E-Learning as a Socio-Cultural System:

A Multidimensional Analysis

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Chapter 1
Individual and Socio-Cultural Framing of E-Learning

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ABSTRACT

Considering e-learning as a socio-cultural system acknowledges that individuals are embedded within different contexts, influenced by the culture and the society the individual lives in. Designing beneficial e-learning scenarios means respecting these socio-cultural contexts and providing appropriate framing. This chapter introduces several aspects influencing e-learning from an individual and socio-cultural perspective. It firstly deals with the aspect of learners' collaborative knowledge construction in e-learning and introduces what this perspective means for the design and implementation of e-learning scenarios. The chapter looks at tools and shared external representations and shows how they can beneficially support learning processes and outcomes. In a third step, it looks at the individual's learning characteristics, for example an individual's prior knowledge, and socio-cultural biases relating to gender, ethnicity, and socio economic background, and discusses how these may be an obstacle for e-learning and how e-learning may help learners to overcome their biases. Finally, the chapter focuses on the issue on evaluation and provides suggestions to evaluate environments for e-learning from a socio-cultural perspective.

INTRODUCTION

E-learning is supposed to provide particular learning means with respect to different goals and target groups. It has evolved since the beginning of the 1990ies with respect to technology and scope. According to Learnframe.com (2005) it often has a focus on the acquisition and use of knowledge, which is distributed and facilitated by electronic means. Initially this meant offering text-based material on physical media like CD-ROMs. Nowadays e-learning provides multimedia contents that may be selected or personalized by the learners and used in online and offline learning scenarios. Unfortunately, changes in media often did not come along with adequate changes in instructional concepts, leading to two major problems: the explicit presentation of knowledge

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for memorizing and training allowed learners to reproduce it in tests, but learners often failed to transfer it to new situations (see Renkl, Mandl, & Gruber, 1996). Furthermore, working through e-learning courses often led to motivational losses and a low acceptance by the learners due to several reasons, on a technical as well as interpersonal level (see Bürg, Kronburger, & Mandl, 2004).

Besides technology, also the needs for learning have changed over the years. Considering our current society as *knowledge society* (see e.g. Drucker, 1969; Nonaka, 1994), it is obvious that knowledge is a major factor for the success of individuals and organizations. Within this *knowledge age* (e.g. Bereiter, 2002) the role of knowledge has changed fundamentally. According to the concept of knowledge age, gaining knowledge goes beyond memorizing facts and practicing procedures. Such repetitive activities were often required from learners in traditional learning scenarios, in which a teacher or trainer actively elaborated his knowledge and learners were expected to memorize and rehearse (see Ertl, Winkler & Mandl, 2007). Knowledge age, however, means that learners construct their knowledge based on situations and experiences (see Greeno, 1998). Lave and Wenger (1991) elaborated on the situativity of knowledge construction and the importance of the social context for learning. Yet, knowledge society does not only relate to learners constructing their own knowledge, it also emphasizes the creation of new knowledge, often in complex environments (see Nonaka, 1994). Taking up these issues, we will introduce constructivist learning approaches postulating that each learner has to construct new knowledge actively to appreciate the applicability of knowledge. Consequently, e-learning should place learners in a collaborative scenario that enables them to construct knowledge actively in collaboration with learning partners. This kind of e-collaborative knowledge construction requires collaboration partners to interact frequently with *content-specific* activities: Learners work together at the same (virtual) place to construct one joint product or mental artefact (see Bereiter, 2002).

Furthermore, e-learning environments rely on ICT, which mediates collaboration partners' communication, e.g. by the provision of newsgroups, chats, wikis, instant messaging tools or audio-visual communication. Therefore, the computer screen has to provide instructional elements for facilitating collaboration. Generally, collaboration partners *share* a computer desktop—even if located in different places, or see the same contents on their individual screens. In other settings, they may share the same interface structure and contents, but do not necessarily see the same picture simultaneously when accessing the environment due to personalization options. By these kinds of tools, instructors may implement specific contexts for the learners and take the benefits of each context to facilitate particular aspects of collaboration processes and outcomes (see Ertl, 2008).

Finally, learning with technology, collaborative learning and discussions are often subject to individual and socio-cultural learning characteristics. The most obvious is a learner's prior knowledge that is the base for a learner to build new knowledge on (Ertl & Mandl, 2006; Shapiro, 2004). Yet, studies (particularly from school contexts) have shown that female often show less self-confidence in the context of information and communication technologies (see e.g. Ertl, Helling, & Kikis-Papadakis, 2010). These results may have implications for the acceptance and performance of female learners in e-learning scenarios, which are strongly based on the use of ICT for learning. Similar phenomena may result from ethnicity and socio-economic background, which are out of the direct scope of this chapter.

1. E-COLLABORATIVE KNOWLEDGE CONSTRUCTION

One major characteristics of knowledge age is the complexity of learning and working scenarios. If we, exemplarily, consider the construction of a car, we can find differences between the first engineers and construction nowadays. In the beginning, one brilliant engineer was able to construct a car by himself having all the knowledge at his hands that was needed for this task. In contrast, nowadays a car is designed by hundreds of engineers that have each a very particular specialization. Yet, for getting the car running, the entire single components have to interact smoothly. To manage this, an engineer has to know more than the explicit special knowledge, e.g. for building an airbag, he also has to comprise of a lot of knowledge about interaction procedures between the airbag and other system components. This kind of knowledge may result from experiences over time, trials and errors and also may be specific to one particular car series. Considering this background, it seems to be helpful that innovative approaches to teaching and learning pay much attention to tacit knowledge (Nonaka, 1994). In contrast to the explicit knowledge, like e.g. the functioning of an airbag and its components, which is easy to document and to memorize, this tacit knowledge is seldom conscious and teaching these aspects may nearly be impossible. Besides facts it also may include conceptual understanding, situational experiences, procedural skills, and strategic competency (see De Jong & Fergusson-Hessler, 1996; Nonaka, 1995). Yet, all of these aspects are crucial for the applicability of knowledge in a specific socio-cultural context and the creation and further development of new knowledge. Particularly in complex situations, each learner has to construct new knowledge besides standard procedures to ensure the applicability of knowledge—as it is postulated by constructivist learning scenarios. Different approaches to learning environments, for example the *cognitive apprenticeship* (Collins, Brown & Newman, 1989) or *situated learning* (Lave & Wenger, 1991), aim to provide such learning experiences. They provide collaborative scenarios for the learners to support active knowledge construction during collaboration. From the perspective of knowledge construction, learners are engaged in four different categories of processes during collaborative learning (see Fischer, Bruhn, Gräsel, & Mandl, 2002): The *externalization* and *elicitation* of knowledge, *conflict-oriented negotiation* and *consensus-oriented integration*. Through externalizations, they elaborate their knowledge. They are challenged to elaborate comprehensibly for their collaboration partners and actively use their knowledge and restructure it to the collaborators background during this kind of interaction. During elicitation, they articulate their needs for information and participation on their collaborators knowledge. This engages collaboration partners to externalize by themselves. Yet, having learners with different socio-cultural backgrounds, socio-cognitive conflicts (see Doise & Mugny, 1984; Vygotsky, 1978) may arise. During conflict-oriented negotiation, learners discuss their different perspectives on an issue—a process that should be followed by consensus-oriented integration. In this process, learners elaborate on synthesizing their perspectives to come to a shared understanding. From the perspective of knowledge age, externalization and elicitation build the core of knowledge exchange to come to a shared knowledge base. Such kind of grounding activities (see Dillenbourg & Traum, 2006) rely on both, content specific interaction but also on socio-cultural exchange—particularly if collaboration partners have different socio-cultural backgrounds. We will elaborate on this later. Nevertheless, during negotiation and integration learners construct new perspectives on an issue and by these activities they build new knowledge. These four processes can provide beneficial learning activities in the context of knowledge age (see e.g. Cohen & Lo-

tan, 1995; Ertl, Fischer & Mandl, 2006; Fischer et al., 2002; Lou, Abrami & d'Apollonia, 2001; Roschelle & Teasley, 1995).

E-collaborative knowledge construction relates to these processes in collaborative e-learning environments. As learning partners have no physical co-presence in these environments, e-collaborative knowledge construction has different affordances on the e-learning infrastructure. This has to provide collaboration that way that learners are able to interact frequently. It furthermore should allow discussions and facilitate learners' elaborations. This has not necessarily to happen synchronously in spoken language—yet, learners should have capabilities to articulate themselves within the e-learning environment and follow the course of discussion (see Ertl, 2008). Finally, learners should have the means to share the same (virtual) place to work collaboratively on the construction of a shared mental artefact (see Bereiter, 2002) or a joint digital product. This shared joint digital product may be seen as a shared external representation of learners' knowledge, which will be the topic of the following section.

2. EXTERNAL REPRESENTATIONS

In e-learning scenarios, learners usually do not have physical co-presence. Collaboration and interaction mainly take place mediated by the shared medium, namely the computer screen and its contents (including audio). Thus, the contents on the screen play a very central role in e-learning, compared to learners in a traditional classroom in which learners may follow the teacher's projection, but may also interact in many other ways with their classmates. As the screen is the main interaction channel for learners, it also plays a central role to support learners' construction of a shared artefact. During this interaction, the shared screen can have two functionalities for the learners in e-learning: it may provide materials and facilitation from the learning environment as well as a place for learners shared negotiation and the construction of the shared artefact. Consequently, the screen is a strong focus for learners' collaborative activities and information and the contents displayed (intentionally or by their mere presence) guide learners through several aspects of their learning tasks (see Ertl et al., 2006; Suthers & Hundhausen, 2003). In both cases, contents on the screen can be seen as externalized representation either of the instructor's knowledge and learning structure or of the learners process and outcome of collaborative knowledge construction (see Ertl, 2007).

In this context, we introduce the term of "external representations" to describe knowledge and structures that are externalized and visible through physical symbols, objects or dimensions (see Zhang & Norman, 1994). External representations can comprise of several symbol codes and address different sensual modalities (see Paivio, 1986; Weidenmann, 2002), e.g. written or spoken textual information, visualizations, animations and videos, or structures like guidelines or templates (see Löhner & van Joolingen, 2001; Zhang, 1997; Larkin, 1989). In scenarios of e-collaborative knowledge construction, there are different features that can be supported by external representations. When learners are communicating synchronously, external representations allow a *permanent display* of knowledge and structures (Dennis & Valacich, 1999; Larkin, 1989; Paechter, 1996) which supports a common ground for knowledge construction (Dillenbourg & Traum, 2006).

If external representations provide an instructional pre-structure for the learners, they can guide them intentionally through their learning process—Suthers and Hundhausen (2003) call this *representational guidance*. This approach allows the instructor to select several aspects learners should deal with and puts them as a pre-structure within the shared external representation. Such process may be implemented by verbal guidelines or visual structures that take up particular aspects or contents and provide facilitation or are of special

impact for learners working on the task. This can provide a special focus for learners' attention on aspects and activities that learners would not use otherwise, e.g. particular ontologies or argumentation moves. Yet, this kind of pre-structure can not only serve as instructional facilitation – it also may—according to Zhang and Norman (1994)—influence learners' perception of a task and due to this changed perception influence their ability to solve this task. Studies of Zhang and Norman (1994) have shown that such modified external representations can help learners to perceive a problem in a different manner, to comprehend it more easily and to deal with it in a more appropriate way (see Zhang, 1997; Zhang & Norman 1994). Thus, an instructor can take benefit of external representations to provide instructional support for the learners.

To sum up, the computer screen is a focal point for the learners in e-learning and e-collaborative knowledge construction. Contents of the computer screen can provide representational guidance for learners, which mean that they draw learners' attention to special aspects of the task or instruction. By this, learner can be supported conveniently in e-learning environments (see Ertl et al., 2006; Fischer, Bruhn, Gräsel & Mandl, 2002; Suthers & Hundhausen, 2003). The following section will show how these effects can be used as instructional tools.

3. INSTRUCTIONAL TOOLS

These characteristics of external representations allow to intentionally using them as instructional tools. They may guide learners instructionally through their learning process or facilitate a conceptual level. On the conceptual level, external representations can draw attention to central characteristics of the learning material in the way that they make important content structures salient. This allows external representations to support learners understanding of a particular problem and to guide learners' content specific negotiations and their outcomes through the representation (see Suthers & Hundhausen, 2003). External representation can implement various structures that offer different kinds of support (see Löhner & van Joulingen, 2001), that can be tailored to the individual and socio-cultural needs of learners. These support styles differ in their structural complexity and in the range of possibilities learners are offered during their learning processes. If an external representation, for example, offers learners a powerful tool with many possibilities, learners have a high degree of freedom to use the external representation—yet, learners must be able to take advantage of these possibilities by themselves. On the other hand, tools may allow learners only limited actions but therefore a high level of support and guidance through the learning process (see Ertl et al., 2006; Reiser, 2004). Thus, instructional tools by external representations should be appropriate for learners' knowledge and skills (see Dobson, 1999; Reiser, 2004). To give more insights in the issue, how external representations may work as instructional tools, we will give examples for three different kinds of support, namely *simulations*, *templates,* and *conceptualization tools*. All of them allow learners to interact with the external representations and guide the learning processes in different ways:

- Simulations (see for example Roschelle & Teasley, 1995) offer the highest kind of pre-structure and go along with the lowest degree of freedom for the learners. Usually simulations aim to visualize processes regarding e.g. scientific, economic, or technical contents. Simulations are based on a model of this process allow learners to change parameters for this process. Examples may be the simulation of an ideal gas, in which a learner may modify temperature and pressure and can see molecular movement—or a biology simulation of

a fish tank in which learners can manipulate the chemical consistency of the water and see how the ecosystem develops (see Liu & Hmelo-Silver, 2010). The example of Roschelle and Teasley (1995) was called "Envisioning Machine" and simulated the physical concepts of velocity and acceleration in the context of Newton's Law. This simulation allowed learners to manipulate the size and direction of velocity and acceleration in this Newtonian world so that they were able to see the effects of these manipulations displayed by the simulation. Thus, dealing with simulations we can see, that they allow learners to manipulate parameters and then represent for the learners what this change has as consequences for the system. This allows learners to get direct feedback on their manipulations which can help them to understand the system with respect to the impact of particular parameters for the whole (simulated) system.

- In contrast to simulations that visualize processes, templates pre-structure the contents or epistemic conceptualizations of a domain (see Brooks & Dansereau, 1983; Ertl et al., 2006; Suthers & Hundhausen, 2003). Templates often have the look of tables with different categories and guide learners' content-specific negotiations by their structure. The categories and blank cells of the table draw learners' attention in the basic way to fill the blank cells—what means that they have to discuss about the conceptual aspects the cell stands for. By that, templates can introduce important content categories to the learning process (see Brooks & Dansereau, 1983; Ertl, Reiserer, & Mandl, 2005; Suthers & Hundhausen, 2003). Compared to simulations, templates allow learners many ways to work with the template and its structure and by this they offer learners a higher degree of freedom than simulations. Yet, learners are not able to change the structure of the template or model a new kind of relations. Thus, they mainly support learners' conceptual clarity in the way that they have to deal with the ontologies and relations modelled by the template. The template of Ertl, Reiserer, and Mandl (2005), for example, provided the categories of *theory*, *evidence*, *own experiences* and *consequences*. These categories allowed learners to focus their discussion on these categories and to become a conceptual clarity to which of these categories the particular topics discussed belong to. Thus, the pre-structure of templates allows learners to get familiar with ontologies and give them the freedom to decide how to deal with these ontologies even they are dependent on the ontologies given by the external representation.
- Conceptualization tools give learners most freedom at hand. They only offer learners a vague pre-structure and allow them to model relations. For such actions, the tool just provides objects that represent particular ontological dimensions and relations and learners have the freedom to arrange the objects and connect them with particular relations (see Fischer et al., 2002; Suthers & Hundhausen, 2003). An example of this may be the "CoStructure tool" for structured visualization by Fischer et al. (2002). In this study, learners were in the role of teachers and had to decide for a lesson plan for their class. They had to decide based on motivational theories about which kind of task or assignment to choose for the lesson. For their negotiation, learners got the CoStructure tool that provided different kind of cards for lesson elements and motivational aspects. They were able to model relations between them by different styles of lines representing relations. Working with this tool, learners were supported in their negotiations and decisions. By con-

necting lesson elements with motivational theories, they learned about motivational advantages and disadvantages of different lesson elements and were supported in their decision for a particular lesson plan. In this way, conceptualization tools can facilitate the deeper understanding of structures and relations within a particular content domain – yet, learners should comprise of the skills necessary to deal with the respective tool.

To sum up, external representations can provide different kind of instructional tools for e-learning. We have seen that they provide different degrees of freedom for the learners and aim at different learning goals and support mechanisms. Yet, they are always dependent on the learners' individual and socio-cultural characteristics in a way that learners need different knowledge, skills and attitudes to work with the tools and e-learning in general beneficially. This will be the discussed in the following sections.

4. LEARNERS' INDIVIDUAL LEARNING CHARACTERISTICS

As we have seen, several studies have shown that external representations and instructional tools can provide benefits for e-learning. The various styles of instructional tools offer many opportunities for learners' facilitation with different degrees of support and with a different power for the learners to express contents in their own style. Yet, some facilitation methods have less desired effects than expected (see Weinberge, Ertl, Fischer, & Mandl, 2005) in a particular context. This highlights the aspects of the individual's characteristics that have a strong impact on learning. In this context, studies have shown that the individual's prior knowledge (Ertl & Mandl, 2006; Shapiro, 2004), its cognitive abilities (Sweller, van Merrienboer, & Paas, 1998), or general motivational aspects (Deci & Ryan, 1992) can have a huge impact on learning processes and outcomes.

In e-learning, without synchronous teacher-learner interaction, it is much harder for a teacher to realize, if learners are still on task and able to follow the course or likely to drop out. It is also important in the context of tools and their different degrees of complexity. Some tools and contents may require different skills from different learners, e. g. a high level of prior knowledge to work with them beneficially. Some methods and tools – for example an unstructured whiteboard, offer a lot of freedom for the learners, but this freedom may increase complexity if, for example, the learners do not have an idea about the contents they should visualize on the whiteboard, and may for that reason be too complex to facilitate beneficial learning activities (see Dobson 1999). Thus, applying powerful tools with many freedoms for the learners may exceed their cognitive abilities and produce cognitive overload (see Sweller, van Merrienboer & Paas, 1998). Particularly for novice learners, either with respect to a content domain, the style of e-learning and e-learning environments, or the use of tools for learning, this may have detrimental effects on learner' motivation and learning outcomes. Highly complex e-learning scenarios and facilitation methods that offer learners a high degree of freedom may therefore be most appropriate for experienced learners and allow them to express their potential. In contrast, for inexperienced beginners it may be essential to have very stepwise instructions not only for the content but also for the learning environment with the support by highly structured facilitation methods (see Ertl et al., 2006).

On the other hand, very structured facilitation methods may also have detrimental effects. A task that is pre-structured too strongly may look rather trivial, without freedom for the learners (see Dillenbourg, 2002). Thus, if a task looks too easy learners may reduce their mental activities.

However, as learners' mental activities are the key for understanding, too much simplification may reduce their learning outcomes. Thus, it should be the aim of facilitation methods to evoke beneficial mental activities (see Salomon, 1984). The tasks need to be designed according to the learners' individual learning characteristics, e.g. taking into account if they are novice or expert learners with different level of prior knowledge (see Dobson, 1999; Ertl et al., 2006). For novice learners it may be most appropriate to make a complex task easier, to support their learning. This can facilitate learners and help to understand a subject matter. For experienced learners, the opposite may apply. Here, facilitation methods should increase the difficulty of a task to increase their mental activities alike, e.g. by application or transfer exercises or the task to create a visualization of it. By this, learners get challenged to invest mental effort and better learning outcomes (see Reiser, 2004). Yet, not only individual characteristics but also learners' socio-cultural background can have impact in e-learning in different ways. This will be discussed in the following section.

5. LEARNERS' SOCIO-CULTURAL BACKGROUND

Projects, initiatives, or guidelines that focus on e-learning from a heterogeneity and diversity perspective generally advocate the relevance of the learner's socio-cultural background, which should be considered for the design of facilitative e-learning scenarios on all educational levels. Relevant reports are often published by and targeted at practitioners or address the educational policy level and educational networks. Often, the focus is on exemplary cases and experiences from teaching practice in secondary school; the related recommendations and instructional consequences are discussed on a theoretical level. While the socio-cultural background comprises various aspects, such as gender, ethnicity, and social status, the differences in male and female students' ICT usage and their achievement in e-learning are prevalent in the discussions (e.g. Schrack, Schwarz & Nárosy, 2010; Goodman, 2003; Pauschenwein, 2009; Zauchner, Siebenhandl, & Wagner, 2007). Heemskerk, Brink, Volman and ten Dam (2005) present a literature review on how specific characteristics of ICT tools in education can include or exclude learners with diverse gender, ethnicity and social class. They assert that there is a lack of empirical research in this context. In particular, they discuss that numerous references just show "practice-oriented reflections on theory and research, arguing that one should recognize students' individual backgrounds when developing or using multimedia and the Internet in education" (Heemskerk et al., 2005, p. 4). Even if the studies presented in this section mainly relate to secondary school, it can be assumed that the aspects they describe also may be relevant for e-learning in general. Therefore, we will follow their line of discussion and provide further support for it.

According to Heemskerk et al. (2005) differences in students' access to computer and Internet by social status, educational background, race or sex might influence learning with ICT, at home or at school. The so called digital divide refers to socio-cultural differences in the access to computers on a technology level (i.e. having access to the hardware devices), as well as with regard to non-physical resources, such as the educational background, computer literacy and skills, language barriers or support from social networks (Hoffmann, Novak & Schlosser, 2001; Van Dijk & Hacker, 2003; Warschauer, 2004). The perceived self-efficacy about Internet usage can increase the gap between learners from different socio-cultural groups (Eastin & LaRose, 2000). The learners' self-judgment about their abilities to perform certain activities with the computer and Internet has an influence on their actions and attainment, showing with a positive correlation between self-efficacy and computer or Internet usage (Compeau *&* Higgins, 1995*;*

Dickhäuser, 2001; Eastin & LaRose, 2000). A recent study from the European Schoolnet & University of Liege, Psychology and Education (2013) shows that students who have high access to the computer and Internet at home and at school develop higher self-confidence in their ICT and social media usage skills. In the context of gender and e-learning, female learners tend to estimate their computer skills below that of male learners (e.g. Dickhäuser, 2001; Haubner et al., 2009). According to Dresel, Schober, and Ziegler (2007) such gender effects can be amplified by teachers' and parents' stereotypical expectations about the students' different performance levels.

Various studies show differences in the attractiveness of educational computer applications and tools for different socio-cultural groups, according to their interests, prior experiences and attitudes formed by their living environments or learning approaches (e.g. Chisholm, 1995; Damarin, 2000; both cited by Heemskerk et al., 2005). Heemskerk et al. (2005) report that often a focus is set on the gender-situation, with e-learning being designed rather for boys' interests than for girls'. Joiner, Messer, Littleton and Light (1996) experimentally compared the effects of different versions of educational game software that were designed to appeal either to male or female school children. The results show that girls prefer the female version of the software, while boys have no specific preference. Girls also performed better with the female version, but their performance is below that of the boys for both versions. Heemskerk et al. (2005) summarize that such results formed the basis for postulating the need of educational software addressing both, male and female students. Additionally, Morgan and Morgan (2007) reflect on existing empirical e-learning research, concluding that female perspectives and role models need to be included in the design of e-learning materials to contradict prevalent stereotypes of gender and technology. However, results from an exemplary study (Helling & Ertl, 2011) on the quantitative and qualitative representation of men and women in online learning materials for teaching ICT at schools in Germany show a stereotypical bias. Comparable results are reported by Hunze (2003) for school books, and it is concluded that these materials are less appealing for female learners, as they offer limited possibilities for identification (see also Faulstich-Wieland, 2004). Heemskerk et al. (2005) further discuss that recent publications seem to transfer the gender-perspective in the design of educational software to other socio-cultural groups, determined by heterogeneity in their socioeconomic status or ethnicity. Likewise, Volman, van Eck, Heemskerk and Kuiper (2005) showed in their study at primary and secondary school level, that pupils from ethnic-minority groups perform less elaborated drill-and-practice tasks with the computer, as compared to pupils from the majority group. In this sense, the school context reproduced the digital divide found for ethnic-minority groups in the Netherlands. The authors conclude with strategic suggestions on how to design ICT-based learning experiences that take into consideration the diversity of the pupils. Equal distribution of the ICT-related learning activities between pupils from different socio-cultural groups (e.g. by changing roles of pupils during task performance and collaboration) and the design of educational software according to the different group interests are the main strategies to be applied for e-learning in a socio-cultural context.

Heemskerk et al. (2005) agree that socio-cultural and individual differences with regard to prior knowledge, language spoken at home and at school, preferred learning strategies, and performance of collaborative learning activities need to be considered in the design of e-learning environments (see also Schulmeister, 2004). Larson (1999, cited from Heemskerk et al., 2005) points out that the representation of socio-cultural groups in educational software needs to go beyond quantitative aspects (i.e. ensuring that an equal number of males and females are represented) and should take into account the life contexts

on private and professional level, also reflecting intra-group diversity. According to Irwin et al. (1994; cited by Heemskerk et al., 2005), designing a multicultural educational website with relations to the personal experiences and background of the students creates a sound basis for students' learning. Such authentic learning contexts and related problem-solving activities support constructivist educational approaches as described above according to Greeno (1998) and Lave and Wenger (1991).

Heemskerk et al. (2005) conclude that the educational design of ICT in education needs to be inclusive with regard to gender and cultural aspects on three levels, as introduced in their 'index of inclusiveness'. On the *content level* inclusiveness is characterized by the gender and cultural sensitivity of the presence and representation of groups and the type of contributions attributed to these groups, as well as the respect of their diverse values, interests and life contexts. The *user interface level respects* the diversity of the user group from a visual and audio perspective. The *instructional structure* requires inclusiveness with regard to prior knowledge, learning strategies, learning activities, support structure, individualized learning opportunities and self-confidence of learners. Heemskerk, Volman, tem Dan and Admiraal (2011) point out that software generally is designed for certain users groups by encompassing 'scripts' (Woolgar, 1992, cited from Heemskerk et al., 2011) that determine the usability of the software. While a script can be inclusive for a group of people, it might exclude another group at the same time (Akrich, 1995; Rommes, 2002; both cited from Heemskerk et al., 2011). Consequently, 'social scripts' presume socio-cultural and gender differences among users, thus influencing the inclusiveness of technological learning environments with regard to content, audio-visual interface and the instructional structure (Heemskerk et al., 2011; see also Heemskerk et al., 2005 for the index of inclusiveness). In their study with 81 students from secondary schools in the Netherlands, Heemskerk et al. (2011) found that on the instructional level, teachers can support the inclusiveness of a tool, e.g. by referring to students' prior knowledge or providing explicit support for using the tools. It was found that teachers show such actions rather with tools that already show a certain extent of inclusiveness. When the more inclusive tools were used, the students – especially girls and students from minority groups – showed a tendency towards more active participation during lessons and more cooperation among the students was observed.

6. EVALUATION OF E-LEARNING

After discussing the socio-cultural framing of e-learning, we will exemplify how this can have an impact of different dimensions for the evaluation of e-learning. In this section, we will discuss how to evaluate the learning environment itself but not how to assess the outcomes of the learners. The latter one would comprise issues of particular learning goals with respect to different contents as well as different types and qualities of knowledge that have to be assessed appropriately. This would go far beyond the scope of this chapter because already the evaluation of the environment is a multi-dimensional endeavour.

Evaluation of a learning environment can refer to different aspects, e.g. analyzing the quality of the learning material, having a look on learners' outcomes (by assessments or process observations), and analyze the pedagogical approach that aims to facilitate and develop learners' knowledge and skills. Besides the mere rehearsal of facts, learners may also develop knowledge and skills regarding different kinds of knowledge, e.g. about procedures, strategies, or situations, all of those on different levels (see De Jong & Ferguson-Hessler, 1996). Furthermore, observed behavioural changes may also be seen as outcome of learning (Kirkpatrick, 1994). Having a look on learners' negotiations in the learning environment

is an important mean to improve the quality of a learning environment. Mandl and Hense (2007) emphasize this by stressing that the most important aspect of evaluation for realizing best benefits for the learners is to get insights, how learners interact with a learning environment regarding its functions and peculiarities. Particularly when taking a socio-cultural perspective, one has to focus on issues like how the learning environment supports the enculturation of knowledge (see Lave & Wenger, 1991), how collaborative processes take place (Resnick, Levine, & Teasley, 1991) how the environment allows learners to participate in cultural practices (Sfard, 1998), or in how far the design of its content, interface and instructional structure is inclusive of certain socio-cultural groups (Heemskerk et al. 2005; Heemskerk et al., 2011).

Tergan and Schenkel (2002) introduce four different contexts with relevance for e-learning scenarios: the context of the individual that comprises of all learner individual and socio-cultural aspects, the application context which has a focus on contents, the educational context with the instructional design, and the technical context considering media and learning technologies. Yet, these four dimensions come short regarding the social context that is important with regard to the collaborative aspects of e-learning. Lakkala (2008) takes this up and suggests a framework of four pedagogical infrastructures. According to her, (collaborative) e-learning environments should be classified, designed and evaluated according to a cognitive, an epistemical, a social, and a technical infrastructure. These four infrastructures or dimensions relate to different parameters for evaluation. In the following, we will give an overview on these four infrastructures as dimensions for evaluation and introduce related evaluation parameters. A more detailed description of this approach with guiding questions for the evaluation can be found at Ertl, Ebner, and Kikis-Papadakis (2010).

6.1 Cognitive Dimension

Evaluation regarding the cognitive dimension analyzes learners' cognitive characteristics, for example their prior-knowledge, skills and strategies, and how far these are an appropriate base for participating in the learning environment. Fricke (1997) calls such kind of analysis as *input analysis* and emphasizes its importance for running a beneficial e-learning course. As we have shown above, learners may differ regarding their individual and socio-cognitive background and this also has effects on their chances for a beneficial participation in e-learning. The perspective on the cognitive infrastructure can provide means to define a target group for an e-learning course and to set specific learning goals.

A learner's individual prior knowledge is in particular important for individual and collaborative outcomes in e-learning (see Ertl, Kopp, & Mandl, 2005; Shapiro, 2004). The learning environment should therefore adapt its structure and contents to the target group's level of knowledge: Stark and Mandl (2002) elaborate that learners with different levels of prior knowledge can perform very different in a learning environment and the knowledge about these differences allows designing particular facilitation.

Besides prior knowledge, Mandl and Friedrich (2005) emphasize individual learning strategies as important input factor (see also Pintrich, Smith, Garcia, & McKeachie, 1993). E-learning environments have very different options for implementing learning scenarios ranging from drill and practice to scientific inquiry. Some of them provide a strong guidance for the learners and others many degrees of freedom. Thus, each of the different scenarios may require learners to apply different strategies and learners have to proficient in the specific strategies that are required for performing well in the respective scenario.

6.2 Epistemic Dimension

The epistemic dimension relates to a defined target group and the contents provided for this target group. Thus, the structure of the content of an e-learning environment is evaluated, its particular implementation and their effects on the learners. This analyzes correctness and appropriateness, presentation and instructional design and also learners' perception and acceptance.

Correctness seems to be the most obvious aspect regarding this dimension as no teacher should want to teach wrong concepts. Yet, for many areas there are different approaches or epistemic trends prevailing that rather should be categorized as approach or perspective than as evidence. We have elaborated before that also the appropriateness for a target group is important to consider. In global e-learning scenarios participants may come from very different educational and cultural backgrounds and therefore appropriateness should not only relate to the level of difficulty of a course but also to the learners' social and cultural backgrounds.

Besides the appropriateness of *what* is thought, also style *how* teaching takes place relates to this dimension. This relates to the instructional design of an e-learning environment and evaluates instructional efforts for facilitating learners' knowledge construction (see Tennyson, Schott, Seel, & Dijkstra, 1997). Analyzing this focuses the appropriateness of the teaching methods and can include different aspects, for example the theoretical soundness of a learning environment, an analysis of general and specific learning goals, learner motivation and, if applicable, the integration in a curriculum.

A third aspect in this dimension relates to the acceptance of a learning environment by the learners. The concept of acceptance describes how learners perceive the learning in an environment in general, but also with respect to contents and teaching methods (see Bürg & Mandl, 2005; Davies, 1989). This aspect has a particular impact on the success of a learning environment because low acceptance could prevent beneficial learning activities and cause drop offs.

6.3 Social Dimension

Regarding drop offs, also the social dimension may have an impact. Considering that e-learning usually takes place in settings that have only few or no physical co-presence, sociability of an environment becomes an important aspect of e-learning (see Kreijns, Kirschner, & Jochems, 2002). This can include support and tutoring by the providers of the learning environment as well as the interaction of learners amongst each other's.

The construct of sociability describes how far a learning environment supports interpersonal contacts and how far participants perceive it as social medium (see Kreijns, Kirschner, & Jochems, 2002). Considering learners' anonymity in online courses, the sociability may be a crucial aspect for e-learning courses—particularly for such ones that require learners' commitment or last over a longer period of time. Schuler and Stehle (1983) argue that commitment is an important criterion for the social validity; it is also necessary to reduce particular group phenomena, e.g. social loafing or flaming (see Weinberger, 2003).

The social dimension also includes the aspects of tutoring/feedback. So it relates to issues how far a moderator of a learning environment is able to deal with group phenomena to ensure beneficial collaborative work (see Tergan & Schenkel, 2002). Moreover, it relates to several aspects of the social presence of a tutor (see Schweizer, Paechter, & Weidenmann, 2001) when supporting learners during content specific issues like comprehension problems or support for the collaborative work.

6.4 Technical Dimension

Learning and collaboration in e-learning environments have to be supported by the technical system of the e-learning platform. There are

several technical aspects important for running e-learning courses, for example reliability, bandwidth options, scalability and interoperability. For this dimension, we will primarily deal with user aspects like usability and the support for technical issues to keep the focus of our contribution.

ICS (2010, p.1) defines usability as "the extent to which a product can be used by specified users to achieve specified goals effectively, efficiently and satisfactory in a specified context of use." It can disclose, how far learners have the appropriate (technical) skills, but also how far they have the technical infrastructure that allows them to work with the learning environment smoothly (e.g. Abran, Khelefi, Suryn, & Seffah, 2003). Usability can facilitate the satisfaction of a user with the handling of an e-learning environment and may be seen as an aspect contributing to the acceptance of a learning environment. Yet, regarding e-learning it is important to separate both aspects because learners may have appropriate skills for working on the contents of an e-learning environment but lack in technical skills or infrastructures to work in a particular e-learning environment. Thus, it is important, how easy learners can accomplish a task when coming to a learning environment (see Nielsen, 2012).

The latter goes along with the issue of technical support. Some e-learning environments use open media formats and offer a lot of complexity for the learners. Others are very focused in necessary user interaction but need the installation of proprietary software or adaptive firewall settings. Moderators and tutors of e-learning environments usually can give hints about general technical issues—yet, an option for support seems to be indispensable for any kind of e-learning course.

CONCLUSION

This chapter aimed to give insights into the individual and socio-cultural framing of e-learning. It introduced, how e-learning can be a motor for knowledge age when it transforms from knowledge deployment to an environment for e-collaborative knowledge construction. E-collaborative knowledge construction can support the challenges of the knowledge age like interdisciplinary collaboration that requires experts from different knowledge domains to collaborate for solving problems (see Rummel & Spada, 2005), or other global collaboration requirements. During these processes, it is important that learners contribute with their particular expertise and negotiate their different backgrounds and perspectives for establishing a shared problem space (see Fischer, Bruhn, Gräsel, & Mandl, 2000) and finally creating a shared mental artefact (see Bereiter, 2002).

In e-learning, these processes take place in remote setting and learners interact in different way through the computer, which offers a shared external representation of learning and collaboration artefacts. External representation can be structured in very different ways and have to be adapted to the respective tasks and content domain—a chance and a challenge for the providers of learning environments. They can provide powerful cognitive tools (see Resnick, 1989) that guide learners through their learning and collaboration processes (see Ertl et al., 2006; Suthers & Hundhausen, 2003), but they may heavily relate to the individual and socio-cultural background of the learners, thus providing individual and socio-cultural framing for the processes of e-collaborative knowledge construction. Dobson (1999), states that the tools have to meet the skills of the learners, Shapiro (2004) argues for the role of prior knowledge as important variable for e-learning, Reiser (2004) elaborates that tools have to challenge learners' cognitive activities, and Heemskerk et al. (2005) postulate the need of socio-cultural inclusiveness for the design of technological learning environments. Yet, learners' performance in such settings is influenced by socio-cognitive factors, like expectancies (Dickhäuser, 2001) or attributions from others (Dresel et al., 2007). Therefore, e-learning environments have to be evaluated in

a multi-dimensional approach that targets the different aspects, as was introduced in our overview on an approach for the evaluation of e-learning.

We elaborated on differences in the participants' individual and socio-cultural background, attitudes, values, and stereotypes. These aspects are even more important for designing technological learning scenarios that target heterogeneous groups of participants. This also may apply to specific instructional approaches, e.g. collaborative methods may encounter problems when applied with learners from a highly hierarchical background (Hofstede, 1980) or participants of some backgrounds may be reluctant to ask for help. The scope of this chapter was to show which aspects of e-learning may be specific to the learners' socio-cultural background and to show evaluation parameters therefore. For a more detailed elaboration on the evaluation dimensions and related guiding questions we would like to refer to Ertl, Ebner, and Kikis-Papadakis (2010). We are aware, that economic aspects were not included in the presented evaluation infrastructure; however, they may be subject to socio-cultural effects regarding the value of learning in different cultures. This may affect the means that are available for realizing technological learning environments and therefore indirectly influence all of the four evaluation dimensions in one or the other way. Further research in this direction should complete the framing of e-learning from a socio-cultural perspective.

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KEY TERMS AND DEFINITIONS

Collaboration: Intense joint activities with a strong commitment towards joint output.

Collaborative Learning: Learning method that takes benefits of learners' collaboration to achieve improved learning results.

E-Collaborative Knowledge Construction: Collaboration in the context of computer supported scenarios with the goal to acquire or create new knowledge.

External Representation: Visible structure of information.

Instructional Design: The rationale for a learning scenario. It provides learning materials and structures collaboration and the application of learning tools.

Mental Artefact: Immaterial product, e.g. learners' shared knowledge.

Prior Knowledge: A learner's knowledge before entering a learning session.