 2007, Torgunrud 2007, Baggetun and Wasson 2006, Bråten et al 2003, Anmarkrud et al 2002,).

Referring to this definition self-regulated learners are students who "... approach educational tasks with confidence, diligence, and resourcefulness. They are aware of when they do or do not know something. They seek out information when needed and follow the necessary steps to master it. When they encounter obstacles such as poor study conditions, confusing teachers, or abstruse text books they find a way to succeed." (Zimmerman 1990:4).

Bråten (2002) explains how self-regulated learning is a Methological direction within pedagogical psychology focusing on individual activity and responsibility for one's own learning process. This perspective finds learning as a dynamic process in interaction with educators, pupils at same age, teachers and the learning materials. Cognitive, emotional and social perspectives on learning are analyzed as key-factors in self-regulated learning (Zimmerman 2000 in Torgunrud 2007).

While Zimmerman's definition is used in nearly all articles investigated, Knain and Turmo (2000) find that defining self-regulated learning is not a straightforward matter. They emphasize that SLR may be linked to several research traditions and conclude that it is difficult to find a consensus definition. They claim that definitions of self-regulated learning tend to focus on *factors* connected to self-regulated learning rather than self-regulated learning itself. They choose a definition by Pintrich, to highlight this orientation, where the authors define "self-regulated learning [as being] an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features in the environment (Pintrich 2000:453 in Knain and Turmo 2000)."

Knain and Turmo (ibid) explain SLR as a dynamic process where learners organize knowledge, skills and attitudes regarding the contexts. They also find that they need arrange of learning strategies in order to do this. Therefore the learners may need to acquire specific experience in using learning strategies in various situations and reflect on their learning efficiency.

According to Baggetun and Wasson (2006) several theoretical perspectives are used to explain how competence in self-regulated learning develops (Schunk 1999 in Anmarkrude et al 2002).

Common for theses perspective is the focus on social interaction heavily influence by the Vygotsky's theory (1978), which is exploited as a theoretical foundation for the development of the theory of self-regulated learning. Baggetun and Wasson (2006) also mentions how research on SRL has been conducted from various theoretical perspectives, e.g., studies in meta-cognition originating in the social cognitive theories of Bandura (1986, 1991). This theoretical framework is also adopted by some educational psychologists, who investigating how individuals strive for control of their learning activities; attempt to design approaches that may empower them as learners (Baggetun and Wasson 2006).

Anmarkrud emphasizes the importance of social interaction in learning processes using social cultural theory from Vygotsky (1996 in Anmarkrud et al 2002). Anmarkrud (ibid) finds social theory (Vygotsky) suited to explain the development of self-regulated learning. By letting skills first be learned by interaction with others, they will she argues, be internalized by the learner.

Having mentioned some of the basic factors and elements concerning self-regulation, there is one factor that seems to be most stressed in SLR – motivation. This motivation is stimulated by the ability to see the relevance in selected learning strategies. Knain and Turmo (2000) stress how SRL is related to students' self concepts, efficacy beliefs and how successes and failures are experienced and explained. This contextual approach constitutes a theoretical background which may shed light on studies on self-regulation in learning in Norway.

Norwegian studies of self-regulation

There are several Norwegian studies investigating self-regulated learning and different related aspects. Throndsen (2005) has been investigating how self-regulated learning can be used within mathematical education. Stengrundet (2007) has done a comparative study of Norway and Switzerland covering pupils' conceptions of classroom conditions and self-regulation. Parallely, appears SLR as a popular subject for master theses in 2006/2007 (i.a., Gravdal 2006, Haagensen 2006, Løland 2007, Torgunrud 2007 and Stengrundet 2007). However, it appears that many Norwegian studies investigate the effect of self-regulated learning without explicit focus on ICT aspects (this is the case of Anmarkrud et al 2002, Bråten et al 2005a, 2005b, 2004a, 2004b, 1999,

Haagensen 2006, Haakanes 2000, Knain 2002, Olaussen et al 2004a, 2004b, 1999, Olsen 2000, Strømsø et al 2004, Torgunrud 2007, Weinstein et al 2006). Some of these studies focus on learning habitus and learners' ability to self-regulate, while some studies concentrate more narrowly on the benefit of self-regulation for special groups of learners. The example below may illustrate this tendency:

In a study at the University College of Oslo, regarding self-regulation, teacher students were asked about to what extent other people had influenced their study habits. The result of the study showed that 34,6 of the students regarded their parents or close family to have the largest impact. While only 17.3 % of the group answered the teachers. Still 28,1% of the students ticked the teacher category when being able to tick more than one category. The students marking for teacher emphasised that active and engaged teachers were essential for motivation, both for learning strategies and building knowledge. Yet, the skill factor, knowing how to perform good learning techniques, was essential for the study situation (Anmarkrud et al 2002).

Another aspect emerging from the review of Norwegian papers is how research in later years has found that self-regulated learning can be useful for learning benefit for students with ADHD and related syndromes. Self-regulation techniques as self-monitoring, self-instruction, self-evaluation and self-rewarding can lead to increased academic productiveness and accuracy for this category of learners. The use of SLR-oriented techniques has also shown increased concentration (Harris et al 2004, Reid et al 2005 in Torgunrud 2007).

As a preliminary conclusion, most Norwegian studies on self-regulated learners do not relate self-regulated learning to the impact of Technology Enhanced Learning Environments (TELEs). Nonetheless, in spite of the absence of TELEs elements, the results from such studies may enhance or even foster research interest in involving ICT to in the study of self-regulated learning, since, most contemporary observers will agree, digital technology and life-style is being increasingly integrated in most aspects of everyday life. Among all Norwegian studies dealing with learners' self-regulation in general, it will be interesting to highlight studies where one finds explicit concern with ICT and the self-regulated learner.

Self-regulation and Technology

Although self-regulation turns out to be a well-known aspect within educational science and psychology and, although technology indeed surround accompanies, conditions and host an increasing amount of learning activities, SRL and TELEs, surprisingly, do not constitute an object of explicit investigation in most of these studies. Still, technology offers many practical possibilities and actualizes many old and new educational questions which may apply to the learning situation (Stømsø et al 2007, 2004 Bråten et al 2006a, 2006b, 2003).

Baggetun and Wasson (2006) mentions how SRL in recent years also has been incorporated in ICT, e.g., as illustrated by diverse computer-supported collaborative learning environments, by teachers scaffolding students using ICT, by the proliferation of blended learning contexts, and, more generally, as an issue of concern in self-instruction and courses in business settings using the worldwide web.

Some researchers (Bates and Khasawneh 2007 in Løland 2007) claim that there is a potential in the use of ICT in learning situations and a connection between self-efficacy, foregoing events and the learning outcome. Technology may, increasingly, contribute to shape premises for learning, and influence the learners' perception of their self-efficacy as being a central element in the overall knowledge benefit acquired by the learner.

Regarding the situation in Norway Bråten, Strømsø and Olaussen (2003) find that ICT is looked upon as an essential tool for transforming traditional teaching into forms of self-regulated and collaborative learning. They claim that there are very good conditions for technology-based educational reforms in Norway due the very high internet availability.

Baggetun and Wasson (2006) highlight, from a socio-cultural perspective (Vygotsky, 1978; Lave, 1988; Lave & Wenger, 1990; Wertsch, 1991 in Baggetun and Wasson 2006), the role of tools as social mediators of learning in students' self-regulation. This context appears to be of particular interest, since it fosters situation where SLR is embedded *in* and mediated *by* a community and its cultural artefacts.

In the European TELEPEERS project, which focused on Technology-Enhanced Learning Environments (TELEs) that support SRL, Baggetun and Wasson (ibid) have been studying students using weblogs. Weblogs are software systems making it possible to write and post text, and, more recently pictorial and audiovisual content. It is possible to hyperlink to other internet pages and labels the post by a category. Whenever the Weblog author creates a post, he or she can also decide if visitors will be allowed to add comments to the post.

Baggetun and Wasson (ibid) found that weblogging supported SRL in various ways and the study illustrated various aspects of students' weblogging and their relation to SRL. In this study, the student learning activities were not tied to a particular course. Common for these students were their use of weblogs and the fact that they were doing it on their own free will. The authors analysed the student weblogs, covering both their structure and content, with regard to how it supported SRL. The authors isolated a number of SRL sub-processes involving, e.g., reflection, collaboration, ownership, motivation, categorisation, personal knowledge organisation, and testing/demonstrating knowledge. Many of the postings studied appeared to be of very reflexive nature, in the way that it not only was the solution to particular problems which was posted in the weblogs, but, alternatively, various reflections on the process. This reflection included important clues describing the context of the learner's struggle with knowledge and construction, how the learners' conception of the project changed and addressed various social resources that they drew on in order to solve the problems.

As other authors (Løland 2007, Imenes 2004 Bråten et al 2004, Bråten et al 2003, Anmarksrud et al 2002, Knain and Turmo 2000) Baggetun and Wasson (ibid) mention how motivation is another important aspect of SRL. Self-regulated learners are said to 'motivate themselves and focus on learning in the face of distractions' (Lynch & Dembo, 2004 in Baggetun and Wasson 2006). In an earlier weblog project (Baggetun, Wasson & Andersen, 2003) the analysts found that bloggers found comfort in knowing that there existed others students who were also struggling with related issues. Posting about struggles, reading about them and getting replies were a way to increase awareness of the material, content, and concepts that were thought to be difficult in a specific course.

The authors further mention how some students can find motivation in writing for an audience. Equally, it may also be motivating and useful to have access to other people's writings and discovering that other learners or observers find your writing interesting. The clearest influential role of SLR was linked with reflecting publicly on a topic, with participation in invited and initiated conversations, with building a personal knowledge base, posting solutions to problems, and testing what they knew about current issues that were relevant for their studies, theorise about current issues and demonstrate their knowledge. The authors conclude that the structural features of weblogs give students an easy-to-use tool to document what they discover in their learning, enabling them to write and communicate about it. The open and collective nature of weblogging leads the authors to recognise that the SRL is not limited to the one individual. By using weblogs the student took ownership of their learning and used digital tools actively in their learning activities. The authors suggest that the informal 'open' learning as it is expressed in weblogs may give new ways of thinking about SRL; instead of using the term to describe the activity of a single individual, it could also be applied to describe the learning activities of a community of learners (Baggetun and Wasson ibid).

Another study concerning SRL and ICT was conducted by Bråten, Strømsø, and Olaussen (2003). Their study looked at Norwegian teacher education with attempts to develop ICT-based learning environments. They discuss the strong emphasis that was given to promote competence in using information and communications technology (ICT) within Norwegian teacher education, and showed how this joined up with a strong emphasis on developing self-regulated learners. They found that teachers themselves, in the project believed that the use of ICT might promote student skills in self-regulated learning. The authors emphasize how student teachers must acquire different skills in their study, and this should enable them to plan, implement, and evaluate learning processes and teaching. Another aspect, having an important role in the current models of self-regulated learning, was working deliberately towards a goal.

Contrasting with what may be the situation for Baggetun and Wasson's blogger students, Bråten, Størmsø and Olaussen's (ibid) find that the use of ICT in higher education in general, or in teacher education in particular, does not foster self-regulated learning in itself. Neither do they

find that it makes collaborative learning more effective. The authors claims that if the ICT-based environments are not carefully designed to support the development of SLR and collaborative skills, there may be a risk that only students already possessing such skills get the potential benefits of the new technology. This latter aspect may also be the situation for the student blogger in Baggetun and Wasson's study.

Bråten, Samuelstuen and Strømsø (2004) refer to a project regarding self-regulated learning and Text Comprehension. The group collected several sets of evaluation data from students within general teacher education and business administration during their first year of study and assessed students' use of meta-cognitive and self-regulatory strategies. Their goal was to look at to what extent students used self-regulatory activities to plan, monitor and regulate their cognition and learning. Their findings indicated that the student teachers used self-regulatory strategies more than business administration students. Moreover, as mentioned earlier, for both the student teachers and the business administration students, self-regulatory strategies were uniquely predicted by master goal orientation but not by perceived self-efficacy

As Bråten, Strømsø, and Olaussen (2003) they found no reason to believe that the introduction of an ICT-based learning environment automatically promoted students' self-regulatory and collaborative learning skills, and there seemed to be little or no support for students' development of self-regulatory learning skills. The authors found no indications in students developing sophisticated self-regulatory learning skills on their own, and suggest that those skills probably need to be directly supported if the students are to succeed in such an environment (Bråten, Samuelstuen, & Strømsø, 2004).

Another Norwegian study has been conducted by Løland (2007). She has been investigating students' use of strategies and motivations for the use of internet in the study situation focusing on communication and searching activity on the internet among students. Løland explains how the students, through preparation, are forced to analysing the task to get it done and find individual motivation. This preparation also implies that the learner activate some expectations on what results to expect and how to orient one self towards a goal. Løland mentions how self efficacy will be a factor in this preparation process.

She found, using the Bandura's theory of self-efficacy, that the ability to motivate one self is important for the self-regulated learner. Another finding in Løland is the users' ability to take control as a particular interesting factor related to Internet use because it probably can lead to more self-regulation and meta-cognitive competence. To be a self-regulating student one must be capable of evaluating one owns actions and adjust them in relation to ones goals. Another aspect mentioned was how the use of internet when studying gave high expectations to be independent and effective in the study situation. Students themselves have to control their own learning process to reach their goals. Løland thinks that this control can be a motivating factor and also result in self-efficacy in the use of internet. Løland finds that meta-cognitive factors require that students' capability to reflect on its own cognition, will play a role to what extent the student can master its own learning process and to what extent they get an advantage in their study situation, when using internet.

Imenes (2004) has been investigating student ability to learn and be motivated to use Learning Management System (LMS) by using principles from theory of skill development or self-regulated learning. He finds that both student learning LMS by skill development theory or self-regulated theory got the first necessary training in the program and was able to make use of, meaning being able to understand how the system functioned, and use most basic and necessary functions. Though there still were many aspects with the system students in both groups did not understand.

The students taking the course based on skill development got to see different aspects of the system such as log in, sending messages, chatting and forum on a big screen. After this presentation they got different tasks to solve by using the system. The students taking the self-regulation course got PowerPoint presentations with different screenshots (ibid).

Imenes (ibid) found some significant differences in the two groups. Students learning the system in a more traditional way based on skill development theory, gave the system a relevant higher score (5,22) than those learning the system based on theories form self-regulation (3,75). Still it does not seem like the students learning the system based on skill development theory, handled

and understood the system better than those learning with theories based on self-regulation. Imenes still found the first group to have a slighter better understanding of conceptional tasks, regarding the system, than the self-regulated group. Imenes suggest that the students getting the skill development training got more confident in their skills while the self-regulation group got more capable of seeing the possibilities in the system.

The author mentions both courses suited for learning this type of LMS system but suggest blending the courses probably would give better learning possibilities especially for students not known to computer programs in learning situation. He further suggest the skill development course best for getting to know the program before starting with self-regulated learning.

Conclusion

Literature concerning self-regulated learning in Technology Enhanced Learning Environments shows that ICT actualizes several factors useful for SLR. There are aspects linked with technology itself that make room for self-regulated learning, e.g., stimulation, motivation, evaluation and the interaction between other students through technology.

Self-regulated learning is a methodological direction within pedagogical psychology focusing on fostering more individual activity and responsibility for one own learning process. This perspective also affects learning as interaction in dynamic processes.

Defining self-regulated learning is not necessarily a straightforward matter and several theoretical perspectives are used to explain how competence in self-regulated learning develops. Both theory of social interaction emphasized using social cultural theory from Vygotsky and social cognitive theory from Bandura is in use. Investigating Norwegian articles show Zimmerman's definition of self-regulation to be the most common in use.

The focus in most Norwegian studies concerning self-regulated learners does not combine the aspect of SLR and Technology Enhanced Learning Environments (TELEs) still there are studies exploring this field entering more and more scenes in peoples every day life. Some of the studies

showed that self-regulatory strategies were uniquely predicted by master goal orientation but not by perceived self-efficacy. Other studies showed that by using technology the self-regulated learner took ownership of their learning and used digital tools actively in their learning activities. There were also findings where the introduction of ICT-based learning environment not automatically promoted students' self-regulatory and collaborative learning skills, as long as there was little or no support for students' development of self-regulatory learning skills.

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PORTUGAL

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Introduction

Portugal undergoes wide changes in the use of Information and Communication Technologies (ICT). These changes affect all segments of social and business life. While experiencing a three year lag as compared to the average EU indicators, the country displays strong patterns of ICT catching-up in areas such as e-Government Broadband penetration, and e-Education (Carneiro & Rodrigues, 2007).

There is a general understanding that ICT can be a formidable catalyst for transformations in the educational landscape. Generally speaking, it is recognized that technology offers seven major possibilities (Carneiro, 2000, 2007):

- The promotion of an open knowledge system.
- An evolution towards learning technologies, as opposed to the continued use of mere teaching technologies.
- A stimulus to turn each student into a researcher.
- The dissemination of interactive tests that support customized and real time student's assessment.
- The formation of distributive networks and virtual learning communities – the new *Agora* of human capital.
- A lever to bring about an effective collapse of the monopolist, mass teaching, centralised education that is typical of the industrial mode of delivery.
- The opportunity to foster intergenerational learning experiences and inclusive support to disadvantaged groups.

Strictly speaking, from a school perspective, a suitable use of ICT makes it possible to combine *remedial* actions (when necessary) with *enriching* actions (where appropriate) to

address learning bottlenecks and/or to improve learning outcomes. In order to realise these objectives the government recently approved (July 2007) a Technology Plan in Education that elicits the school as the most effective platform toward universal access to information and knowledge (http://www.escola.gov.pt/docs/me_plano_tecnológico_educação.pdf).

Against a backdrop of sizable ICT investments the concept of nurturing a 'competent student' finds growing interest among researchers and practitioners, with particular emphasis on higher education (Jardim, 2007). Furthermore, the necessity to reverse a longstanding situation of high school dropout rates and low skills in the labour force with 'aggressive' lifelong learning policies makes the demand driven learning agenda come to life and puts high emphasis on individual informal / non formal learning paths. Hence, it comes without surprise that the academic community in Portugal has turned to the theme of Self-Regulated Learning (SRL) with a growing interest and increasing energy. The considerable number of PhD and Masters dissertations whose empirical research focuses on SRL is a good indicator of this rising trend.

However, there is scant evidence on actual research being conducted on the specific topic of Self-Regulated Learning in Technology Enhanced Learning Environments (SRL in TELEs). This lack of investigation is due to the rather recent nature of systematic e-Learning and/or b-Learning activities in either formal education or business settings, and also to a persistently low awareness vis-a-vis the related international agenda.

This paper will address three major concerns. In a first part we shall account for general theoretical and empirical studies on SRL in Portugal. The second section will describe a study on the impact of a TELE in SRL in the context of a graduate programme of studies offered at the Portuguese Catholic University with a particular focus on motivational profiles of teacher students. The last section provides a brief description of the Digital Portfolio movement in Portugal, a concept that is acquiring momentum among academia and research groups. Finally, the paper ends with a summary of general conclusions derived from the insight given in the three above-mentioned core sections.

Self-regulated learning: theoretical and empirical studies done in Portugal

Setting the Scene

In the last decades we have witnessed an increase in research which includes the following as the central theme: i) the understanding of internal and transactional psychological processes which allow individuals to direct their own behavior in order to achieve objectives and personal goals and to control their feelings, thoughts, behaviours and means in order to maintain those actions until they obtain the desired results; and ii) the understanding of contexts focused on beliefs, conceptions and educational practices of parents and teachers.

Lopes da Silva & Sá (2003) have done an overview about the national and international research on SRL which led to the identification of distinct theoretical approaches and research tendencies. They have concluded that "the work done until the present day allows for a better management of the self-regulated learning construct, although it is still necessary to develop more research in this area which allows the elaboration of an integrative theoretical body of the results from the empirical work and of a theoretical reflection".

It was within this framework that the Self-Regulated Learning Studies Program[1] (PEAAR, 2005) was created and integrated in the Psychometrics Research Units of Educational Psychology and Sciences of Education of the Lisbon University School of Psychology and Educational Sciences with the objective of: a) stimulating cooperation between researchers from diverse theoretical orientations and different fields of Psychology and Education; b) giving emphasis to the development of research work in this area; c) developing a research network which makes the incorporation of post-graduate students feasible.

PEAAR gradually integrated the various strands of SRL studies in the areas of Educational Sciences and Educational Psychology that were organized by the Lisbon University School of Psychology and Educational Sciences and coordinated by Lopes da Silva & Veiga Simão.

Learner autonomy and teacher development are the main areas for reflection and action within GT-PA (Working Group-Pedagogy for Autonomy – Moreira, 2002; Vieira, 2002). The GT-PA group of the University of Minho established its focus around two specific aspects: the

[1] http://www.fpce.ul.pt/investigacao/centros/autoregulacao/

role of the learner in a pedagogy for autonomy and the role of teachers in professional development dealing with learner autonomy

Researchers have chosen learning in a school setting as one of the principal fields in which to apply self-regulation because they consider that students should be taught to understand and to use their personal resources which allow them to reflect on their actions, to control their own learning processes and to reinforce their learning skills. They also believe that teachers should stimulate their students to arrive at competent, efficient and motivated usage of both learning processes and technological and cultural means they have access to.

Although there are differences in the independent variables, which are identified by different authors in order to explain SRL, self-efficacy perceptions, conscious and deliberate use of cognitive and motivational strategies, and effort made to achieve educational objectives appear as the foremost in the multiple theoretical and empirical studies that have been carried out on this topic.

The analysis of papers, thesis and research articles allows us to acknowledge that the prominent theoretical approach is a social cognitive one. The identified studies are dominated by national and international scientific knowledge in Educational Psychology and are essentially accomplished, although not exclusively, by psychologists and teachers in the post-graduate studies areas. The international authors most commonly cited include Bandura, Biggs, Boekaerts, Corno, Deci, Pintrich, Ryan, Schunk, and Zimmerman.

As a rule, we verified that authors, who have dedicated themselves to the student's SRL, consider that self-regulation occurs through different phases and calls for different psychological processes (Boekaerts & Niemivirta, 2000; Febbraro & Clum, 1998; Mahoney & Thoresen, 1974; Pintrich, 2000; Zimmerman, 2000). Zimmerman (idem) elaborated a detailed model of intervention processes in the different self-regulation phases.

Lopes da Silva, Duarte, Sá & Veiga Simão (2004) and Lopes da Silva, Veiga Simão & Sá (2004) conjugate the different models (Boekaerts, 1996; Pintrich & de Groot, 1990; Zimmerman, 2000) and present a theoretical model by phases which has helped integrate the different theories that emerged on this theme and which are intricately connected with the

SRL construct. Four phases are distinguished, namely: forecasting and objectives setting; strategic planning; monitoring/volitive control; and self-reflection and self-reaction. For each phase, the most relevant processes and metacognitive, motivational, volitional and behavioural variables (thoughts, beliefs, strategies, emotions and expectations), which may influence the path of self-regulation, can be analyzed.

Guidelines for Research on Self-Regulated Learning

At this stage, we present the general outline of research undertaken in post-graduate studies and research projects in Portugal. These exemplify the direction which studies on SRL have taken.

One of the central objectives of research done in this area is to theoretically and empirically clarify the SRL phases and processes in order to sustain and perfect the proposed theoretical model.

Research Outline

We can distinguish two main research outlines: the first one, which is more centred in the study of students' cognitive, metacognitive, motivational and behavioural processes; and the second, which is contextual and centred in beliefs, conceptions and teachers' and parents' educational practices.

One of the research lines strives to examine individual or cultural differences which exist in the practice of self-regulation (Jerónimo, 2007) namely when comparing students in different learning cycles, from pre-school to university (Figueira, 2005) or in change situations, such as the transition between learning cycles (Guerreiro, 2005; Prata, 2006; Sá, 2007). Sá (2007) presents the results of two empirical studies which aim to assess the impact that school transitions have on students' motivation, self-efficacy and performance. In the first, an analysis of the impact of transition from elementary to secondary school is presented. In the second one, personal variables (gender, age, grades, coping strategies) that promote a better adaptation (self-efficacy and performance) to the transition to university are analysed. The results emphasise the importance of both social and cultural contexts and previous successes

for the development of positive self-efficacy expectations. These are related to more autonomous motivations and to better academic achievement.

In this sense, we intend to frame the self-regulation model in a developmental perspective and characterize the affective, motivational, cognitive and behavioural processes which are predominantly relevant at different school levels.

Much of the work done in this area targets university students. The preference for university students is grounded on the facts that this academic phase is more autonomous and student responsibility and possibility of choice is greater. In the study *Das concepções aos processos - Stress e Coping nos Estudantes do Ensino Superior*, Figueira & Marques Pinto (2007) study student de-adaptation processes at university level under the perspective of Lazarus & Folkman's stress and coping model in articulation with Wells & Matthews' regulating executive function model. Bessa (2000), Bessa & Tavares (2000) focus their research on levels of adjustment and self-regulation in university students and highlight the relation between positive student self-perception and the approaches to learning and self-regulatory strategies.

The approaches to learning have originated many projects in Portugal (Duarte, A. 2002; Ferreira, 2002; Rebelo, 2006; Rendeiro, 2005; Rosário, 1999; Soares et al 2005; Valadas & Gonçalves, 2002) that adopted Biggs' perspective (1993).

Another type of research strives to understand the relation between educational practices and the development of self-regulating competencies in learning. It also analyzes the influence of the type of family (Vidal Paula, 2004; Sousa, 2006) and classroom environment in student self-regulating processes.

Research Directed Towards Intervention Processes

Many studies have intervention concerns: either in cognitive training (Leandro 2005) or knowing how to increase SRL competencies in students. It is precisely in the field of Education that the self-regulating competencies have been highlighted. It is fundamental to stimulate the development of self-regulating competencies in students and teachers so that

both may take advantage of the means and instruments which are available to them, whether they are internal or generated from the modern use of technology.

In one direction, the goal is to elaborate and test intervention programs with the objective of improving teaching and learning strategies and self-regulation in students, namely through the development and identification of "pedagogical aid" which promote student strategic knowledge in specific situations, such as homework completion (Cruz, 2006; Duarte, F., 2004, Rosário et al., 2005), reading (Araújo, 2006), history (Teixeira, 2004) or writing practice (Fragoso de Almeida, 2004). Fragoso de Almeida & Veiga Simão (2007) present a study with the contribution of primary school teachers where the focus is on the development of self-regulatory strategies in the writing process, identification of difficulties felt during the teaching of this process, and prevention and remedial activities used.

Araújo (2006) presents a case study in which action research was used to articulate the reflective self-development of the teacher-researcher with a pedagogy for autonomy in school. Its objectives were to motivate students towards reading as a communicative practice; to promote self-monitoring of reading and to foster processes of pedagogical self-supervision. The results confirm the possibility of developing reading strategies and cooperative work, revealing that extensive reading may support the development of communicative and learning skills. At a more general level, the study created opportunities to carry out a deep reflection about teaching and the role of professional reflectivity in its transformation.

The study *O Conhecimento Estratégico e a Auto-Regulação do Aprendente*, by Dias & Veiga Simão (2007) sought to understand how the development of strategic knowledge can promote self-regulation in first-grade students. Other objectives of this study also included the development of "pedagogical aid" in order to allow for the development of strategic knowledge - in other words, understanding how the development of that knowledge can promote student self-regulation and giving rise to intervention clues for the participants in education. Homework has become a part of educational practices throughout the last decades and has been an object of research for Duarte, F. & Veiga Simão (2007) in terms of what role it plays in life-long learning and how it promotes the strategic use of knowledge in fourth-grade students.

In other studies (Veiga Simão, 2000, 2002a, 2002b) not only did the teacher work with pupils, aiming to raise cognitive, metacognitive and motivational strategies, but also the researcher worked out a teacher training procedure in order to stimulate a reflective, active and constructive attitude. The scientific value of this educational project lays on the importance of validating it in real contexts, which allows us to analyse the meaning of upcoming changes and compare them with the existing scientific knowledge on the subject. The research showed the possibility of using learning strategies in classroom within a regular curriculum.

Notwithstanding the variety of approaches there are common elements in the different proposals, namely: strategic teaching, strategic practice combined with teacher feedback, strategic use of monitoring, possible alterations of monitoring depending on obtained results, social support provided by teachers and psychologists responsible for the interventions and the withdrawals of this type of support. This work is accompanied by a reflexive practice that aids students in self-evaluating the use and value of adopted strategies and other beneficial results which may be obtained by them.

We highlight a few projects (Lopes da Silva & Sá, 1997; Rosário, 2004; Rosário, Pienda, Pérez, 2006), with the objective of improving self-regulation competencies in private study. Zimmerman (1998) emphasizes that studying is a complex activity where components of a distinctive nature inter-relate: cognitive, emotional, motivational and behavioural dimensions at different phases of the learning cycle. Lopes da Silva & Sá (1997) reveal a program application for the development of study methods in primary and middle school students, which integrates metacognitive, motivational and behavioural variables, and Rosário (2004) presents a program for primary and middle school students which is built on the SRL models and distinguishes three phases which correspond to the three phases of the learning cycle proposed by Zimmerman (1998): the planning phase, the execution phase and the task evaluation phase.

Rosário, Pérez & Pienda (2004) carried out a research program “Stories that show how to study and how to learn: an experience in the Portuguese school system”. Self-regulation of learning is the conceptual framework for the project, called “(Des)venturas do Testas”[“Testas’s (Mis)adventures”]. The innovative nature of the proposal lies in the use of “stories” as a means to convey and discuss study strategies, brought to light by a familiar

model. The (Mis)adventures of Testas, a student like any other, allow pupils to easily identify with proposed solutions that are discussed, as well as to transfer competencies discussed in the classroom to other areas of school and of their own life. Guimarães (2006) carried out a research to promote self-regulation in learning and, more specifically, the effects of a psycho-educational project anchored in the use of the narrative as a tool to transmit and discuss learning strategies.

Methodological Options of the Studies

In methodological terms, the developed studies are of a descriptive and differential nature and include a construction/adaptation and validation of evaluation instruments (Borralho, 2005; Borralho & Lopes da Silva, 2007; Guerreiro, 2005; Vidal Paula, 2004; Rodrigues, 2005), involve intervention valuation (quasi-experimental designs, pre and post-test, Dias, 2004; Duarte, F, 2004), use of portfolios (Fernandes, 2005, Veiga Simão, 2005a, 2005b) and case studies.

Rendeiro & Duarte's (2007) study *Concepções de Aprendizagem face à Avaliação em Estudantes do Ensino Secundário*, is an example of a qualitative study carried out under the phenomenographic perspective, where an empirical taxonomy of learning conceptions are developed for evaluating and verifying how the different system categories find correspondence with the learning conceptions identified by the phenomenographic studies.

Future research should include longitudinal studies which allow us to better understand the development of strategic knowledge and the autonomy in learning throughout schooling. The study *Os efeitos da transição para o 10º ano na motivação para a aprendizagem* by Guerreiro & Sá (2007) is an example of a longitudinal study which intended to describe the role of the social cognitive variables in student motivation for learning in the transition from middle school to high school.

As a transversal objective to all studies, the construction, validation and adaptation of evaluation instruments, which are necessary for the empirical study of analyzed variables in each study, surface (Guerreiro, 2005; Lopes da Silva & Duarte, A., 2001; Rosário, 2001; Vidal Paula, 2004).

In a study *A avaliação do ambiente familiar e o seu papel na competência escolar das crianças: adaptação do inventário HOME,* Vidal Paula & Lopes da Silva (2007) adapted a measurement instrument of the family environment - Bradley, Caldwell, Rock, Hamrick, & Harris' HOME Inventory, for children between the ages of six and ten – and explored the role of the family environment in a child's academic competency and his/her perception of what competency is (consequent and feature of SRL, respectively).

Self-description questionnaires (Dias, 2004; Duarte, F, 2004), interviews (Veiga Simão & Flores, 2007), and observation grids on personal beliefs, self-efficacy expectations, motivational orientations, learning environments, family environments and strategic knowledge (Laranjeira, 2007) are being developed.

Veiga Simão & Flores (2007) focus on the use of interviews to enhance learning in teacher education. SRL theory in educational psychology merges the best thinking about cognition, motivation, volition, social interaction, and expertise to explain how academic learning at its best occurs. However, practitioners have lacked guidance in translating this powerful theory into insightful practice. By using semi-structured interviews within a self-regulation approach teachers are asked to explore students' perceptions of their experience of learning in order to gain deeper understanding of the process.

An overview of the SRL studies

These different lines of research have allowed for testing on the theoretical model which accounts for individual differences in the self-regulating processes (Correia Lopes, 2007; Laranjeira, 2007; Lopes da Silva, Duarte, Sá & Veiga Simão 2004) and the implementation of teaching practices favourable to the construction and development of self-regulation in learning (Dias, 2004, Duarte, F. 2004, Rosário, 2004; Veiga Simão, 2002a). This knowledge will allow us to structure learning environments which permit students to construct knowledge and mobilise resources in order to learn to self-regulate their learning so as to transfer and apply it to their future professional activity.

Nowadays teachers are required to be reflexive and able to analyse their own conceptions and practices in order to face the demands related to teaching and learning if they are to be successful. Thus, they must acquire deep understanding of the cognitive and motivational principles and assumptions of teaching and learning. In order to achieve this purpose, teacher educators must focus on modelling and promoting student teachers' SRL. SRL entails three main characteristics: thinking awareness; use of strategies and motivation maintenance. The idea is to mobilise self-regulated ability, associating specific training in learning strategies with teacher activity, which leads to the recognition of reasons, assumptions and meanings of the teacher's options, decisions and outcomes. (Veiga Simão, 2002b, 2004b).

If students are to strategically use their resources, the teacher needs to be able to strategically teach and learn the curriculum content him/herself. This is why the use of the SRL construct is advocated in the teacher training process as well as the perspective of learning strategies which imply awareness, intention, context sensitivity, control and activity regulation (Veiga Simão, 2002b).

In order to face the challenge of strategic learning, we need teachers who know how to help their students become more autonomous, strategic and motivated in their learning and in an academic context so that they may transfer their efforts and strategies to other contexts. This implies purpose development (from the data found) which may be included in teacher training plans (Veiga Simão, 2002b, 2004b, 2006). Fernandes & Veiga Simão's study (2007) *O portfolio na Educação de Infância: Estratégia de Reflexão dos Educadores e das Crianças* was an attempt to contribute, on the one hand, to the understanding of teacher perceptions with regard to the development of portfolios in a kindergarten context as a reflection, regulation and self-regulation learning strategy and, on the other, to the perception of reflexive regulation and self-regulated learning processes which involve portfolio development for children.

Veiga Simão, (2002b, 2004b, 2006), Veiga Simão & Flores (2007) focus on the importance of quality in teacher preparation. According to the findings, a number of key issues may be identified which can challenge teacher education in general: i) integrating learning strategy teaching throughout the various years of training which may contribute to developing processes of self-regulation in the pre-service teacher; ii) emphasizing student autonomy and

control in learning, which promote self-regulation attitudes and competency development (behavioural, metacognitive, motivational and volition). The challenge is to consider the demands regarding SRL, namely the integration of teaching strategies in teacher education in order for student teachers to change future practices. If teachers are to help their students to self-regulate their learning, then they need to self-regulate their own learning themselves.

As a whole, the results from the research done up to this date, indicate that experienced knowledge of the cognitive/metacognitive, motivational/volitive components, in accordance with the context, constitute a unique tool for students to develop learning experiences which lead to autonomy.

The diversity of themes certifies the complexity and variety which studies on self-regulation may follow in order to contribute to the understanding of the mediating or moderator variables' roles that lead to a much needed conceptualisation of the self-regulation construct.

At the same time, we intend to specify the educational environments and the reciprocal relations between the processes and the adopted procedures by students in managing their academic studies. Another preoccupation in these studies is related with knowing how teachers and students react to interventions which intend to improve scholastic performance through different process acquisition (cognitive, metacognitive, motivational and affective) and use strategic learning.

Finally, the design of research methods and the rehearsal of evaluation measures which help understand evaluate and explain the diversity of interactions involved in learning regulation, is also a preoccupation mentioned in the different studies.

Assessment of TELEs that provide SRL support

An interesting topic of reflection is the study of the extent to which a technology-enhanced learning system provides support to the development and consolidation of SRL skills.

This is an area suffering from a notorious scarcity of empirical research in Portugal. In this section we will describe a research project that was designed to assess the impact of a particular TELE in the development of SRL skills in the framework of university graduate teacher education.

This particular project was developed in the context of TELEPEERS[2], a European consortium involving partners from 9 European countries that dedicated two years of work to develop a better insight on the theme of Self-regulated Learning in Technology Enhanced Learning Environments at University Level.

In the course of the project, research partners designed, tested and validated two evaluation tools targeted at teachers and administrators (TELE-SRL) and students (TELESTUDENTS-SRL).

The Catholic University of Portugal (UCP – Universidade Católica Portuguesa) conducted the research component in Portugal. In particular, UCP carried out a comprehensive study on school teachers who had enrolled in a technology-rich graduate training programme. The study features the impact of a distance education environment, strongly supported with Information and Communication Technologies (ICT), on the motivation profiles of student teachers and the acquisition of self-regulation skills to conduct one's own learning path (Carneiro 2006).

The inquiry into the impact of a Technology Enhanced Learning Environment (TELE) on SRL departs from the assumption that teachers posit higher than average dynamic self-regulation attitudes when acting as learners. This being true, teachers would value settings

[2] TELEPEERS: "Self-regulated Learning in Technology Enhanced Learning Environments at University Level: a Peer Review", Grant agreement 2003-4710-/001-001 EDU-ELEARN, http://www.lmi.ub.es/TELEPEERS/

that are supportive and expressive of a culture of learning, and technology environments that sustain active learning skills.

The universe of observation comprised 143 teachers-students enrolled in a MA degree in Education Informatics beginning in the academic year 2003-04. Students were allocated to five groups ('classes') and were required to undertake a curriculum comprising five terms of studies plus the completion of a dissertation.

The model placed a strong emphasis on group and social learning based on active tutoring and constant stimulation to work in forums and chats. Individual and group online assignments accompanied by ongoing appraisal and assessment exercises were designed to offer stimulating working packages. The choice of both the Learner Management System (LMS) and the complementary software tools pursued the idea of forging a TELE that could afford high levels of social interaction and induced meta-motivation gains.

Empirical research was based on the administration of three time-sequenced, purposefully designed and customised surveys to students who enrolled in the advanced teacher education course in informatics.

Firstly, in January 2004, a baseline survey was administered to student teachers who had enrolled in and were pursuing their first term of graduate studies. A second survey was carried out in the middle of the course (September 2004). This intermediate survey (66 respondents) was designed to analyse learning motivations and to 'explain' how the TELE can assist students in achieving higher patterns of SRL. Particular attention was given to social and self-evaluative features of the TELE. The third wave of field work occurred at the latter part of the curricular requirements of the course (March 2005). It consisted in the administration of the same survey used at mid-course to assess consolidation or modification of students' perceptions as they approached the end of the required curriculum (63 respondents).

A limited number (6-8) of in-depth qualitative interviews and discussions in a virtual forum were also conducted. To complement this, we distributed TELESTUDENTS-SRL to a limited number of students (11 valid responses). This case study approach proved to be instrumental to further clarify the meaning of a selected group of queries such as the extensive use of

MSN, the preference for personal email, and the utmost importance attached to content availability. Finally, we asked one TELEPEERS partner – University of Barcelona (UB) – to apply our second survey model to a sample of students of Audiovisual Communication (Digital Video Course – classroom learning with the support of new media). Notwithstanding marked differenceS in course layout and methodology some of our findings could be contrasted and compared against the data from Barcelona (15 respondents).

The main conclusions of this research can be clustered around seven findings:

1. Teachers sought professional development as their prime motivation to enrol in graduate education[3]. They pursued enhanced gratification through (i) knowledge base expansion especially in quality content and (ii) improved career opportunities.
2. Technology can play an essential role in course attractiveness providing for increased accessibility (time and space) and flexibility in learning. The TELE rapidly evolved to become a 'natural learning environment' propitiating a gradual shift from process to outcome goals (Zimmerman & Kitsantas, 1997).
3. The TELE feature that was most valued by student teachers vis-à-vis motivation was social learning. Learners appeared to value opportunities supported by simple communication systems that are relevant to both virtual and real community building (instant messaging, email, forum, face-to-face sessions)[4].
4. Self-efficacy beliefs that sustain the intrinsic motivation to learn were highly dependent on the use of self-evaluative and monitoring tools readily available in the TELE[5]. A logical explanation stems from the belief that teachers' attributions of self-efficacy grow out of hetero-efficacy expectations (related to students) and that TELEs are reflective tools acting upon two dimensions that serve the purpose of self-efficacy boosting: self-monitoring (intrapersonal attributions) and peer interaction (interpersonal attributions).[6]
5. Teachers revealed a preference for b-Learning models including regular 'traditional' sessions that they deemed instrumental to sustain collaborative learning.

[3] Simons *et al* (2004) correlational studies provide empirical evidence on the relationship between usefulness of course and jobs (instrumentality) as a prime motivation factor and determinant of task orientation.
[4] Bandura (1986, 1997) posited that social factors are prime determinants of self-regulation efforts during learning.
[5] This finding is totally consistent with a triadic cyclical model of self-regulation with particular reference to its third phase where *self-reflection* is strongly contingent on *self-evaluative* practices and reciprocal feedback loops (Zimmerman, 1998, 2000; Zimmerman & Martinez-Pons, 1990).
[6] Learner as "scientist" and learner as "judge" attributions (Tollefson, 2000; Weiner, 2000).

6. The motivation timeline of students can be described as a U-shaped curve where initial enthusiasm was replaced by an immediate disenchantment, followed by a "resilience" trend in conformity with the development of enhanced skills in future goals management[7].

7. No evidence could be found to prove the hypothesis that the TELE *per se* could act as a prime determinant of knowledge acquisition.

Learning and digital portfolios

The theme of learning portfolios has gained widespread adepts in the Portuguese educational arena, recruited among those who are especially close to the most innovative circles (Costa, Rodrigues, Peralta & Raleira, 2006).

Recent policy changes, effected at both European and national levels, that favour a competence-based curricula namely at basic and secondary education, led to a surge of interest in portfolios as a reliable tool to define and measure competencies. Teacher education reflects this new trend at both curricular and methodological levels.

Thus, portfolios appear as powerful instruments to monitor specialized skills and also transversal competencies. These key competencies touch upon 'soft' domains of SRL which address in particular meta-learning aptitudes such as 'learning to learn' and 'knowing to know'.

Field surveys show that the main education publishers in Portugal have seized the market opportunity to offer textbooks and teachers' guides displaying portfolios as a key pedagogical 'novelty' (Bernardes & Miranda, 2003; Coelho & Campos, 2003; Nunes, 2000).

The government initiative Ligar Portugal ('Connecting Portugal'), designed to boost the uptake of the Information and Knowledge Society, proposes the generalization of a student electronic portfolio at the end of compulsory education. This e-Portfolio would register all competence acquisitions and practical skills of the individual (in arts, science, technology,

[7] The underestimation of the commitment required by web-based learning is an important cause of early drop-out. The literature on insufficient perceptions of the effort required at the beginning of a TELE course is abundant. For other empirical evidence see for instance Muse Jr. (2003), Persico & Delfino (2004), Delfino, Persico & Sarti (2004).

sports and other fields). A special emphasis is put on the necessity to report effective use of ICT in the different school subjects.

The first research results on the use of portfolios describe experiments undertaken in a teacher training course. These reports suggest a high effectiveness of portfolios as a means to 'create a new pedagogical culture' (Fernandes, 1997; Cardoso, Barbosa & Alaiz, 1998).

Along similar lines, Sá-Chaves (1998, 2000) studied the impact of portfolios on the initial training of teachers, concretely at the level of supervision activities. The same author proposes the concept of 'reflexive portfolio' in her later research on teacher education and teaching practice (Sá-Chaves, 2005).

Following these seminal studies a number of dissertations revisited the theme of portfolio use by teachers in their assessment practices (Batista, 2004; Coelho, 2000; Menino, 2004; Parente, 2004) and also in initial training of Biology teachers (Grilo, 2004).

It is worth stressing that the research reported is grounded mostly on evaluation theories and learning models. Moreover, they depart from a variety of meanings attributed to portfolios, more often described as a product and less frequently appointed as a curriculum model or a specific methodology.

The literature on digital portfolios is much more scarce and focused in the higher education sphere.

The department of Chemistry of the University of Porto (School of Natural Sciences) developed an on-line application called DPF. This tool is currently used by students in their project work (last year of studies) and also in the context of lifelong learning courses (Norberto et al., 2005a, 2005b).

A number of sites have been constructed to offer information and related tools on the use of portfolios and weblogs:

- www.mocho.pt
- http://nonio.eses.pt/eportfolio

- http://hemajoro.blogspot.com/
- http://mariatec.blogspot.com/
- www.geografismos.blogger.com.br
- http://portefolios.no.sapo.pt/

The latter site refers to the GT-PA, a research group resident in the University of Minho that develops work on concepts of ‘reflection’ and ‘autonomy’ in teacher training.

Conclusions

The Portuguese scientific community disposes of a sizable research track-record in the general field of SRL studies.

Some Schools of Psychology and Educational Sciences such as those belonging to the Universities of Lisbon, Minho, and Aveiro have reached a regular flow of research projects and on-going dissertations in SRL that should guarantee for the future a critical mass of academic focus in SRL related themes.

The setting-up of a Self-Regulated Learning Studies Program (PEAAR) in the Lisbon University represents a significant leap forward in recognizing this important field of studies and in creating a prestigious strand capable of attracting graduate students.

Six domains appear to offer especially promising prospects in the development of action-research as well as in the concrete application of new knowledge generated around the SRL thematic:

- Implementation of a competence-based curricula in basic and secondary schools linked to EQF implementation and to Education 2010 objectives.
- Gradual dissemination and uptake of Web 2.0 software (Second Life, Hi5, MySpace, Tribe, Facebook, Podcasting, Wikis, etc.) for improved social learning purposes.
- Re-dressing the broad area of teacher education, regarding both initial and in-service training programmes and a regular uptake of technology enhanced systems of blended learning.

- Development of personal and social competencies in university students addressing in particular the so-called core and transversal competencies, with a view to combat high failure rates in the first years of university studies.
- Generalisation of the Bologna Declaration in higher education institutions which is expected to lead to a gradual replacement of 'taught learning models' by 'autonomous and group learning' new x paradigms.
- The new thrusts in lifelong learning, with particular emphasis on the implementation of the European Qualification Framework and the need to boost – and accredit – personal non-formal and informal learning experiences.

A survey into the narrower field of SRL in TELEs shows that the research momentum is considerably lagging behind and sparsely documented.

There are tentative studies targeting faculty and students enrolled in higher education programmes that have resorted to e-Learning or b-Learning methods of delivery. The Portuguese Catholic University has done some pilot research with graduate teacher education in computer sciences.

However, the actual research panorama remains patchy and piecemeal, which to a certain extent mirrors some well known difficulties in mainstreaming ICT-embedded solutions into the realm of the educational establishment.

In turn, digital portfolios represent a growing agenda of research. This topic benefits from a synergic combination of information society demands (broadband and virtual campus implementation) and a commensurate supply of technology tools – mostly open source – complemented with support material provided by educational publishers. Furthermore, learning portfolios have drawn the active interest of a wide community of practising teachers for some years.

One final note worth mentioning is a seminal interest on the subject from the part of industry and market players, a trend that was captured during the final phase of TELEPEERS execution when the research consortium reached out to business for feedback on its SRL in TELEs main findings.

Indeed, there are encouraging signs that business actors and prominent companies could be open to the possibility of undertaking research and development partnerships to further explore some relevant dimensions of SRL in TELEs (Carneiro, R., Steffens, K. & Underwood, J., 2005).

Traditionally high drop-out rates from school and a related persistence of low-skilled workers in the labour force pose a formidable challenge to the Portuguese education and training systems. By the same token, upskilling and catching-up strategies for lifelong learning will demand a greater use of ICT and the concurrent development of SRL skills in the bulk of the working force, namely those occupying the lower tier of the skills ladder.

Research conducted in traditional business settings – footwear and textile industry – have demonstrated the leverage effect that ICT can have regarding performance levels and productivity gains in the low-skilled labour force (Carneiro & Conceição, 2002).

The government policy priority designated by 'Novas Oportunidades' (http://www.min-edu.pt/outerFrame.jsp?link=http%3A//www.novasoportunidades.gov.pt/) proposes to reverse the lack of human capital investment and to provide *new opportunities* for the adult population to acquire more advanced skills. These dimensions will absorb roughly 70% of the total Community Support Framework funds during the next 7 years (2007-2013) thereby posing a formidable challenge to the scientific community.

Thus, building better insights into business community interests and finding suitable bridges between academia and economic actors will encompass promising avenues for new research and applied work in the comprehensive area of SRL in TELEs.

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SPAIN

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Introduction

In this contribution, we present a survey of works in SRL in TELEs in Spain. This survey does not include the works from our colleagues from Latin America which amount to the same quantity as those encountered in Spain, although in Latin America, some countries have contributed to this topic to a much higher degree than others.

This survey was carried out in 2007; it was based using the terms SRL and TELEs in different data bases and search engines. In our survey not all of the works which we found are represented; we chose to select an number of texts which clearly illustrate the conclusions at which we arrived.

We carried out our survey with two objectives in mind: we wanted to show that there are indeed publications on SRL in TELEs in Spain, but we also wanted to give examples of the contents on which these publications focus and of the methods used. The number of relevant publications is, however, really very small; it will therefore not be possible to come to generalisable conclusions, we will have to be content with describing the publications which we found.

SRL in TELEs up to the year 2000

Up to the year 2000, the investigation of SRL was carried out in Spain in a number of studies, some of which focused on more practical aspects like the support of teachers while others had a more theoretical orientation.

In this context, publications by Herrera & Ramírez (2006) may be cited, both of which are from the Department of Developmental Psychology and Education at the University of Granada. In their publications, they cite works by other Spanish authors like Rivière, Sarriá, Núñez y Rodrigo (1994) which make refernce to Wellman's studies (1990) on metacognition.

Abascal (1995), Alonso (1983) and Santos (1989) studied motivation and metacognition and their relationship to learning.

Obviously, the learning environments in whose context those studies were carried out were not the TELEs we know today. Susana Rodríguez Martínez (1999) from the university of La Coruña, for example, studied student learning in the university from the perspective of motivational SRL. In her study, questionnaires were applied and several tools for data analysis were used, but technology did not exist. Similar examples are the works by Otero and Campanario (1990) on science teaching in secondary school. These and other contributions which are available at http://www.uah.es/otrosweb/jmc analyse SRL of students who are using text books.

The non-existence of TELEs can also be found in the analysis of Alfonso at al. (1997) and even in the program Pro&Regula by Martínez and Fuentes (2004); the same holds true for contributions to scientific congresses by authors like González, Valle, Suárez, Rodríguez Martínez.

In their survey of SRL, Torrano and González (2004) refer hardly at all to Spanish authors, citing mostly American and English studies; but even there, the potential of the new TELEs is hardly mentioned. In fact, there are three lines in their publication which indicate that TELEs should be investigated, citing as example the work of Hill and Hannafin (1997). It might be expected that between 1997 and 2004, more studies on technology enhanced learning should have been published. But the work of Torrano and Gonzáles might sever as an example of how little attention Spanish researchers have dedicated to the new TELEs.

While the lack of consideration for TELEs is one of the characteristics of Spanish studies on SRL, another one seems to be that – with a few exceptions like Otero and Campanario - all the researchers seem to come from Departments of Psychology. Evidently, in Spain there are two approaches to the study of learning: on which has been established in the context of Departments of Psychology (Educational Psychology, Develomental Psychology, Applied Psychology) and one which originates in the context of Departments of Education. While in the second approach, educational technology has a longer tradition of paying attention to the

media, these studies distinguish themselves from the ones carried out in the tradition of the psychologists.

We might therefore say that the psychologists who studied SRL were not aware of educational technology, while the educationalists who worked in the field of educational technology did not take into consideration the new TELEs. This situation is currently changing, due to the increasing communication between the two scientific communities and to the exchange of researchers from both communities.

SRL in TELEs since the year 2000

The situation has started to change with the arrival of the new millennium. While studies on SRL in TELEs have continued to be published after that date, we can say that in Spain, at around the year 2000, researchers became interested in studying SRL in TELEs.

At that time, researchers became aware of the possibilities of the Information and Communication Technologies (ICTs) and of Technology Enhanced Learning Environments (TELEs). However, in their studies, Spanish researchers referred to principles or works from non-Spanish authors for their theoretical foundations. Gordillo (2003), for example, conducted a study with university students taking part in a master's programme in Commerce and Finances. In his study, he examined the impact of technological resources on presential and distance learning. In the introduction to his publication, he explained how these new technologies may also affect SRL, but then in his experimental study, he did not take SRL into account any more.

Another characteristic of this and similar studies is that they focus more on instructional aspects than on the analysis of individual learning processes.

Some authors who describe the possibilities of the new ICTs also point out the potential of TELEs to support SRL, but the fail to cite any concrete examples (Fandos et al., 2005; Aiello at al., 2004).

Another line of research has focused on the development of computer programs which are supposed to help learners develop their competencies in the field of metacognition. Hernández and Borgues (2005), for example, developed a virtual learning environment called "Navigating in learning". The program was designed for highly gifted students to improve their learning by facilitating specific learning strategies and SRL. It is expected that it may help teachers who have to deal with large classes where many students are not highly gifted and who cannot dedicate sufficient time to their highly gifted students.

There are a few studies on SRL in TELEs and in telematic learning environments for vocational training. Gonzáles at al. (2001) studied groups of students with different SRL levels and analysed those cognitive and metacognitive variables which were related to the differences in SRL between the groups. This study was carried out with students at the university of La Coruña who worked in virtual learning environments. Willem et al. (2006) describe a blended learning arrangement at the Universidad de Barcelona which was evaluated as to its potential to support SRL.

Looking at the publications we presented, it seems that the experts in ICT tend to put more emphasis on the study of metacognitive factors than on the impact of the new technologies on SRL.

In summary, we conclude that SRL in TELEs is a field with very few empirical studies, but with a high potential for development. SRL is likely to be a key competency for learning in TELEs.

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UNITED KINDGDOM

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Introduction

An informal search of UK university web pages about courses and teaching methods, begun by the author in advance of the present study and continuing during it, showed few explicit mentions of Self-Regulated Learning, SRL (also called Self-Directed Learning, SDL), but many mentions of teaching methods that may have elements of SRL, such as Problem-Based Learning, PBL; Enquiry-Based Learning, EBL; Collaborative Learning; and Inquiry or (Scientific) Discovery Learning. Did this indicate that UK university teachers are ignorant of SRL? Probably not, since in UK university web pages about courses on learning to learn or on the psychology of learning, there is mention of terms associated with SRL (e.g., independent learning; learning to learn; reflective learning). However, the SRL literature cited in those web pages tends to be classic European and North American work, e.g., [1-5], of the type cited in a previous and extensive Kaleidoscope study of SRL [6]. UK research on SRL in general, as well as SRL in Technology Enhanced Learning Environments, TELEs, has a smaller literature that is cited far less often. Possible causes: that UK research may be less known or less accessible than US or European literature, and/or may be seen as less significant for UK practice, and/or is not the focus of current UK educational research (this would fit with the lack of recent publications specifically on SRL or SRL in TELEs by leading educational researchers in the UK).

No claims are made for the generalizability or validity of the impressions gained from the above searches. However, they did inform the approach taken in this study for Kaleidoscope (see the Methodology section below).

For example, as a kind of reality check, this KAL study began by asking a few UK academics, active in research into teaching and learning, about their attitudes to and use of SRL, and the relation of that to their colleagues' and institution's strategy and practice in teaching and in

research related to learning. They were also asked if they knew of any external influences on their institution's strategy and practice regarding SRL.

One finding was that respondents typically subscribed personally to the notion that graduates should be able to think for themselves; yet they reported that their own teaching was very directed, as was the teaching of their colleagues. Logically, they knew that independence of thought is not easy to achieve if students experience only directed forms of learning. Yet there was a clear disconnect between their espoused view (independence of thought should be encouraged) and their revealed view (students need strong guidance if they are to learn efficiently).

That disconnect seemed to occur partly for managerial reasons: SRL is perceived as likely to require more resources at some stage, for example may require university staff to spend more time remedying poor study habits in their students, hence is potentially costly and inefficient, compared to more directed approaches. The latter are seen as more likely than SRL to reduce the cost of teaching each student, and to deliver consistent results across student cohorts, regardless of who does the teaching (reproducibility is important in quality assurance). The popularity of more-directive approaches with managers reflects economic factors associated with massification of UK higher education (which are beginning to impinge on even top UK universities) and reduces the institutional support for SRL.

As to the apparent lack of interest in researching into SRL, the general UK constraint is that the bulk of external funding for academic research and teaching-oriented research comes from UK funding councils and linked bodies such as the Joint Information Systems Committee, JISC, and the perception is that those bodies favour more-directive approaches over SRL. A similar pattern is apparent in the UK's design, take-up and deployment of Technology Enhanced Learning Environments, TELEs.

The situation in Ireland appears to be different; there, it seems that universities are still committed to the "graduates should be able to think for themselves" notion (part of what used to be called "graduateness", in the days before massification), and see this as a way to make Irish graduates more valuable to employers (hence more employable) and to male Ireland more competitive. As a result, SRL is given increasing attention by researchers in Ireland (see e.g., [7, 8]).

Background

Earlier Kaleidoscope-funded studies of aspects of self-regulation (e.g., [6]) set out some of the key literature on SRL, and provided an analytic framework. Thus, regarding the framework, Ton de Jong, writing in [6], says of inquiry or (scientific) discovery learning that "learners more or less take the role of scientists who want to design theory based on empirical observations", with "a fair consensus about which processes basically comprise inquiry learning… "orientation", "hypothesis generation", "experimentation", …"drawing a conclusion" and "making an evaluation". …"this does not mean that this is necessarily the order in which the processes are carried out by the learner. …De Jong and Njoo (1992) added the concept of regulation of learning, which comprises processes aimed at planning and monitoring the learning process".

Two years on from that study, most TELEs used in the UK still do not make explicit provision for that regulation of learning, hence this report.

Methodology

Data for this report was gathered in three ways:

1. An impressionistic desk study of education press pieces from 2007 (newspapers: The Times Higher Education Supplement; The Guardian);

2. Informal and impressionistic interviews of a small number of university teachers and researchers in campus-based institutions;

3. A desk study of current UK academic interest and practice in SRL, TEL and related areas, as represented by (a) publications by UK researchers; (b) papers accepted by UK editors of journals relevant to TEL and TELEs (primarily the British Journal of Educational Technology); (c) the type and number of SRL-relevant presentations from UK researchers at major conferences on teaching, learning and TEL, such as ALT-C).

Key findings

Study 1 (impressionistic desk study of newspaper editorials)

Negative comments were more common than positive comments, in editorials (including leaders and think pieces) about UK higher education and about the quality of its outputs (their ability to think for themselves, and other attributes of 'graduateness' that might be expected to follow from experience of SRL). The editorials were taken at face value (i.e., no attempt was made to verify the claims), and no checks were made to see whether the picture was different prior to 2007. The tone of the extract below [9] is typical, in this case claiming that there are systemic weaknesses in UK education, associated with being too didactic:

> This education system fails children by teaching them to parrot, not think… What the top universities are looking for, besides academic performance, is intellectual creativity, a capacity for lateral thought and argument, and a deep knowledge of and enthusiasm for the subject [but, in many schools preparing children to gain the qualifications needed to apply to university, the priority is]… the delivery of the test results and statistics which prove that education is a success. [In today's UK]… what most children learn is that as long as they memorise what they are told for tests, and repeat the key words on the mark schemes in exams, then a questioning approach and wider reading are neither necessary nor welcome [thus...] the experience of a history teacher, in an apparently excellent state school, who finished teaching his 14-year-olds about the first world war on a Tuesday. The following Thursday the class began studying the rise of Nazi Germany, 1933-39. After 20 minutes, one child put her hand up to ask what had happened between 1918 and 1933. "We really don't have the time to go into that now," the teacher said. So they never did.
>
> The limitations of this kind of approach are increasingly being acknowledged by the government's own agencies. This summer [the government agency] Ofsted issued a report on the teaching of history. It said that a "successful curriculum" had been "faithfully delivered". And what was the result of this success? Why, in Ofsted's own words, that young people "could not answer the big questions of history", that they had "little sense of how events connected", that their knowledge was "patchy", their "sense of chronology weak", and that "they are generally unable to reflect on themes and issues, or relate a longer story of the history of Britain, Europe or elsewhere over an extended period of time" (page 35).

Study 2 (informal interviews of university teachers)

Background: UK universities often use a mix of commercial and academically-developed TELEs. No published surveys could be found on the main ways in which individual teachers use those two types of TELE, particularly in the context of directed and undirected learning. Neither could the author find any unpublished surveys, despite talking to knowledgeable

representatives of the for-profit and open-source communities: members of the European Learning Industry Group, ELIG, and the developer of the open source TELE, Moodle (Martin Dougiamas).

Information gathering: To begin to understand the present pattern of usage of TELEs (in the context of SRL), colleagues in several UK universities, active in research into teaching and learning, were asked in unstructured interviews to talk about their attitudes to and use of SRL, and the relation of that to their colleagues' and institution's strategy and practice in teaching and in research related to learning. Additionally they were asked about research and practices in their institutions regarding TELEs (both desk-based and accessed via mobile devices), and specifically about use of SRL and PBL (problem-based learning). Finally they were asked if they knew of any external influences on their institution's strategy and practice regarding SRL. The style of interview was naturalistic, meaning conversational, without taking notes. The author made notes of key points after the face-to-face or telephone conversation.

The impression gained was that SRL, and hence research into SRL, was of little interest to them or their colleagues. Regarding teaching:

- In their experience the most common application of TELEs used for mainstream (institutionally-supported) teaching was to highly-directed forms of teaching, which allow the learner little or no discretion in what they learn and how they learn it.
- Self-directed (student-directed) PBL is rare, like student-directed SRL, and was only mentioned in connection with academic-sourced TELEs.
- Directed forms of PBL were common, and experience of those forms of PBL is captured and shared across the UK via a dedicated CETL (Centre of Excellence in Teaching and Learning); there are many CETLs in the UK, each covering a specific topic and involving a small group of universities.
- Interviewees tended to be negative about the whole idea of SRL as part of university teaching, making comments such as "risky" compared to didactic approaches (would the syllabus be "covered" if students had more choice in what they learned, when, and how?); "inappropriate for my students"; and "inefficient and costly" (SRL was felt not to maximise the number of students who pass through the checkpoints (e.g., exams) that determine whether their institution receives funding for students enrolled on a course).

On the face of it, those views are inconsistent with the view of the UK Prime Minister that students should receive a personalised education, including opportunities to learn to think for themselves.

Study 3 (analysis of conference articles)

To get a fuller picture of current UK practice regarding SRL in TELEs, indirect measures were sought of UK (and near-UK, meaning Irish) interest in SRL and in the use of TELEs for SRL. The measures chosen included the type and number of SRL-relevant presentations from UK researchers at major conferences on teaching, learning and technology-enhanced learning, TEL, inside and outside the UK, such as ALT-C [7, 10-21] and ECTEL, as well as papers in one of the leading educational technology journals in the UK [22-29]. The assumption was that data on the coverage of each conference, and the coverage of UK-published research papers, versus that of comparable work in North American centres [30-32], symposia [33-37] and journals [4, 38-63], would serve as a proxy for SRL-related priorities, influences and practices in UK higher education.

The Annex to this report comments on the most relevant of those papers (which include papers on Problem Based Learning, PBL, used in ways reminiscent of SRL, to offer students varying degrees of discretion in what they study, when, how and with whom).

Overview of findings:

There were few conference papers reporting on UK use of SRL in any context, let alone using SRL in TELEs. There were many papers about UK research into teaching and learning using a wide variety of forms of TEL and a number of TELEs. However, only a small proportion of those UK papers reported on experiences with self-regulated forms of learning. None looked at how TELEs can be used to cut the costs of SRL. The references in this report, comprising samples of those papers and comparable or more advanced work elsewhere, provide a snapshot of current practice in the UK and in academically-close countries, notably the USA and Ireland.

Conclusion

There seems to be a need for an in-depth study of UK practice regarding SRL in TELEs. This could perhaps dispel the worrying impression from the present exploration that UK higher education is unaware of, or unconvinced of, the potential of SRL in TELEs. Kaleidoscope could help here by undertaking independent scientific research, on a par with the KAL-funded JEIRPs (Jointly Executed Integrated Research Projects) cited in [6], that looked at how interaction analysis could be used to support SRL.

Annex – Commentaries on the most SRL-/TELE-relevant of the research and conference papers listed in the references

Category: papers about SRL, EBL or PBL

UK: University of Manchester [64]

Commentary on paper

Describes a facilitator-led approach to Enquiry-Based Learning, EBL, developed at the UK's Centre for Excellence in Enquiry-Based Learning, but not specifically using TELEs. The focus of the enquiry is limited to pre-set scenarios, determined by the facilitator. Its publicity material refers to SRL but it is a kind of "training wheels" preparation for full SRL. To explain, the student can choose a scenario and takes the lead in choosing the process of enquiry. With the guidance of their facilitator, and working within the scenario, students identify their own issues and questions. "They then examine the resources they need to research the topic, thereby acquiring the requisite knowledge". Claimed benefits: "Knowledge so gained is more readily retained because it has been acquired by experience and in relation to a real problem. Learning is essentially student-centred, with an emphasis on group work and use of library, web and other information resources." (This use of information resources is the nearest that the EBL Centre comes to SRL in a TELE.) "Lecturers become facilitators, providing encouragement and support to enable the students to take responsibility for what and how they learn. Students reach a point where they are not simply investigating questions posed by others, but can formulate their own research topics and convert that research into useful knowledge. Students gain not only a deeper understanding of the subject-matter, but also the knowledge-development and leadership skills required for tackling complex problems that occur in the real world. Fundamentally, students are more engaged with the subject. Learning is perceived as being more relevant to their own needs, thus they are enthusiastic and ready to learn. Students can expand on what they have learned by following their own research interests. EBL allows students to develop a more flexible approach to their studies, giving them the freedom and the responsibility to organize their own pattern of work within the time constraints of the task. Working within and communicating to a group are vital for a student’s employability. Self-directed learning not only develops key skills for postgraduate study, but also leads to original thought that contributes to larger research projects, papers and publications."

UK: University of Nottingham (at Ningbo Campus, China) [13]

Commentary on paper

Contrasts experience with directed and undirected computer assisted language learning, collaboration, and lifelong learning. The TELE used, CLLE, is specialised for language learning and supports personal learning experiences and resources over different topics at different places and times. CLLE's grammar mapping tool and collaboration features "allow the students learning English and Chinese to experience a visual, interactive method of examining their language ability. Users of the system have vastly different abilities, from complete beginner in Chinese, to advanced academic English. They also have differing combinations of formal, informal, directed and undirected methods of learning. Using the system exposes them to the knowledge implicitly built up by learners using other methods of learning and their own previously successful subconscious methods. Outside the system, the data collected provides a view of the interactions between the learners and each individual learner's learning trail. The affect the instructor makes to directed learning is also exposed in this network of collaboration. Social and temporal views of this collaboration graph are used to illustrate these claims. Interesting usage examples of the grammar mapping tool are provided to show how it provides interaction in both a directed and undirected learning setting."

UK: University of Leicester [10]

Summary of workshop

The workshop gave participants experience of using a wiki as a learning environment in itself, or as part of e-activities or "e-tivities" within a TELE (what are called "wiki-tivities"). The conditions for students to succeed in using a wiki that has been set up for such purposes include making the role of the wiki clear to them within the e-tivity environment, and making sure that students recognise that collaborative knowledge construction is at the heart of their activities, in the wiki or elsewhere.

UK: University of Manchester Faculty of Life Sciences [11]

Commentary on paper

Innovative approach, suitable for both SRL and directed learning. Enquiry-Based Learning environments to promote group-based and faculty-led engagement, interaction and enquiry, in the form of physical and virtual learning spaces, were created from videoconferencing tools, such as Macromedia Breeze (Marratech and Horizon Live Classroom), within computer

clusters to extend real-time lectures and seminars to students remote from the Faculty, including those on industrial placement. The Breeze polling tool was used "to elicit instant feedback on problems, review opinions and stimulate discussion on topics like bioethics and project design. In the conventional lecture theatre, as an alternative to PC-based technologies, we used radiocontrolled handsets for interactive voting to promote social and experiential learning. A problem-solving exercise in bioinformatics, for instance, involved a group task to search for genomic sequences of a virus causing disease outbreak. A scenario was presented to students who voted on the routes to follow in order to identify and control the virus. Final year students are designing additional scenario-based e-resources using new software, PBLi, installed in a dedicated project laboratory. We are currently the only University in the UK using this innovative software to develop online problem solving in virtual learning spaces."

UK: University of the Arts (Chelsea College of Art and Design) [65]

Commentary on paper

Findings are limited to experiences in teaching Graphic Design Communication (contrast with the paper that follows below). Describes using Weblogs (Blogs) to support meta-cognitive activity such as reflection, and to encourage community/peer learning. Usefully, compares Blogs with non-TELE approaches (sketchbooks and reflective journals) "in terms of collating and organising information and reflecting on action", and "questions how this implementation can further foster an autonomous approach to learning".

UK: Open University [17]

Commentary on paper

Broad context: explores perspectives of students from across the university on blogging versus other possibilities (e..g, ePortfolio), incidentally setting out the potential advantages and revealed problems associated with the use of Blogs. These include: (positives) "encourage student-centred pedagogic practices, networking and community-building, meaning-making and sharing of resources and opinions" and (negatives) "haphazard contributions to blogs; minimal communication between students through their blogs and poor quality reflection upon the course materials as evidenced in blog content; minimal level of blogging in order to meet assessment requirements; plagiarising from others' blogs", and tensions arising from "publishing private thoughts in a public space".

Category: papers about effects of use of TELEs

UK: University of Hull [22]

Commentary on paper

Unusual feature: a longitudinal study (4 years). Looked at how membership of a secure and supportive TELE, a virtual learning community (VLC), gave rise to changes in students' 'horizons of action' and learning and career trajectories. The effect of VLC membership was to encourage SRL.

University of New South Wales, Sydney, Australia [49]

Commentary on paper

The contention of this paper is that the design of TELEs can be informed by Cognitive Load theory. TELE design in the UK tends not to draw upon such research, so lacks the possibility set out in this paper of being able to manage cognitive load and enhance the teaching and learning efficiency of TELEs.

Category: UK papers about reflection tools

In the UK, one popular category of extensions to TELEs is for reflection: support and scaffolds to help users to review their experiences in a manner that helps them to learn more from them, and if necessary demonstrate to others where they have got to as a result.
An example is the ePortfolio approach: providing users with a personal database that can help them to develop a meaningful integration of practice (e.g., samples of what they did using the TELE or can do as a result of using it), and iterative review of that practice (considering why they have chosen those samples of work for their portfolio).

Another example is the development of self-directed learning strategies as part of actively monitoring, evaluating, and modifying their thinking and comparing it to the models of experts and peers. The US leads the UK on theoretical and practical aspects of such work, and here it is US rather than UK research that is influential in the UK.

To illustrate, there is a body of US work on assessing the cognitive effects of case-based formats such as problem-based learning (PBL), specifically assessing problem-solving processes as well as products, to check achievement of the theoretical goals of PBL within a

domain (in medicine, the goals would include "clinical reasoning, integration of scientific and clinical knowledge, and lifelong learning skills" as well as using "cognitive measures associated with expert performance… to assess the extent to which PBL affects the development of expertise".) [66]. In that study, "the problem-solving protocols were examined for coherence, use of science concepts, strategy use, and self-directed learning. The results indicate that cognitive measures can be used to distinguish students who have participated in PBL from their counterparts in terms of knowledge, reasoning, and learning strategies". If comparable or stronger work is being undertaken by the UK's specialist centre in PBL, the PBL CETL, it is not apparent at first glance.

Category: papers about features of TELEs

UK: University of Warwick, University of Aberstwyth, University of Southampton [12]

Commentary on paper

A snap-shop of UK operational use of TELE "Learning Design" tools, in this case resulting from the UK's EDIT4ALL project. The EDIT4ALL tools are typically used for directed learning rather than SRL. In this paper, users report that both tools are "too linear" and have an "impoverished educational model". Despite those criticisms, the tools have sector-wide institutional support.

Japan: Osaka University [67-69]

Commentary on paper

Current TELEs are deficient in that they do not adequately support self-regulated learners in the task of reflective monitoring of the knowledge resources they have encountered during SRL. In most TELEs, it is hard for learners to keep track of what they have seen during a learning session, and how what they have seen relates to their previous state of knowledge. The result is that SRL in those TELEs often leads to incomplete knowledge, but learners do not realise this. Hence the rationale for referencing this Japanese research, which has led to the creation of useful tools to generate maps showing what learners have encountered during SRL, which allow them to reflect on those maps from other perspectives, then publish their maps and compare their maps with those of other learners. There appears to be no SRL-specific equivalent of such work in the UK.

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SUMMARY

1. France (Dominique Lenne, Université de Technologie de Compiègne),

The authors point out that the term self-regulated learning is not often used in France; there are, however, a number of related concepts like self-education and autonomous learning. Consequently, there are only a few studies on SRL while there are many on related concepts.

In view of this situation, the authors decide to approach the topic from their own perspective which basically is the design of TELEs or, more precisely, the design of technological artefacts that support SRL. The authors therefore first present some technological tools and environments that can support SRL, then they review recent work on activity tracing and interaction analysis that can provide metacognitive support, and finally they describe a study that evaluated the potential of a TELE in the framework of the TELEPEERS project

Since learning in TELEs requires a high degree of autonomy on the part of the learner, the authors present research that investigates how different tools can aid SRL: progress indicators, awareness tools, structuring of forums and learning memories.

To new directions which recently emerged in order to personalise learning environments also seem to have some potential for fostering SRL: interaction analysis and learners' activity tracing.

As part of the TELEPEERS project, a course on 'Introduction to Algorithms and Programming' given at the Université de Techologie de Compiègne was evaluated using questionnaires developed in the project (TELE-SRL and TELESTUDENTS-SRL). The course was given in two versions: In the first case, SRL was firmly encouraged by various means, in the second case the pedagogy was more traditional. The results showed that the course was more appreciated in the first case (SRL encouraged) than in the second case (traditional teaching). The study concludes that if technological tools (web sites, hypermedia, LMS etc.) are useful to support SRL, they cannot be used alone. They have to be integrated into pedagogy and need human interventions (tutors, teachers, discussions), and social aspects.

From the authors' point of view, the interest for SRL and TELEs has not been very high in France by now. According to the authors, this may be the case because the role of human tutors is often stressed. Indeed, SRL requires capabilities that are not very widespread among students and actual uses of TELEs often include tutors interventions.

There is, however, a growing research interest in France on technological tools that could enhance SRL. Students activity traces can be easily captured by the environment, but these traces by themselves are likely to be of no use. They need to be modelled and worked in order to provide students with images of their activity. Furthermore static images may not be sufficient. Interaction means need also to be defined to allow students to have different points of view on their activity and on the activity of other students.

2. Germany (Karl Steffens, Universität zu Köln),

The German review is based on books and contributions to books whose titles were given by various web-based search engines when entering the terms SRL (Selbstgesteuertes Lernen) and Learning with the New Media (Lernen und Neue Median).

Search results showed that there are quite a number of books on the topic of SRL; this may be due to the fact that SRL has a long tradition in German pedagogy, albeit in the more fundamental sense of developing one's own personality. There are significantly fewer books on learning and the new media, and there are only very few book on TELEs that support SRL.

From the review of books and articles on SRL, the following conclusions may be drawn:

- The theoretical concept of self-regulated learning is not a unitary concept, rather it is many-facetted, with some of the facets not clearly distinguishable;
- In many studies, self-regulated learning is considered to be a disposition or personality trait; little is know about the processes that are involved when a person actually self-regulates her learning;
- There are hardly any long-time studies on self-regulated learning;

- Most studies on self-regulated learning were conducted with high school or university students; little is known about the self-regulation of grown-up learners in out-of-school and professional environments;
- correlations between reported cognitive and metacognitve strategies on the one hand and learning outcomes on the other tend to be low;
- Little is known about learning environments that support self-regulated learning.

Recently, a number of books were published on learning with the new media that also take SRL into consideration, however in varying degrees. Most of them approach the topic from an educational or instructional point of view, only very few actually empirically investigate the impact of TELEs on SRL. In those studies which do address the topic, results are not clear-cut.

Since ILIAS, a Content Management or Learning Management System which was developed at the University of Cologne was mentioned in the literature and since evaluations for ILIAS with respect to its capacity of supporting SRL were available from different sources were available, evaluation results were presented and discussed in the last part of the contribution.

3. Italy (Manuela Delfino & Donatella Persico, IDT-CNR)

Like the French authors, the Italian authors note that there are not many studies directly addressing the topic of SRL in TELES, but if concepts akin to that of SRL, the number of available studies increases significantly.

The Italian authors grouped the studies they considered for their review into three categories:

1. studies of the metacognitive abilities involved with the use of Information and Communication Technology,
2. studies aiming to design and implement systems that support the development of SRL and
3. studies aiming to assess and evaluate the potential for SRL development of different kinds of learning environments.

Studies on Web information problem solving, online learning and computer-based simulation show that working in ICT-based learning environments requires, but also enhances SRL.

In the second part of their paper, the authors report on the development of learning environments that support the practice and the development of SRL. In the DID@Browser, meta-cognitive questions are posed to students while they navigate a hypertext or a website in the attempt to foster meta-reflection and therefore improve the cognitive strategies adopted while navigating. The did@browser metacognitive questions therefore raise awareness of the users searching abilities. The LEARNING TUTOR, instead, mostly focuses on enhancing students' control by providing planning, monitoring and evaluation functions in an e-learning system. Learning to learn from colleagues is one of the aims of the LODE system, a collaborative environment that combines the socio-constructivist ideas behind the communities of practice with an extension of the concept of Learning Object that takes into consideration the need to share competence and experience, not just physical resources. The last example embraces a whole category of systems, i.e. the e-portfolios. Be them of the "developmental" type, or the "reflective" or "showcase", these digital archives of multimedia documents concerning its authors achievements are not only a major incentive for self-evaluation, but also a useful tool for planning and monitoring.

In the last part of their contribution, the authors focus on studies which aim at evaluating the potential of TELEs to support SRL. In particular, Computer-Supported Collaborative Learning environments were investigated quite deeply, but systems for individual use were also analysed. Most of the studies of this type were carried out within the framework of the TELEPEERS project.

4. Netherlands (Jos Beishuizen, Vrije Universiteit Amderstam),

In order to describe and characterize recent developments in Dutch educational research on SRL in TELEs, the author distinguishes four factors influencing the process of self regulated learning in technology enhanced learning environments: (1) the student, (2) the teacher, (3) the community of learners, (4) the learning environment.

The analysis is based on 20 representative articles from Dutch authors selected from 6 international and Dutch journals; these were to report results of empirical studies on SRL in TELEs. The selected articles were published between 1998 and 2007.

According to the author, recent Dutch research into SRL in TELEs has disclosed important relationships between the arrangement of the learning environment, the learning process and the learning outcomes. The conclusions can be arranged under five beneficial characteristics of TELEs: adaptability, complexity, interactivity, articulation, and balance.

Adaptability: In many ways students display different learner characteristics. The existence of technological support creates opportunities for adapting the learning environment to learner differences, both in complexity and in interactivity. Moreover, by adapting instruction in a TELE to varying learner characteristics, a proper balance may be found between structure and freedom to learn in a self-regulated way.

Complexitiy: The complexity of TELEs can be adapted by properly arranging learning materials and by providing various learning tools. The concept of cognitive load relates the objective complexity of the learning environment to the learner's processing capacity. Reducing the cognitive load of the learning environment enables the student to focus on the learning process by deploying and further developing self-regulation skills.

Interactivity: Increasing the interactivity of the learning environment by means of technological support is a successful way to foster learning processes. However, time and again it has been shown that fostering learning processes does not necessarily lead to improved learning outcomes.

Articulation: An important beneficial effect of TELEs is that often the structure of the learning task and the learning process is made transparent by visual tools. This was illustrated in two recent studies on collaboration between students in a Community of Learners. As other authors made clear, various visual tools have various effects on the learning process, but the articulation characteristic is itself an important asset of TELEs, fostering both learning processes and regulative behaviour.

Balance: Too much structure in a TELE creates dependent learning behaviour. Therefore, teachers play an indispensable role in TELEs. They should develop and apply a powerful repertoire of design and support strategies to enrich the learning environment with both technological tools and personal support and feedback. The principal role of teachers in a TELE is to establish a balance between structure and freedom to learn in self-regulated way.

5. Norway (Cecilie Hansen, Intermedia, Universitetet i Bergen),

In her contribution, the author investigates the state of the art in Norway regarding the field of self-regulated learning (SRL) and the impact of Technology Enhanced Learning Environments (TELEs). Literature covering the theme of self-regulated learning in Technology Enhanced Learning Environments shows that ICT involves several factors useful for SLR. There are aspects inherent to technology itself that makes room for self-regulated learning e.g., stimulation, motivation, evaluation and the interaction between other students through technology.

Self-regulated learning is a methodical approach within pedagogical psychology focusing on fostering individual activity and responsibility for one owns learning process. This perspective also applies to learning as interaction in dynamic processes.

Defining self-regulated learning is not necessarily a straightforward matter and several theoretical perspectives may be used to explain how competence in self-regulated learning develops. Theories of social interaction emphasizing social cultural theory, e.g., Vygotsky's work and social cognitive theory, e.g. Bandura are applied to SLR. Desk research of Norwegian articles covering this field, show Zimmerman's definition of self-regulation to be the most common in use.

The approach revealed in most Norwegian studies pertaining to self-regulated learners does not combine the above mentioned aspects of SLR and Technology Enhanced Learning Environments (TELEs). Yet, there are studies exploring this. Some of the studies showed that self-regulatory strategies were uniquely predicted by teacher-defined goal orientation criteria but not by criteria tied to the learners' perceived self-efficacy. Other studies, highlighting learner empowerment, showed that by using technology, the self-regulated learners took

ownership of their learning and used digital tools actively in their learning activities. There were also findings where the introduction of ICT-based learning environment not automatically promoted students' self-regulatory and collaborative learning skills, as long as there was little or no specific support for students' development of self-regulatory learning skills.

6. Portugal (Roberto Carneiro, Universidade Católica Portuguesa, & Ana Margarida Veiga Simão, Universidade de Lisboa)

In the first part of their paper, the authors provide an overview of theoretical and empirical studies on SRL in Portugal. In the second section, they describe a study on the impact of a TELE in SRL in the context of a graduate programme of studies offered at the Portuguese Catholic University with a particular focus on motivational profiles of teachers students. The last section provides a brief description of the Digital Portfolio movement in Portugal, a concept that is acquiring momentum among academia and research groups.

The authors, by citing a large number of Portuguese studies on SRL, demonstrate that the Portuguese scientific community disposes of a sizable research track-record in the general field of SRL studies. Some Schools of Psychology and Educational Sciences such as those belonging to the Universities of Lisbon, Minho, and Aveiro have reached a regular flow of research projects and on-going dissertations in SRL that should guarantee for the future a critical mass of academic focus in SRL related themes. The setting-up of a Self-Regulated Learning Studies Program (PEAAR) in the Lisbon University represents a significant leap forward in recognizing this important field of studies and in creating a prestigious strand capable of attracting graduate students.

On the other hand, the authors note that the topic of SRL in TELEs is an area suffering from a notorious scarcity of empirical research in Portugal. They therefore describe a research project that was designed to assess the impact of a particular TELE in the development of SRL skills in the framework of university graduate teacher education. This particular project was

developed in the context of TELEPEERS[1], a European consortium involving partners from 9 European countries that dedicated two years of work to develop a better insight on the theme of Self-regulated Learning in Technology Enhanced Learning Environments at University Level.

The Catholic University of Portugal (UCP – Universidade Católica Portuguesa) conducted the research component in Portugal. In particular, UCP carried out a comprehensive study on school teachers who had enrolled in a technology-rich graduate training programme. The study features the impact of a distance education environment, strongly supported with Information and Communication Technologies (ICT), on the motivation profiles of student teachers and the acquisition of self-regulation skills to conduct one's own learning path.

The main conclusions of this research can be clustered around seven findings:

1. Teachers sought professional development as their prime motivation to enrol in graduate education[2]. They pursued enhanced gratification through (i) knowledge base expansion especially in quality content and (ii) improved career opportunities.
2. Technology can play an essential role in course attractiveness providing for increased accessibility (time and space) and flexibility in learning. The TELE rapidly evolved to become a 'natural learning environment' propitiating a gradual shift from process to outcome goals.
3. The TELE feature that was most valued by student teachers vis-à-vis motivation was social learning. Learners appeared to value opportunities supported by simple communication systems that are relevant to both virtual and real community building (instant messaging, email, forum, face-to-face sessions)[3].

[1] TELEPEERS: "Self-regulated Learning in Technology Enhanced Learning Environments at University Level: a Peer Review", Grant agreement 2003-4710-/001-001 EDU-ELEARN, http://www.lmi.ub.es/TELEPEERS/

[2] Simons *et al* (2004) correlational studies provide empirical evidence on the relationship between usefulness of course and jobs (instrumentality) as a prime motivation factor and determinant of task orientation.

[3] Bandura (1986, 1997) posited that social factors are prime determinants of self-regulation efforts during learning.

4. Self-efficacy beliefs that sustain the intrinsic motivation to learn were highly dependent on the use of self-evaluative and monitoring tools readily available in the TELE[4]. A logical explanation stems from the belief that teachers' attributions of self-efficacy grow out of hetero-efficacy expectations (related to students) and that TELEs are reflective tools acting upon two dimensions that serve the purpose of self-efficacy boosting: self-monitoring (intrapersonal attributions) and peer interaction (interpersonal attributions).[5]

5. Teachers revealed a preference for b-Learning models including regular 'traditional' sessions that they deemed instrumental to sustain collaborative learning.

6. The motivation timeline of students can be described as a U-shaped curve where initial enthusiasm was replaced by an immediate disenchantment, followed by a "resilience" trend in conformity with the development of enhanced skills in future goals management[6].

7. No evidence could be found to prove the hypothesis that the TELE *per se* could act as a prime determinant of knowledge acquisition.

The theme of learning portfolios has gained widespread adepts in the Portuguese educational arena, recruited among those who are especially close to the most innovative circles (Costa, Rodrigues, Peralta & Raleira, 2006). Recent policy changes, effected at both European and national levels, that favour a competence-based curricula namely at basic and secondary education, led to a surge of interest in portfolios as a reliable tool to define and measure competencies. Teacher education reflects this new trend at both curricular and methodological levels. Thus, portfolios appear as powerful instruments to monitor specialized skills and also transversal competencies. These key competencies touch upon 'soft' domains of SRL which address in particular meta-learning aptitudes such as 'learning to learn' and 'knowing to know'.

[4] This finding is totally consistent with a triadic cyclical model of self-regulation with particular reference to its third phase where *self-reflection* is strongly contingent on *self-evaluative* practices and reciprocal feedback loops (Zimmerman, 1998, 2000; Zimmerman & Martinez-Pons, 1990).

[5] Learner as "scientist" and learner as "judge" attributions (Tollefson, 2000; Weiner, 2000).

[6] The underestimation of the commitment required by web-based learning is an important cause of early drop-out. The literature on insufficient perceptions of the effort required at the beginning of a TELE course is abundant. For other empirical evidence see for instance Muse Jr. (2003), Persico & Delfino (2004), Delfino, Persico & Sarti (2004).

Portfolios seem to have some promising characteristics; this will probably also be true of ICT-based portfolios, i.e. digital portfolios. The literature on digital portfolios is, however, still very scarce and focused in the higher education sphere.

7. Spain (Antonio Bartolomé, Universitat de Barcelona),

The Spanish contribution represents the results of an analysis of searching several data bases for the terms “self-regulated learning” and “learning and ICT”. According to the author, only a few works have been published on these topics. There is, however, a difference between works published before the year 2000 and those published after 2000.

Before the year 2000, there are practically no studies which take learning in ICT-based learning environments or in TELEs into consideration. The few studies mentioned are dedicated to metacognition, SRL and self-regulation of motivation.

In Spain, there are two distinct research traditions on learning, one being carried out by Departments of Psychology, the other one carried out by Departments of Education or Pedagogics. While the first research tradition before the year 2000 seems to have been ignorant of the new ICTs, the second one did not pay any attention to the topic, although learning with media traditionally is a topic in Educational research in Spain.

The situation began to change after the year 2000. Studies on learning in TELEs began to be published. These, however, concentrated more on instructional aspects than on the analysis of individual learning processes.

The author concludes that in Spain, there are up to now very few studies on SRL in TELEs. Those that do exist tend to take into account variables related to metacognition, but the impact of TELEs on SRL is hardly studied.

8. United Kingdom (Paul Lefrere, Open University)

The report from the UK combined data gathered in three ways:

1. An impressionistic desk study of education press pieces from 2007 (newspapers: The Times Higher Education Supplement; The Guardian);
2. Informal and impressionistic interviews of a small number of university teachers in campus-based institutions;
3. A desk study of current UK academic interest and practice in SRL, TEL and related areas, as represented by (a) publications by UK researchers; (b) papers accepted by UK editors of journals relevant to TEL and TELEs (primarily the British Journal of Educational Technology); (c) the type and number of SRL-relevant presentations from UK researchers at major conferences on teaching, learning and TEL, such as ALT-C).

As for study 1 (desk study of education press pieces from 2007), the author concludes that negative comments were more common than positive comments, in editorials (including leaders and think pieces) about UK higher education and about the quality of its outputs (their ability to think for themselves, and other attributes of 'graduateness' that might be expected to follow from experience of SRL).

In study 2 (interviews with colleagues in the UK), the author gained the impression that in their experience, the most common application of TELEs used for mainstream (institutionally-supported) teaching was to highly-directed forms of teaching, which allow the learner little or no discretion in what they learn and how they learn it. Interviewees tended to be negative about the whole idea of SRL

Study 3 was a desktop study on current UK academic interest and practice in SRL, TEL and related areas. To get a fuller picture of current UK practice regarding SRL in TELEs, indirect measures were sought of UK (and near-UK, meaning Irish) interest in SRL and in the use of TELEs for SRL. The measures chosen included the type and number of SRL-relevant presentations from UK researchers at major conferences on teaching, learning and technology-enhanced learning, TEL, inside and outside the UK, such as ALT-C and ECTEL

The annex to the UK contribution comments on the most relevant of those papers (which include papers on Problem Based Learning, PBL, used in ways reminiscent of SRL, to offer students varying degrees of discretion in what they study, when, how and with whom).

On the basis of the papers reviewed, the author reached the conclusion that there were few conference papers reporting on UK use of SRL in any context, let alone using SRL in TELEs. There were many papers about UK research into teaching and learning using a wide variety of forms of TEL and a number of TELEs. However, only a small proportion of those UK papers reported on experiences with self-regulated forms of learning. None looked at how TELEs can be used to cut the costs of SRL. The references in this report, comprising samples of those papers and comparable or more advanced work elsewhere, provide a snapshot of current practice in the UK and in academically-close countries, notably the USA and Ireland.

9. Conclusions

Conclusions to be drawn from our research

In this European review of research on SRL in TELEs, the different contributors used different approaches: some concentrated on a systematic survey of the topic as published in scientific journals (Netherlands, Norway, Portugal, Spain, UK), one studied text books (Germany) and some used specific selection criteria for the publications they chose to study (France, Italy).

The contributions to this review present a rich picture of the practices of teaching in the European countries participating in this review. The summaries presented in this chapter will not do justice to this richness and diversity, and any conclusions which will be at an even more abstract level will do so to a much lesser extent. Notwithstanding these limitations, at a very abstract and general level one could conclude that there are certainly communalities in the findings of the research carried out in the different countries. The authors agree that in their respective countries

- there is a large number of publications on the topic of SRL,
- there are some publications on ICT-based learning, and
- there are very few publications on SRL in TELEs.

Our conclusion therefore is that in-depth research on the topic of SRL in TELEs is urgently needed.

Since SRL is becoming increasingly important in our societies, it is extremely desirable to explore the potential of TELEs to support SRL. We are, however, aware that his will not be an easy task. This is a lesson to be learned from studies – most of them non-European - on the impact of TELEs on learning outcome.

In recent years, a large number of empirical studies have been conducted to find out whether TELEs influence learning outcomes. Results are, however, inconclusive. Clark (1983) reviewed a number of studies on the impact of media on learning and came to the conclusion that there was consistent evidence "… for the generalisation that there are no learning benefits to be gained from employing any specific medium to deliver instruction" (Clark, 1983, p.445). In his opinion, "… media are mere vehicles that deliver instruction but do not influence achievements any more that the truck that delivers our groceries causes changes in our nutrition" (Clark, 1983, p.445), a position which he upheld and defended ten years later, claiming that "media will never influence learning" (Clark, 1994). Disagreeing with Clark's position, Kozma (1994) suggested to reframe the debate: "Perhaps the appropriate question is not *do* but *will* media influence learning" (Kozma, 1994, p.7). He was convinced that media do have a potential for supporting learning, but that they will only do so under a specific set of conditions: "I believe that if we move from 'Do media influence learning?' to 'In what ways can we use the capabilities to influence learning for particular students, tasks and situations?' we will both advance the development of our field and contribute to the restructuring of schools and improvement of education and training" (Kozma, 1994, p.18).

Achieved added value to the KALEIDOSCOPE network

In the mission statement of KALEIDOSCOPE, it is says: "Kaleidoscope is the European research network shaping the scientific evolution of technology enhanced learning. It integrates the leading research teams in the field, who work collaboratively across educational, computer and social sciences to transform the quality and reach of the learning experience." (http://www.noe-kaleidoscope.org/pub/about/?lang=en).

Technology Enhanced Learning Environments which support Self-regulated Learning are very likely "to transform the quality and reach of the learning experience." As far as we know, our work constitutes the first review of SRL in TELEs on a European scale. By

exploring a topic that is highly relevant to lifelong learning in a knowledge society and in particular, to technology enhanced learning, our work certainly adds value to the KALEIDOSCOPE network of excellence.

As explained in the introduction to our review, In European societies, the growing need for more, and more effective, forms of lifelong learning (including informal learning), personalised to each citizen's needs, has become an important issue. The rate of change in all aspects of our lives has increased remarkably, making it necessary to adjust the way we learn to these new conditions. Lifelong learning implies that learning is likely to take place outside and beyond traditional schooling. In parallel to these developments, instructional paradigms are changing: teaching and training is becoming more student-oriented and less instructor-oriented, thus requiring a higher degree of Self-regulated Learning (SRL).

At the same time, recent developments in technology, coupled with the growing availability of low-cost or no-cost educational materials of high-quality (e.g., Open Content), have made it possible to develop powerful yet potentially widely available Technology Enhanced Learning Environments (TELEs). It therefore seems to be desirable to explore the potential of existing TELEs for supporting SRL in order to provide a framework for future research in the field of SRL in TELEs.

The importance of exploring the potential of TELEs to support SRL was also acknowledged at the KALEIDOSCOPE-TACONET conference which had been organised by the members of this seed project and which took place at the Vrije Universiteit Amsterdam on Oct.5 (see http://www.lmi.ub.es/taconet/amsterdam). Main results of our review were communicated there. In addition, views from academia, business, policy and communities of practice were presented. The event certainly served to raise the profile of KALEIDOSCOPE. The proceedings of the Amsterdam conference will be published by the seed project by the end of this year.

Plan for future activities

Scepticism regarding the influence of ICT on learning is still going strong. Cuban (2001) believes that there is hardly sufficient research evidence for beneficial effects of ICT in the

classroom; on the contrary, ICT is viewed as a drain on the educational system (Cuban et al., 2001; Oppenheimer, 2003).

As Kirkwood and Price (2005, p.272) state after having analysed around 80,000 responses from a range of postal surveys which addressed the issue of ICT in education: "The most important point to conclude from the studies presented in this article is that the medium itself is not the most important factor in any educational programme – what really matters is how it is creatively exploited and constructively aligned. The educational benefits that students perceive as gains from using ICT are more significant than the intrinsic characteristics of any particular medium".

Underwood & Dillon (2007) in trying to explain the still missing "hard" research evidence for the positive impact of TELEs on learning suggest three possible causes:

1. With traditional assessments tools, we may not be measuring the value added by technology. As an example, they cite the case of mobiles phones in the U.K. While mobiles phones are used practically by everybody, supposedly enhancing the efficiency of communication, there is no evidence of the impact of mobiles phones on the economy of the country.
2. It seems to be difficult to identify those variables that have a causal influence on learning; technological innovations may not influence learning outcomes directly, their influence may be mediated by the learning environment in which they are used.
3. A third line of argument holds that learners and teachers may need years of practice with the new technologies before a positive effect of their use can be demonstrated.

Underwood & Dillon (2007) conclude that education is a highly complex system, and that any attempt to assess the impact of ICT on learning outcomes needs to take into consideration the complexity of the system in which the use of ICT is embedded: "We argue that a new approach to educational research is needed to capture the rich interplay of variables when [the introduction of innovative technology into a complex educational system] is to be monitored. Further, such evaluations need to be grounded in a model of how actions in particular contexts produce observable outcomes and recognize both the primary (direct causal) and secondary effects (facilitation and amplification) of the technology" (Underwood & Dillon, 2007, p.217). The authors therefore suggest that to capture the complexity of the educational

environment in which technological innovations are being implemented, a maturity modeling approach might be appropriate.

Originally, maturity models were developed to help a company assess the stages of maturity is had reached with respect to several workforce-related domains (Curtis, Hefley & Miller, 2001). Each maturity level is described by specific process areas, process area goals and practices. For each maturity level in each domain a scoring rubric is provided which allows individual evaluators to reliably score what level the company has reached in a specific domain. Lesgold (2007) suggested to apply maturity modelling to determine the effects of technology in complex school environments. In his opinion, domains whose level of maturity might be important in trying to assess the impact of technology on learning are

1. Instruction,
2. Technology infrastructure,
3. Educational software,
4. People.

It seems to us that it is time to acknowledge that it simply does not make sense to ask “Do media influence learning?”. The invention of the printing press and the introduction of books in education was certainly a revolution. But today, nobody would ask “Do books influence learning?”, not because we do not believe that books will influence learning, but because we realize that books are a necessary, but not sufficient condition for academic achievement. Books are an important part of the learning process, but only one of many important components of the total and very complex learning environment. Learner characteristics, teacher and teaching methods, peers, the complete school structure and its relation to parents and the community are other important components of the learning environment. Following Kozma (1994, p.18), we might therefore ask “In what ways can we use the capabilities of TELEs to influence SRL for particular students, tasks and situations?”.

Based on our own empirical research, we believe that TELEs do have the potential to support SRL. In our TELEPEERS project where more than half of its partners were KALEIDOSCOPE members, the following TELEs were evaluated with respect to the potential to support SRL (see Table 1; see also the German contribution in this review and Carneiro & Steffens, 2006; Steffens, 2006; Bartolome & Steffens, 2006).

The TELEs were evaluated using the TELE-SRL questionnaire (see http://www.lmi.ub.es/telepeers/) which consisted of 43 items each of which was to be rated on a scale from 0 to 5 where 5 indicated full support. In table 1, overall means for each of the TELEs are given, showing that most of the TELEs were evaluated to have a good potential to support SRL.

It is interesting to note that the TELEs in the first group, container systems with tutor, received the highest ratings for their potential to support SRL. This may be due to the fact that in a container system, the content has to be fed into the system by the students, thus requiring and fostering a very active and possibly more sell-regulated way of learning. Also, teachers or tutors may serve as coaches, thereby supporting SRL in their students.

TELE / home	**Description**	**M**
Container systems with tutor		
Digital Portfolio / Vrije Universiteit Amsterdam	a web-based collection of student's work to demonstrate his/her efforts, progress and achievements in one ore more areas	**4.0**
DiViDU / Vrije Universiteit Amsterdam	web-based digital video used in teacher training to help student reflect on professional skills and attitudes	**3.9**
ILIAS / Universität zu Köln	an Internet-based authoring environment for course designers as well as an Internet-based learning environment for students at university level	**4.2**
Weblogs / Universitetet i Bergen	a personal, but public web space for self-expression	**3.1**
Content systems with tutor		
ICT-based Teacher Training / Universidade Católica Portuguesa	an ICT-based teacher training master course to improve ICT knowledge and skills	**3.2**
Cognitive Psychology Course / Nottingham Trent University	web-based support for an undergraduate course on cognitive psychology	1.4
Digital Video Course / Universidad de Barcelona	a blended learning course aimed at helping students acquire appropriate skills to use digital video and increase awareness of the media	**3.1**
Teacher Training Course on ET / CNR Istituto per le Tecnologie Didattiche Genoa	a Computer Mediated Communication Systems (CMCS) used in teacher training to improve knowledge and skills in Educational Technology	**3.3**
Content systems without tutor		
Sunpower / Universität zu Köln	a CD ROM program to improve communication strategies in English for business purposes targeted at adults with an intermediate level of English	2.4
Databases / Université de Technologie de Compiègne	an online tutorial on databases with topics ranging from design issues to practical aspects	**3.0**
Programming Tutorial / Université de Technologie de Compiègne	an online tutorial algorithms and programming based on Pascal	**3.0**
SWIM / Aalborg Universitet	a streaming web-based information module which serves as an online tutorial to help students acquire adequate strategies for information seeking	**3.0**

Table 1: Evaluation of TELEs with respect to their potential to support SRL

It is also worth noting that it was the digital portfolio system being used at the Vrije Universiteit Amsterdam that received a very high rating for its potential to support SRL. As mentioned in the introduction to this review, digital portfolios are receiving increasing attention, and this may be due to their potential to facilitate SRL. We should like to add that it is not the digital portfolio per se that may support SRL; rather, it is probably the way students are using the digital portfolio, i.e. the way they are being coached to use it and they way they are given freedom to explore its possibilities that helps students to self-regulate their learning. As Jos Beishuizen concluded in his contribution, teachers are an indispensable part of any TELE, and their principle role is to establish a balance between structure and freedom to learn in a self-regulated way.

Of course, research is still needed to show that those TELEs that seem to have a good potential to support SRL do indeed foster SRL. The actual research question will have to be much more complex, however. We will have to look for the constellation of factors in TELEs – in complete and complex TELEs, not just in their technological components – that are related to a learners' competence to self-regulate their learning. A maturity model approach might be one which would allow us to capture the complexity of the processes that take place in a TELE which has a potential for supporting SRL.

In answer to call FP7-ICT-2007-1 in the 7th Framework Programme of the European Commission, we have proposed a STREP on SRL in TELEs in the context of which we want to investigate the impact of TELEs that support SRL on SRL and learning achievements. We have made special efforts to develop a research design – based on maturity modelling - that will capture the complexity of TELEs in which learning and the self-regulation of learning takes place. The proposal was evaluated positively, but it has not been decided yet whether the project will be funded by the European Commission or not (proposal number 216393, ICT-1-4.1 - Digital libraries and technology-enhanced learning).

Independent of whether the proposed project on SRL in TELEs will be funded or not, we will continue so seek funding from the European Commission for conducting research on SRL in TELEs. In doing so, the TACONET network on SRL in TELEs (http://www.lmi.ub.es/taconet/) will provide us with a platform to continue our dialogue on SRL in TELEs with other researchers, with educators in academic as well as in non-academic

settings and with policy makers, hopefully turning the network into a community of practice.

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