

Pilot Phase of VEL (Vienna
E-Lecturing): A Formative and
Summative Evaluation

D I P L O M A T H E S I S

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Introduction

The demand for self-dependent graduates with life long learning skills is constantly growing. An important aspect for achieving this goal is to foster self-regulated learning skills by means of flexible modes of learning and to focus on the learning process rather than on specific outcomes. Yet, fixed scheduling and teacher-centered delivery modes of traditional classroom teaching provide limited opportunities for promoting autonomous learning. In particular, traditional lectures are characterized by a “teacher-as-expert” and “student-as-recipient” paradigm, resulting in passive students who are lacking essential skills of self-motivation, self regulation strategies, and application of acquired knowledge.

On this account, Christiane Spiel, Dean of the Faculty of Psychology at the University of Vienna and Professor in Educational Psychology, initiated the project “E-Lecturing for Large Scale Lectures” in 2001 and changed the traditional lecture “Research Methods & Evaluation” to an e-lecturing format (**Vienna E-Lecturing**). E-lecturing is defined as application of online learning to large scale lectures. Independent learning as well as collaboration are essential aspects of VEL, thus, it appears to be a remedy for the drawbacks of traditional large scale lecturing.

Evaluations are necessary for testing intended and unintended effects of a program and whether the program’s goals were achieved. Moreover, evaluations help to improve an ongoing given program. Thus, an important part of VEL is its summative and formative evaluation.

The first part of the present thesis provides an overview on evaluation in the context of social research, discusses essential elements of successful online delivery, and provides a review of current evaluation studies dedicated to evaluating online learning including research designs, methods and pertinent results. Part two describes the VEL project, its goals and didactical design. The evaluation of the second pilot semester of VEL is presented and its results are discussed. Finally, a preview of the ongoing process of VEL is provided.

Part I

Evaluating E-Learning in Higher Education

1 Evaluation: A Short Overview

In recent years, the term *evaluation* increasingly gained importance. Yet, the denotation of the term is not consistent and the definitions diverge widely. Hence, the risk of equating evaluation with everyday life estimations is high (Spiel & Gössler, 2001). In the academic context, the term evaluation also has diverse denotations. Not only systematic, theoretically grounded empirical research studies, but also analyses of subjective opinions of a not specifically determined target group, are regarded as evaluations (H. Kromrey, 2001). In order to clarify the term evaluation, this chapter contains a short overview on evaluation in the context of social research. A definition is provided and its purposes and different forms are discussed. Methods of evaluations are described and some methodical challenges are addressed.

1.1 Evaluation in the Context of Social Research: Definition, Purpose, and Forms

In the context of social research, evaluation is a subarea of empirical research. It refers to the process of “systematic investigation of the worth or merit of an object” (JCSEE, 1994) and implies the application of systematic scientific research methods. Thus, it is also referred to as *evaluation research* (see introductory literature e.g. Fink, 1997; Rossi, Lipsey, & Freeman, 2003; Berk & Rossi, 1999; Spiel, 2001; Wottawa & Thierau, 1998; Mittag & Hager, 2000; Bortz & Döring, 2002).

By and large, the objects of evaluations in the context of social research are social interventions and programs, respectively (see e.g. JCSEE, 1994; Bortz & Döring, 2002). Thus, evaluation is also called *program evaluation* (e.g. Rossi et al., 2003; Spiel, 2001; Berk & Rossi, 1999). A program is defined as the sum of “educational activities that are provided on a continuing basis” (JCSEE, 1994). It should always contain a description of the program’s goals and the procedures for achieving those goals (Mittag & Hager, 2000).

Program evaluation represents an adaption of social research methods to the task of studying social interventions so that sound judgements can be drawn about the social problem addressed, and the design, implementation, impact, and efficiency of programs that address those problems (Rossi et al., 2003).

The purpose of evaluation is to provide information on the effectiveness of programs, as well as to optimize outcomes, quality, and efficiency (Fink, 1997). In order to judge the effectiveness of a given program, it is essential to clarify and to operationalize the intended program's goals (H. Kromrey, 2001).

Depending on the purpose of the evaluation and the chosen measuring time, the literature distinguishes between different forms of evaluation, most prominently between *formative* and *summative* evaluation. This classification traces back to Scriven (1967) and is discussed throughout the current introductory literature of evaluation (Rossi et al., 2003; Berk & Rossi, 1999; Spiel, 2001; Mittag & Hager, 2000; Wottawa & Thierau, 1998; Bortz & Döring, 2002; H. Kromrey, 2001).

According to these authors, formative evaluation is conducted concomitant to a program. It aims to optimize the effectiveness of a program by collecting intermediate results. These results have an impact on the ongoing program. Therefore, formative evaluation is an appropriate instrument for developing and assuring quality. Hence, qualitative research methods play a major role in formative evaluations.

In contrast, summative evaluation is conducted towards, or after the termination of a program. It aims to assess the effectiveness of a program by evaluating whether the program reaches its goals. In addition to evaluating the achievement of the objectives, the program's characteristics as well as unintended effects should be examined. Thus, one can investigate which effects support the achievement of given objectives and which effects are detrimental to the given goals (Stockmann, 2004). For this form of evaluation, primarily quantitative research methods are used.

An alternative model of program evaluation is to distinguish between *input evaluation*, *process evaluation*, *output evaluation*, and *impact evaluation* (Rossi et al., 2003). The purpose of input evaluation is to "provide information on the quality of resources used by the program and to determine how to best use these resources to achieve program objectives" (Rovai, 2003). Important inputs that should be evaluated include student characteristics, instructor/tutor experience, competence of administrative staff, efficiency of course development, and institutional cooperation/support. Process evaluation focuses on information about all parts of the ongoing program and includes teacher and cost effectiveness. The evaluation should not only assess

what is happening within the program, but also what should be happening and yet is lacking. In contrast, output evaluation addresses the direct effects of the program. It assesses the extent to which the program objectives were reached, changes in skills, knowledge, or attitudes. Impact evaluation, in contrast, focuses on the long-term results of a given program (Rovai, 2003).

The systemic evaluation model of Rossi et al. (1999; 2003) is similar to the CIPP-Model of Stufflebeam (2001), where *context evaluation*, *input evaluation*, *process evaluation*, and *product evaluation* are described. In this model, context evaluation focuses on the determining factors of a program, input evaluation addresses the evaluation of prerequisites of participants, process evaluation focuses on the period of program implementation, and product evaluation explores outcome achievement. In both models, the systemic model of Rossi et al. and the CIPP model of Stufflebeam, process and product evaluation are similar to formative and summative evaluation, respectively. They are overlapping and can be seen as “different paths to the same goal” (Rovai, 2003).

1.2 Methods of Evaluations

The goal of an evaluation, as applied research in general, is to reveal *effects*. These effects may be measured by three approaches, i.e. indirect measurement of change, direct measurement of change, and criteria oriented approach (Behrens, 1999):

- (1) Indirect measurement of change: An effect is revealed if the dependent variable (e.g. knowledge, attitude, skills etc.) significantly differs between two measuring times (e.g. pre-post).
- (2) Direct measurement of change: An effect is revealed if the participants directly make a statement concerning the change of the examined variable (improvement of skills, knowledge, attitudes etc.).
- (3) Criteria oriented approach: This approach does not measure changes, but compares the actual state with the ideal state. For this purpose, criteria of success are employed. The difference between actual and target state give information about the extent of goal achievement.

Indirect measurement of effects is the most widely applied method. However, it inherently entails some methodical challenges. First of all, the identification of causal relations between the observed effect and its cause is difficult.

Evaluations are conducted in the practical field, and therefore, in most cases, are quasi-experiments. Randomized experimental designs are rarely feasible. Yet, only experimental designs are able to determine reliable and valid causal interpretation

Other disadvantages of indirect measurement of effects are coincidental factors when completing the questionnaire, remembrance of the items when responding a second or third time, and ceiling effects. Hence, if the ratings at measuring time I are very high, they cannot be exceeded at measuring time II. Even though there might be any changes, they do not appear. Indirect measurement also can cause annoyance, as participants recognize that they are repeatedly prompted to respond to the same questions. This can then negatively affect the quality of the data.

In some cases, when direct queries are feasible, a direct measurement of effects prevents some of these problems. The chance of revealing effects is higher than in an indirect mode of measuring, since ceiling effects do not interfere with the results. Moreover, when queried directly, participants get the feeling of being taken seriously. Finally, the interpretation of direct questioning in non-randomized field studies is unequivocal compared to indirect measurement.

Targeted evaluations aim to examine whether the program achieved its goals. For this purpose, it may be reasonable to determine exact criteria of success. These criteria are a measure of the target state and indicate whether a goal was achieved and to what extent.

Relating to data collecting methods for revealing effects, all methods of quantitative and qualitative research may be used. In practice, primarily the following methods are employed: questionnaires, interviews, group discussions, performance tests, observations, verbal feedback, learning diary, and others (Behrens, 1999 and cites therein).

1.3 Summary

In the context of social research, evaluation is a subarea of empirical research and refers to the systematical investigation of an object by using scientific research methods. By and large, the objects of evaluations are social intervention programs and programs, respectively. The purpose of evaluation is to provide information on the effectiveness of programs, as well as to opti-

mize outcomes, quality, and efficiency. Depending on the purpose and the measuring time, the literature distinguishes between different forms of evaluation, most prominently between formative and summative evaluation. A formative evaluation is conducted concomitant to a program and aims to optimize the effectiveness of a program by collecting intermediate results. In contrast, summative evaluation is conducted towards, or after the termination of a program and aims to assess the effectiveness of a program by evaluation whether the given program reached its goals.

The goal of evaluation is to reveal effects. These effects may be measured by three approaches: Indirect measurement of change, direct measurement of change, and criteria oriented approach. Relating to the data collecting methods for revealing effects, all methods of quantitative and qualitative research may be used.

2 E-Learning: An Overview

The body of literature in the field of e-learning is substantial and continues to grow. Particularly in the English-speaking literature, numerous journals and conferences address this issue. A valuable resource of peer-reviewed and published international journal articles and proceedings papers in the field of educational technology and e-learning can be found online at <http://www.aace.org/dl>.

The German-speaking literature regarding e-learning and educational technology is not that large yet. The bigger part of the papers is published as chapters of books compiled by editors. To date, dedicated journal articles are relatively sparse.

In this chapter, an overview of e-learning is given and important terms are outlined. The next section of this chapter focuses on self-regulated learning, an essential skill required for online learning as well as a key qualification for professional development. The need for independent and autonomous students is outlined, a definition of self-regulation is provided, and a theoretical framework for self-regulated learning (SRL) in online learning environments is discussed. Based on this framework, suggestions are made how to foster self-regulation in online environments. In section 2.3, virtual collaboration as an essential element of effective learning is discussed. Since the basis of virtual collaboration is communication technology, section 2.4 provides an overview to computer mediated communication (CMC) and its attributes. Discussion board and email as important tools of online learning are discussed in more detail. In section 2.5, the concept of blended learning is examined and its advantages are outlined.

2.1 E-Learning: Definition of Terms

In the literature, the term *e-learning* is used for various scenarios of teaching and learning. All these different views have only one thing in common: the use of electronic media. Accordingly, e-learning is defined in a very broad sense.

In a true sense, Elearning can be thought of as the delivery of information via all electronic media, including the Internet, intranets, extranets, satellite broadcasts, audio/video tape, interactive TV, and CD-ROM (Pastore, 2002).

When narrowing down the term, e-learning is defined as a teaching and learning process using the internet or intranet as medium for teaching and learning, including offline learning with CD-ROM (Weidenmann, 2002). However, the most popular definition of e-learning today refers to the use of internet technology as medium for teaching (Pastore, 2002). Still, this definition is extremely broad. On one pole, the term e-learning is used for a mere add-on to face-to-face teaching. An add-on could be, for instance, providing materials online in order to facilitate the distribution of the materials. Presently, such an approach seems to dominate at European universities (Baeßler, Lücke, Koring, Kinnebrock, & Rössler, 2003). A study at the University of Vienna also showed this trend (Zens, Jirasko, Ecker, & Zwiauer, 2003). On the other pole, the term e-learning is used for entirely online courses or programs, respectively.

However, most authors currently avoid the term e-learning and use various terms instead. Today, the most popular term is *online learning*. The majority of authors use this term for describing learning processes that partially, or exclusively use the internet or specific intranets as medium (Döring, 2002). A much more precise definition comes from Sims, Dobbs, & Hand, 2002. They define online learning as “an environment that integrates collaboration, communication, and engaging content with specific group and independent learning activities and tasks”.

In the context of the present project VEL, we use the term *e-lecturing*, defined as the application of online learning to large scale lectures (Spiel et al., 2004). The term corresponds to the definition of Sims et al. (2002) mentioned above. The term e-lecturing assumes an environment that integrates internet technology in large scale lectures within the context of higher education, with the goal of providing information, facilitating communication, and fostering the involvement with the subject matter by collaboration and independent learning. In contrast to exclusive online courses, we utilize a mix of virtual and face-to-face learning. This concept is called *blended learning* (Garrison & Kanuka, 2004; Brunn & Frank, 2002; Reinmann-Rothmeier, 2003).

2.2 Self-Regulated Learning in Online Environments

“A lecture is the best way to get information from the professor’s notebook into the student’s notebook without passing through either brain”, assumes

Bill Pelz, Professor of Psychology of Herkimer County Community College, New York (Pelz, 2004). He suggests that the more time students spend engaged in content, the more of that content they learn. By definition, traditional lectures miss these times of active engagement with the content. Teaching complies with a “I talk - you listen’ style” (Pelz, 2004). The traditional educational system focuses on outcomes rather than on processes (Boekaerts, 1997, cited in McMahon & Oliver, 2001) and hence does not create active and self-dependent students.

Christiane Spiel, Dean of the Faculty of Psychology of Vienna University also observed that students are acting like “consumers” rather than actively engaging with the content. Students tend to settle back during the lectures, and when the exam is approaching, they are learning the content by memorization, often without deeper understanding (Spiel et al., 2004). The result is the acquisition of theoretical knowledge without the ability to apply this knowledge to real-life problems (Renkl, 1996, cited in Mandl & Winkler, 2002). Students receive grades, but lack essential applied knowledge. Exemplifying this situation, a student of psychology is learning a myriad of theories, explaining how individuals are acting, thinking, and feeling, but has no idea on how to utilize these theories in a given situation when it comes to subsequent professional activities. Learner-centered teaching practices focus on repeating what was imparted in class, with emphasis placed on memorisation, thus creating passive students (Pedró, 2001).

In the long run, the main danger of excessive lecturing, is the creation of a student who does not have a true university experience based on independent study, the comparison of sources, the resolution of problems, and the acquisition of professional autonomy (Pedró, 2001).

Today, universities are moving more and more towards student-centered learning. Yet, traditional teaching offers little possibilities for autonomous learning. A potential remedy of this drawback appears to be online learning.

2.2.1 Changed Roles of Teacher and Student

Online learning is more flexible than traditional learning. It is lacking direct personal interaction and scheduling of class times. Thus, there are less regulatory mechanisms that ensure students’ learning progress. Accordingly,

students in online learning environments must become more active and more responsible for their own learning (Dringus, 2000, cited in Lieblein, 2000). As a result, the roles of teacher and student must change.

...teachers must become the facilitators of the student's education, the engineers of this highly complex process, and not merely a store of academic knowledge to be transmitted during classes (Pedró, 2001).

The teacher as a lecturing expert who is imparting factual knowledge is changing towards a facilitator who enables learning by selecting and applying appropriate methods, helps to solve problems, and enhances dialog (Baumgartner, 1998; Strohmeier, Spiel, Faradji, & Zens, 2003). The traditional *push* orientation is changing towards a *pull* orientation, whereby the students are responsible for their own learning and self-dependent in organizing it. "Learning is not something that happens to students; it is something that happens by students" (Zimmerman, 1989).

2.2.2 A Definition of Self-Regulation

Self-regulation can be defined as "the process whereby students activate and sustain cognitions, behaviours, and affects, which are systematically oriented toward attainment of their goals" (Schunk & Zimmerman, 1994, cited in McMahon & Oliver, 2001). Brooks (1997) emphasizes that self-regulation is active and goal directed, resulting from self control of behaviour, motivation, and cognition.

This mode of learning requires the ability to self-monitor and strategically plan the handling of information and knowledge. These abilities can be referred to as *meta knowledge* (Hesse, 2002) or *meta cognitions* (McMahon & Oliver, 2001). Metacognition can be defined as "knowledge and beliefs about thinking and the factors affecting thinking" (Pressley, 1998, cited in McMahon & Oliver, 2001).

2.2.3 A Model of Self-Regulation

There exist a large number of models explaining self-regulation, such as Phenomenological, Social Cognitive, Volitional, Vygotskian, and Cognitive Constructivist Theories (Zimmerman, 1989). The focus here is on a framework of McMahon and Oliver (2001), combining cognitive, affective, and en-

Figure 1.*Model of Self Regulation (SR), McMahan & Oliver, 2001*

Environment & Context		
Cognitive Domain	SR	Affective Domain
Metacognition		Self-concept
Self-monitoring		Motivation
Strategy formation		Volitional control strategies

vironmental variables related to online learning environments. This model was selected, since it refers to important components of the learning process in regard to online learning.

In the given model (McMahon & Oliver, 2001), self-regulation is seen as the intersection of self awareness at a cognitive and affective level. The primary processes in this model are metacognition and self concept, causing self monitoring and motivation. The self concept is aligned with self-esteem and is a quite subjective and personal construct. In turn, self monitoring and motivation cause the development of cognitive learning strategies and regulation strategies. Cognitive learning strategies include rehearsal, elaboration, organizational strategies, memorization, imagery, and so on (Weinstein, 1986). These strategies are usually internally developed, whereas regulation strategies have a role in accommodating the environmental and contextual factors. Figure 1 shows a graphic illustration of the model.

The authors refer three important components of the learning process: Activities for self-regulation, resources for self-regulation, and supports for self-regulation. (1) Activities are, for example, reflective journals, problem-based learning, inquiry learning, and authentic activities. (2) Resources are, for example, multiple perspectives, primary sources, instructional games, case studies, and narratives. (3) Supports are, among other things, online discussions, peer-to-peer tasks, tutoring, and self-assessment. The importance of authentic resources that provide multiple perspectives is emphasized by several authors, as suchlike resources can enhance the process of knowledge construction (Cunningham, 1993, cited in Scheuermann, Larsson, & Toto, 2000) and stimulate reflective thinking (McMahon & Oliver, 2001). Encouraging students to solve problems can improve their metacognitive

knowledge and skills (Boekaerts, 1997, cited in McMahon & Oliver, 2001). In order to enhance the level of motivation of the students, activities should be grounded in authentic and relevant situations (McMahon & Oliver, 2001, Cunningham, 1993, cited in Scheuermann et al., 2000).

It is emphasized that, in order to enhance self regulation, it is essential to focus on the process level and to make students become aware of self-regulatory strategies, to provide guidance in using them (McMahon & Oliver, 2001), and to encourage self-awareness of the knowledge construction process (Cunningham, 1993, cited in Scheuermann et al., 2000). Yet, teaching self-regulation is not an easy task. Poor self-regulators aren't likely to be changed quickly. Nevertheless, online learning environments seem to offer good opportunities to train self-regulatory skills (McMahon & Oliver, 2001).

2.3 Virtual Collaboration

Modern learning theories suggest that learning is constructed by humans through collaboration and is not a set of facts. The constructivist view is definitely the most prominent theory in the current literature. It is highly learner-centered and assumes that learning is dependent upon life experience and motivation. Essential for the learning process is the mutual discourse rather than unidirectional reception (Johnson & Johnson, 1991, cited in Wessner, 2003; Slavin, 1993). A brief discussion of the most common learning theories (Behaviourism, Cognitivism, Constructivism) is provided by Baumgartner (1998). Quilter and Weber (2004) summarize these learning theories and others in respect of online learning. Gros (2002) provides a comprehensive summary of constructivist perspectives of online learning.

Collaboration is often equated with cooperation. Both terms refer to a group of people working together on a task. Yet, there are essential differences between collaboration and cooperation. In collaborative learning processes, communication and negotiation are essential, whereas cooperative learning refers to a division of sub-tasks among group members (Gros, 2002; Roschelle & Teasley, 1995, cited in Goodyear, 2001). Dillenbourg provides a clear definition of collaboration: "A situation is termed 'collaborative' if peers are (a) more or less at the same level and can perform the same action, (b) have a common goal, and (c) work together" (Dillenbourg, 1999, cited in Gros, 2002).

The collaborative learning literature shows that collaborative methods have a positive effect on students' achievement (Leung & Chung, 1997; Slavin, 1993; Johnson & Johnson, 1991, cited in Wessner, 2003; Rezaei & Katz, 2003, and cites therein). Collaboration increases student involvement with the subject matter (Hiltz, 1994, cited in Hiltz, 1998), enhances engagement in the learning process (Harasim, 1990, cited in Hiltz, 1998), and promotes student satisfaction (Kerres & Petschenka, 2002). Verbalizing problems provides a good precondition for reflection, since thoughts have to be structured and clearly stated to be understood by the peers. Thus, gaps in one's own knowledge are revealed (Reimann & Zumbach, 2002). Moreover, collaborative learning can improve group organization and teamwork skills (Kerres & Petschenka, 2002). These are essential key qualifications and important for professional development.

True collaboration requires well-designed learning activities (Rezaei & Katz, 2003; Kerres & Petschenka, 2002). As a staff member of the e-learning support center of the University of Vienna, the author was consistently confronted with faculty's concerns about student's lack of participation in on-line discussions and collaborative activities. It is a repeating issue: students don't engage in collaborative and communicative activities when they are not forced to do it. This observation corresponds to Schreiber (2002) and Kerres (2001, pp. 264/265) who also pointed out that interaction has to be designed into the course to happen and does not occur automatically. Whether students collaborate and communicate with their peers is a question of good instructional design and well-designed activities.

2.4 Computer Mediated Communication (CMC)

"The key is to focus on what we can do with IT that we cannot do without it" (Reyes-Méndez, Torres-Velandia, Harrison, & Moonah, 2003). Thus, when designing an online learning environment, it is essential that the use of communication tools is appropriate for the respective learning goals, the learners' needs, and general conditions of students (Jechle, 2003). According to Aufenanger (2002), "[...] the pedagogical sense of using such platforms [virtual learning environments] must fit the communication and cooperation demands of students". An added value of communication media is only obtained when the technology leads to solving an educational concern and pedagogical objectives (Kerres & Petschenka, 2002; Salomon, 2000).

Moreover, one has to consider whether the learner has access to adequate technical equipment (easy access to computers, sufficient internet bandwidth and so on). Otherwise, the learning experience will be frustrating and hence unsuccessful.

Research on CMC is heterogeneous regarding objectives, application, and methods. Furthermore, many theories exist, describing and explaining CMC and its advantages. In the following subsections, a definition of CMC is given and differences of communication media are outlined, considering relevant media theories. Based on these frameworks, advantages and disadvantages of asynchronous computer conferencing tools are discussed.

2.4.1 CMC: Creating Networked Learning Environments

The term *computer mediated communication* relates to the use of internet technology for creating a networked learning environment. According to Goodyear (2001), a *networked learning environment* has the following characteristics:

[...] information and communication technology (ICT) is used to promote connections: between one learner and other learners, between learners and tutors; between a learning community and its learning resources.

Similar to this definition, Moore and Kearsley (1996) describe three types of interaction that foster effective learning in online learning environments: learner-content, learner-instructor, and learner-learner. Accordingly, based on the current literature debate and personal experiences as instructor, Anderson (2003) proposes an *equivalency theorem* of student interactions, which suggests that

sufficient levels of deep and meaningful learning can be developed as long as one of the three forms of interaction (student-teacher, student-student, student-content) are at very high levels. The other two may be offered at minimal levels or even eliminated without degrading the educational experience.

An exploratory study of Driver (2002) supports this assumption by pointing out that small group interaction in a networked learning environment may

lead to overall class satisfaction, even in the absence of students' active interaction with their instructor. Given the limitations of the study due to its explanatory character, it seems that learner-learner interaction in terms of content-related online group discussions may enhance students' class experience. The study suggests that, rather than trying to enhance all types of interaction, instructors may consider focusing on certain types of interaction to enhance students' learning experience, in order to make an efficient use of resources.

In contrast, McKenzie, Mims, and Bennett (2003) suggest that "the proper balance of activities between the instructor, students, and virtual learning groups is essential". Based on a literature review and interviews with effective instructors (the term "effective" being not defined), the authors summarize key dimensions for successful interaction in online learning scenarios. These include the following: getting to know each other (social dimension), group projects (content-related collaboration in small groups), synchronous sessions (enabled by chat or face-to-face meetings), group discussions (reflective content-related discussions), instructor feedback, student centered involvement, and frequently asked questions (support).

2.4.2 Characteristics of Communication Media

Interactions between people in networked learning environments (learner-learner, learner-tutor/teacher) can be characterized to be synchronous, asynchronous, or both. The internet technology provides various tools for facilitating these interactions. According to Friedrich, Hron, and Hesse (2001), these tools can be distinguished between text-based communication (e-mail, discussion forums, mailing lists, chat), technologies that enable audio-visual or audio communication (video conferencing, telephone conferencing), and tools which allow for virtual collaboration (shared whiteboard, cooperative/collaborative writing tools, simulation tools).

The essential characteristic of synchronous communication is the immediacy of mutual interaction (e.g. face-to-face, chat, video conferencing), whereas asynchronous communication allows for greater temporal flexibility (e.g. e-mail, discussion forums).

One of the most widely applied theories of media use is *media richness theory* (Draft & Lengel, 1986, cited in Dennis & Valacich, 1999). *Media richness* assumes that, depending on the medium, the transmitted information

is more or less “rich”, i.e., is able to reduce equivocality and uncertainty of the communication situation. The richness of a medium depends on various media characteristics like multiplicity of cues and immediacy of feedback. According to media richness theory, the richest communication scenario is the face-to-face situation. Video conferencing would be an example for a rich medium, a discussion forum would be a “rich” to a lesser degree. The theory also suggests that leaner media are preferred. Thus, individuals use the leanest medium, which is still able to prevent uncertainty and equivocality.

In contrast, the *theory of media synchronicity* (Dennis & Valacich, 1999) provides a more differentiated view, especially for internet based communication media. It describes differences between communication media in terms of media attributes and their effect on cognitive and social processes in communication situations. *Media synchronicity* is defined as the “extent to which individuals work together on the same activity at the same time; i.e., have a shared focus ” (Dennis & Valacich, 1999). The theory suggests that every medium has a set of characteristics affecting the communication process. These characteristics are:

- (1) Immediacy of feedback
- (2) Symbol variety
- (3) Parallelism
- (4) Rehearsability
- (5) Reprocessability

Immediacy of feedback is the ability of the medium to support rapid bidirectional communication. Immediacy of feedback is highest in a face-to-face situation. Chat, video and audio conferencing also provide for a high level of immediacy of feedback.

Symbol variety is the number of ways in which information can be communicated. Face-to-face situations, video and audio conferences have the potential for high levels of symbol variety.

Parallelism is the number of simultaneous conversations that can take place in a given moment. Many electronic media can be structured to enable a large number of simultaneous conversations. Parallelism is high in groupware tools, chat, email, and discussion boards.

Rehearsability is the extent to which the medium enables rehearsing or fine tuning the message before sending it, in order to assure that the intended

idea is expressed accurately. Rehearsability is high in e-mail communication, discussion boards, and asynchronous groupware tools.

Reprocessability is the extent to which a message can be reexamined or reprocessed within the context of the communication event. Reprocessability is highest in e-mail, discussion boards, and groupware tools.

As can be seen from this description, no one medium is suitable for all communication situations. The media synchronicity theory suggests that the performance in communication processes will be enhanced when the media attributes are aligned with the needs of the specific situation: the individuals, task, and social context – and when these attributes comply with the two primary processes of every group communication process: *conveyance* and *convergence* (Dennis & Valacich, 1999). *Conveyance* refers to the cognitive aspect of communication: information exchange followed by deliberation on its meaning. Hence, individuals focus on the information in order to comprehend it from the individuals' point of view. *Convergence* refers to the social aspect of communication: the development of a shared meaning of information. In this process, individuals are trying to understand each other's views.

Dennis and Valacich suggest that low media synchronicity supports the conveyance process. Hence, communication tools which provide high parallelism, rehearsability, reprocessability, and low immediacy of feedback are appropriate. These tools are commonly associated with asynchronous communication. In contrast, high media synchronicity supports the convergence process, whereas communication environments that allow high immediacy of feedback, symbol variety, and low parallelism, are most suitable.

2.4.3 Discussion Board and E-Mail

Discussion boards and e-mail currently are the most often used communication tools in the context of online learning, referred to as *computer conferencing* tools. These require less technical resources than other media, like video conferencing etc. As asynchronous tools, they provide spatial and temporal flexibility of the participants and allow participants to interact with one another at any place and time convenient for them. Thus, the immediacy of feedback is low. Responding instantaneously to a query is not possible, while temporally prolonged discussions are often annoying

for participants. Furthermore, certain types of symbol systems, like non-verbal behaviour and social cues, are not transmitted. Thus, a perceived lack of social presence is likely (Friedrich et al., 2001). Social presence is described as the ability of learners to feel socially and affectively connected to a community (Hew & Cheung, 2003).

Email and discussion board postings are able to address a large number of individuals. Thus, interaction between individuals of large groups can be managed effectively and discussions are facilitated (Holley, 2002). The rehearsability of discussion boards and e-mail is high. Participants are able to reflect, edit, and revise messages before sending. An in-depth engagement with the subject matter is fostered (Petrides, 2002, cited in Song, Singleton, Hill, & Koh, 2004; Döring, 2002). Asynchronous computer conferencing tools can help students to carefully construct and express their ideas and reflect on the issues that are being discussed (Petrides, 2002, cited in Song et al., 2004; Vonderwell, 2003; Nistor & Mandl, 1997; Garrison & Kanuka, 2004). In contrast to face-to-face situations and diverse synchronous tools, the communication process is recorded. The posted messages are permanent and can be reprocessed. This permanent access to records can foster follow-up discussions that are more thoughtful, reasoned, and supported by scientific evidence (Meyer, 2003; Petrides, 2002, cited in Song et al., 2004; Chizmar & Walbert, 1999, cited in Song et al., 2004).

In summary, media synchronicity of discussion boards and e-mail is low. Hence, based on the media synchronicity theory, these tools support the cognitive aspect of a communication situation (conveyance), i.e. the process of information exchange and individual understanding. Rice (1993) also emphasizes that the intention of the communication plays a major role for assessing the quality of the media. E-mail is considered to be useful for facilitating rapid information exchange, or posing simple queries. In contrast, face-to-face communication is more appropriate for the social dimension of communication and for discussing controversial issues. Face-to-face communications “have energy and enthusiasm that are spontaneous and contagious” (Garrison & Kanuka, 2004).

Given that a social dimension is considered to be important for the learning process (Garrison & Kanuka, 2004; Baum & Albrecht, 2003; Grune, 2000), the deficiencies of asynchronous text-based tools, and subsequent difficulties in virtual communication and collaboration, have to be considered

when designing an online learning environment. In order to benefit from the capabilities of both, asynchronous computer mediated communication and face-to-face communication are used complementary, in what is described as a *blended learning* environment.

2.5 Blended Learning: A Thoughtful Integration of Face-to-Face and Online Learning

In the current literature of online learning, a trend towards blending face-to-face and online learning can be observed. This concept is referred to as *blended learning* (Garrison & Kanuka, 2004; Brunn & Frank, 2002; Reinmann-Rothmeier, 2003) or as *hybrid model of learning* (Kerres & Petschenka, 2002; Kerres, 2001; Jechle, 2003; Young, 2002). Especially in American universities, as a result of negative experiences, the trend toward exclusively online degree programs has decreased. Thus, some colleges turned exclusively online courses into hybrid courses after realizing that some activities are better done in person (Young, 2002). Graham B. Spanier, president of Pennsylvania State University, calls the convergence of online and on-campus teaching “the single-greatest unrecognized trend in higher education today” (cited in Young, 2002). Exemplifying this trend, many well-known institutions of higher learning in the USA, like Harvard University, are moving toward hybrid models of teaching. This trend can also be observed in Europe. The University of Vienna, for example, decided to implement the concept of blended learning on a large scale in 2003.

In contrast to exclusive online courses, internet technology is often used as an add-on, enhancing on-campus face-to-face teaching (see section 2.1). The concept of blended learning is distinguished from both of them. It relies on “the thoughtful integration of classroom face-to-face learning experiences with online learning experiences” and represents a “significant departure from either of these approaches. It represents a fundamental reconceptualization and reorganization of the teaching and learning dynamic” (Garrison & Kanuka, 2004). Accordingly, Brunn and Frank (2002) offer a clear description of a blended learning scenario:

Blended learning implies that already known components of virtual and traditional methods, concepts, and didactical beliefs, both used in isolation or in group work, are being put together to offer a holistic learning experience to the students. This typically integrates virtual study phases and settings where students learn alone or in groups – both virtually and/or traditionally. A holistic learning experience [...] substantially builds on collaborative learning.

Garrison and Kanuka emphasize that blended learning is about rethinking and redesigning the teaching and learning relationship. It is an “*integration* [italics added] of face-to-face and online learning experiences – not a layering of one on top of the other” (Garrison & Kanuka, 2004). As discussed in section 2.4.3, both asynchronous computer conferencing tools and face-to-face communication have their capabilities and disadvantages. In a blended learning scenario, these can be utilized in order to promote critical, creative, and complex thinking skills (Garrison & Kanuka, 2004). Kerres and Petschenka (2002) point out that the goals of face-to-face meetings must change from dissemination of knowledge to interpersonal communication. Hence, in order to build a sense of community and to prevent anonymity and difficulties in subsequent virtual collaboration, a few authors (Garrison & Kanuka, 2004; Kerres & Petschenka, 2002; Viitala, 2003; Mangold, 2003) propose a face-to-face meeting at the beginning of a course. Garrison and Kanuka suggest that, in order to promote higher levels of learning, this sense of community and belonging must be both on a cognitive and social level.

2.6 Summary

The term *e-learning* is very broad and is used for diverse scenarios of teaching and learning. In this context, e-learning implies the use of the internet as medium, including computer mediated communication, collaboration, and self-directed engagement with the subject matter. Currently, most authors use the term *online learning*. In the context of VEL, the term *e-lecturing* is used, defined as the application of e-learning to large scale lectures. The term e-lecturing assumes an environment that integrates internet technology in large scale lectures within the context of higher education, with the goal of providing information, facilitating communication, and fostering the involvement with the subject matter by collaboration and independent learn-

ing. In contrast to exclusive online courses, a mix of virtual and face-to-face learning is utilized.

Modern learning theories, like constructivism, emphasize the drawbacks of traditional lecturing. Traditional lecturing is based on the assumption that knowledge can be passed from the teacher to the students much like a commodity. In contrast, modern views of learning emphasize the importance of the knowledge construction process. Hence, academic teaching is heading for student-centered learning and the importance of autonomous learning is gaining in importance. Self-regulation is not only a way to foster the knowledge construction process, but it is also a key qualification that is important for professional development and should be fostered. Yet, traditional teaching offers limited possibilities to train self-regulation.

Online learning appears to be a remedy in that it is more flexible than traditional learning and thus fosters self-regulation of the students. Interactive collaborative online environments change the roles of teacher and student. The role of the instructor is changed from what was a “lecturing expert” to that of a facilitator and coach, who selects appropriate methods and content, helps to solve problems, and enhances dialog. In order to enhance students’ self-regulation, the online learning environment must include activities and resources which foster the knowledge construction process and stimulate reflective thinking. These are, for example, reflective journals, problem-based learning, and resources including multiple perspectives, instructional games, case studies, and narratives. Activities grounded in authentic and relevant situations enhance student motivation. Another important factor is student support through peers and tutoring.

Discussion and collaboration are essential factors for self-regulated online learning environments. True collaboration affords a group of people working together and having the same goals. It has to be differed from cooperation, a division of sub-tasks among group members. Collaboration in an online environment, especially when asynchronous, is not an easy task and requires well-designed learning activities. When properly designed, collaboration increases student engagement with the subject matter, fosters reflective thinking and thus improves student achievement. Collaboration also promotes student satisfaction in online courses. Student satisfaction is associated with motivation, which is an important factor for learning.

Most prominently, asynchronous computer conferencing tools like discussion board and email are used for the communication and collaboration process. These tools have their advantages and disadvantages. As written asynchronous media, they promote the cognitive aspect of communication, reflective thinking and in-depth engagement with the subject. On the other hand, they are lacking an important social dimension, i. e., the development of a shared meaning of information. The latter process, the social aspect of communication, can be better achieved by face-to-face communication. In order to benefit from the capabilities of both asynchronous computer mediated communication and face-to-face communication, both methods are used complementary in blended learning environments.

Blended learning is a thoughtful *integration* of online learning and face-to-face learning. Thus, face-to-face meetings must change from dissemination of knowledge to interpersonal communication. A face-to-face meeting in the beginning of the course is suggested to promote the process of community building and to prevent anonymity and subsequent difficulties in virtual communication.

3 Evaluation of E-Learning: A Meta-Analysis

The body of literature dedicated to evaluating e-learning has been growing in recent years. Numerous studies from all continents focus on the evaluation of online learning activities. As discussed in chapter 2, online learning is a broad field and includes a great variety of didactical implementations, ranging from a mere add-on to traditional methods up to exclusive online programs. The objectives and methods used in these evaluation studies are highly divergent and comparability of produced research is therefore difficult.

In the following chapter, an overview to evaluation of e-learning is provided. For this purpose, a meta-analysis of 81 studies, dedicated to evaluating online learning from all continents, was undertaken. Current evaluation studies are examined with regard to their objectives and methods, and a few pertinent results are discussed. Section 3.7 draws a conclusion concerning principles for effective online instruction.

3.1 Search Procedures and Selection Criteria for the Studies

The studies were selected by both a systematic and a non-systematic search. The procedures for selection were the following:

1. Most of the studies were retrieved from the database of AACE (Association for the Advancement of Computing in Education) at <http://www.aace.org/dl/index.cfm/fuseaction/AdvancedSearch>. This database is a resource of peer-reviewed and published international journal articles and proceedings papers in the field of educational technology and e-learning and includes ten journals and five conference proceedings¹.

¹Journals: (1) International Journal on E-Learning (IJEL) (2) Information Technology in Childhood Education Annual (ITCE) (3) Journal of Computers in Mathematics and Science Teaching (JCMST) (4) Journal of Educational Multimedia and Hypermedia (JEMH) (5) Journal of Interactive Learning Research (JILR) (6) Journal of Technology and Teacher Education (JTATE) (7) AACE Journal, formerly Educational Technology Review (AACEJ) (8) Contemporary Issues in Technology & Teacher Education (CITE) (9) International Journal of Educational Telecommunications (IJET) (10) WebNet Journal: Internet Technologies, Applications & Issues (WEBNETJ); Proceedings: (1) International Conference on Mathematics / Science Education and Technology (MSET) (2) Society for Information Technology and Teacher Education International Conference (SITE) (3) World Conference on Educational Multimedia, Hypermedia and Telecommunications (EDMEDIA) (4) World Conference on E-Learning in Corp., Govt., Health., & Higher Ed. (ELEARN) (5) World Conference on the WWW and Internet (WEBNETC)

All journals and proceedings of the database were included into the search procedure. The keyword pairs “evaluation” and “e-learning” and “evaluation” and “online learning” were used. In order to confine the results, the additional search criterion “Search in Abstract” was added.

2. The abstracts of the approximately 300 results were manually reviewed and studies were selected according to the following criteria:
 - (1) The studied courses partially or exclusively utilized the internet as medium for teaching and learning;
 - (2) Virtual communication and/or collaboration were integrated into the course to some extent;
 - (3) The studies were conducted in the field of higher education; the samples were graduate and undergraduate students and faculty members. Studies examining university college students were also taken into account;
 - (4) The studies were published from 1997 up to date.

Meta-analyses and studies evaluating more than a single course were also included, regardless of whether the didactical realisation of the courses was described or not.

In several instances, the abstracts did not contain sufficient information to decide whether a study met the criteria, and the entire article had to be obtained.

3. A query of the databases “PsychInfo”, “PSYINDEXplus”, and “ERIC”, using the same keywords (in key phrase), was conducted. The queries of PsychInfo and PSYINDEXplus provided nine results each; the query of ERIC did not provide any results. However, none of the results met the criteria mentioned above.
4. The abstracts of the following journals were reviewed manually with regard to the above mentioned criteria:
 - ▷ The Internet and Higher Education
(<http://www.ingentaconnect.com/content/els/10967516>)
 - ▷ The Journal of Asynchronous Learning Networks
(<http://www.sloan-c.org/publications/jaln/index.asp>)

- ▷ The American Journal of Distance Education
(<http://www.ajde.com/contents.htm>)
- ▷ The Canadian Journal of Learning and Technology
(<http://www.cjlt.ca/archivedissues.html>)

5. Finally, several studies were found by a non-systematic search and by an ad hoc selection of secondary literature.

3.2 Publication Type, Year, Country, Course Type

Reviewed were 40 published conference proceedings papers (49.4%), 31 journal articles (38.3%), and 10 chapters of books compiled by editors (12.3%). To a large extent, the studies were published from 2002 up to date. Only 13 studies were published in the years 1997 to 2001. For details see table 1. Most studies were found in the USA and in Europe, but also in Canada, Australia, Asia, Central America, and South America were represented. Frequencies are presented in table 2.

Twenty-nine studied courses (35.8%) were entirely online courses, 21 courses (25.9%) were blended or hybrid models. Twenty-two (27.2%) evaluated a set of courses. Three studies evaluated online learning within a whole institution (Newland, 2003; Valenta, Therriault, Dieter, & Mrtek, 2001; Aspeden & Helm, 2003), and three studies were meta-evaluations (Roberts & Huffmann, 2003; Allen, Bourhis, Burrell, & Mabry, 2002; Fritze, 2003).

3.3 Samples

The studies were conducted in the field of higher education. The participants were graduate and undergraduate university students and university college students. In several studies, faculty members were included². Several authors also assessed experiences of instructional designers³.

²Sloan, Novikova, Ansorge, & Xu, 2002; J. Kromrey et al., 2004; Wang, 2004; Sugar & Schmidt, 2004; Smith et al., 2004; Schrum & Benson, 2000; Richardson & Turner, 2000; Keeton, 2004; Brown, 2001; Tucker, Montes, Willis, & Blocher, 2002

³J. Kromrey et al., 2004; Smith et al., 2004

Table 1.
Studies by Publication Year

Year	Frequency	%
1997	2	2.5
1998	2	2.5
2000	7	8.6
2001	2	2.5
2002	26	32.1
2003	24	29.6
2004	18	22.2

Table 2.
Studies by Country of Origin

Country	Frequency	%
USA	39	48.1
Canada	2	2.5
Brazil	1	1.2
Central America	1	1.2
Europe ^a	30	37.0
Asia ^b	3	3.7
Australia	2	2.5
Cooperations ^c	3	3.7

^aGermany, UK, Austria, Greece, Finland, Island, Italy, Norway, Switzerland, Turkey, Portugal

^bJapan, Taiwan

^cCanada - Australia, Japan - Australia, USA - Turkey

The sample size of the studies was highly diverse and ranged from small-scale case studies with about 20 participants or less⁴ up to large-scale evaluations of multiple courses with 100, 200, or more participants⁵.

3.4 Evaluation Objectives, Designs, and Methods

The purposes and objectives of the evaluation studies were multifaceted. Most studies examined several objectives and conducted an overall course evaluation, but also targeted issues were investigated. The most frequent objectives are summarized in table 3.

As can be seen from the summarized objectives of the studies, the assessment of students' perceptions, attitudes, and experiences with the on-line learning activity were the most prevalent goals. Students' satisfaction and students' learning (outcomes and processes) were also investigated fre-

⁴e.g. Stokes, 2000; Vonderwell, 2003; Johnson, Aragon, & Shaik, 2000; Müller, 2003; Viitala, 2003; Murphy, Drabier, & Epps, 1998; Nistor & Mandl, 1997; Maraschin, Costa, & Pacheco, 2002; Cryan, Mentzer, & Teclhaimanot, 2004; Curtis, 2002

⁵e.g. Newland, 2003; Bolliger & Martindale, 2004; Allan & Lawless, 2003; Glenn, Jones, & Hoyt, 2003; Roberts & Huffmann, 2003; Lorenzen-Huber, 2003; Williams & Pury, 2002; Horz et al., 2003; Richardson & Turner, 2000; J. Kromrey et al., 2004; Baker, 2004; Hesse & Giovis, 1997

quently, as were online communication, online collaboration, and online interaction. A large number of studies intended to optimize the course or program (formative evaluation), while only a few specified this purpose explicitly.

The research designs of the selected studies ranged from descriptive case studies up to randomized field experiments. However, the bigger part of the studies (47 studies, 58.0 %) were exclusively descriptive in nature, without pretests or comparison groups. This result is not surprising, since evaluation helps to identify problems and to optimize the quality of a given program. The primary goal of evaluations is to improve new initiatives and not to gain scientific insights (Reinmann-Rothmeier, 2003). Thus, in most of the selected studies, descriptive methods were used at least as a supplement to more elaborate research designs. Frequencies of the used research designs are presented in table 4.

Out of a total of the selected 81 studies, 39 (48.1 %) used both qualitative and quantitative methods, 14 studies (17.3 %) were exclusively qualitative, and 28 studies (34.6 %) exclusively used quantitative methods. The common methods of data collection were questionnaires, student performance measures, interviews, focus groups, observations, content-analyses, feedback sheets, verbal student feedback, and learning diaries. In the most instances, a multi-method approach was used and different methods were combined (43 studies, 53.1 %). These methods mostly combined quantitative and qualitative data collection.

As singular method of data collection, 27 studies (33.3 %) used Likert-scaled questionnaires, mostly with additional open-ended questions. Three studies (Maraschin et al., 2002; Chester & Gwynne, 1998; Hesse & Giovis, 1997) used content-analysis as singular data collection method. One study (Vonderwell, 2003) exclusively used qualitative in-depth interviews, and one study (Rekkedal & Quist-Erikson, 2004) conducted quantitative and qualitative structured phone interviews for data collection. One study used a focus group (Müller, 2003) and one study used course performance (Curtis, 2002) as singular evaluation method. In four papers, the method of data collection was not presented.

Table 3.
Studies by Evaluation Objectives

Objective	References
students' perceptions of and attitudes towards the course ^a	Kim & Hudson, 2002; Janes, 2002; Hannigan & Davies, 2004; Inan & Yukselturk, 2004; Cryan et al., 2004; Yueh & Lin, 2003; Belvin, 2003; Yang, Lohr, & Ku, 2003; Garreck et al., 2002; Viitala, 2003; Valenta et al., 2001; Holley, 2002; Hatzipanagos et al., 2003; Williams & Pury, 2002; Konradt, Marsula, & Rakuljic, 2002; Song et al., 2004
perceptions of instructors	Schrum & Benson, 2000; Smith et al., 2004; Sloan et al., 2002; Richardson & Turner, 2000
students' experiences with various elements of a course	Vonderwell, 2003; Uskov, 2003; Hendriks & Maor, 2003; Aufenanger, 2002; Nistor & Mandl, 1997
experiences with using virtual learning environments in general	Richardson & Turner, 2000
student satisfaction and student acceptance	Kim & Hudson, 2002; Inan & Yukselturk, 2004; Cryan et al., 2004; Lorenzen-Huber, 2003; Bolliger & Martindale, 2004; Allen et al., 2002; Driver, 2002; Johnson et al., 2000; Mandl & Winkler, 2002; Thurmond, Wambach, & Connors, 2002; Thurmond, 2003; Nistor & Mandl, 1997

^aIn these studies, the authors focused their investigation on students' perceptions and attitudes explicitly as a purpose of the study. Considering the used research methods in the selected studies (see below), it is safe to say that evaluation studies of online learning activities largely assess students' attitudes and perceptions.

table continues

continued

Objective	References
learning outcomes	Cryan et al., 2004; Lu, 2004; Terashima, Ikai, Yoshida, Kamei, & Kubota, 2004; Hatzipanagos et al., 2003; Mandl & Winkler, 2002; Johnson et al., 2000; Neuhauser, 2002; Lorenzen-Huber, 2003; Nistor & Mandl, 1997; Curtis, 2002; Picciano, 2002
learning processes	Yun, 2004; Gabriel & MacDonald, 2002; Richardson & Turner, 2000; Baker, 2004
comparison of online learning and face-to-face learning in respect of various issues	Cryan et al., 2004; Sugar & Schmidt, 2004; Allen et al., 2002; Konradt et al., 2002; Johnson et al., 2000; Neuhauser, 2002; Glenn et al., 2003; Lorenzen-Huber, 2003; Curtis, 2002; Glowalla, Glowalla, & Kohnert, 2002
optimizing and redesigning the course (formative evaluation) ^b	Terashima et al., 2004; Yun, 2004; J. Kromrey et al., 2004; Lorenzen-Huber, 2003; Mandl & Winkler, 2002; Müller, 2003; Kaiser & Taubmann, 2003; Horz et al., 2003; Schmidt, 2000; Tucker et al., 2002

^bIn these studies, the purpose of optimizing the course was stated explicitly. Considering the research methods of the selected studies, it is evident that the majority of studies aimed to collect data in order to optimize the learning activity, or program.

table continues

continued

Objective	References
online communication	Vonderwell, 2003; Brunn & Frank, 2002; Stokes, 2000; Murphy et al., 1998; Nistor & Mandl, 1997
online collaboration	Serce & Yildirim, 2003; Sumner & Hostetler, 2002; Warrick, Connors, & Norton, 2004; Williams & Pury, 2002; Allan & Lawless, 2003; Murphy et al., 1998; Nistor & Mandl, 1997
online interactions	Driver, 2002; Glenn et al., 2003; Picciano, 2002; Murphy et al., 1998; Hesse & Giovis, 1997
online community & social presence	Brown, 2001; Tu & McIsaac, 2002; Chester & Gwynne, 1998; Picciano, 2002

3.5 Relevant Evaluation Results

Due to divergent didactical designs, objectives, and technical realisation of the courses, as well as heterogeneous samples and research designs, comparing the present studies is challenging. However, the results are relatively consistent. The sample sizes and sample characteristics of the studies discussed in the following section are summarized in table 5.

3.5.1 Learning Outcomes: Comparison of Traditional and Online Courses

Numerous studies focused on the measure of learning outcomes of web based courses. Differences in the types of courses, instructional design, self-selected groups, and other factors, make comparison of online versus traditional courses difficult (see also Glenn et al., 2003). In the most cases, the studies included in the present analysis revealed no differences between online and web based courses.

In order to eliminate most of the interfering variables, Glenn et al. (2003) selected eight course pairs of undergraduate college courses at a US university college, meeting the following criteria: (1) The course was taught both

Table 4.
Studies by Research Design

Design	Frequency	References
Descriptive ^a	47	Studies are not listed due to large number
Pre-post: one group, two measuring points	8	Psaromiligkos & Retalis, 2003; Garreck et al., 2002; Stokes, 2000; Uskov, 2003; Kaiser & Taubmann, 2003; Murphy et al., 1998; Nistor & Mandl, 1997; Martins, Carvalho, Azevedo, & Ribeiro, 2002
Quasi-experimental: one group, three or more measuring points	4	Persico & Delfino, 2004; Inan & Yukselturk, 2004; Smith et al., 2004; Newland, 2003 (longitudinal study)
Quasi-experimental: comparison of different groups	9	Wang, 2004; Lu, 2004; Sugar & Schmidt, 2004; Lorenzen-Huber, 2003; Keeton, 2004; Johnson et al., 2000; Neuhauser, 2002; Glenn et al., 2003; Curtis, 2002
Randomized field experiment	3	Kim & Hudson, 2002; Cryan et al., 2004; Sumner & Hostetler, 2002
Cross-sectional design (Correlational study)	6	Thurmond, 2003; Thurmond et al., 2002; Valenta et al., 2001; Bolliger & Martindale, 2004; Baker, 2004; Tu & McIsaac, 2002
Meta-analysis	3	Roberts & Huffmann, 2003; Allen et al., 2002; Fritze, 2003

Note: One paper did not contain information about the research design.

^aIn most of the selected studies, descriptive methods were used at least as a supplement to more elaborate research designs. These 47 studies used *only* descriptive methods.

in traditional and online format during the same semester; (2) *WebCT* was used as the online course management and delivery platform; (3) The same instructor taught both classes during the semester; (4) both courses had identical structure, in that the content, assignments, and exams were identical; (5) Course enrollment exceeded 10 students per section. The total sample size (all eight course pairs) included 522 participants. The results showed that in only one case, students of online courses significantly scored higher on the exams than students of traditional courses.

Cryan et al. (2004), Neuhauser (2002), and Johnson et al. (2000) found similar results. Cryan et al. randomly assigned 42 students, enrolled in the Bachelor of Education in an Early Childhood Education program at a US College of Education, to a web-based and a traditional section of a course, thereby eliminating the selection bias. The learning outcomes of both the traditional and the online group were equal. Neuhauser and Johnson et al. also compared two sections of the same course (without random assignment of the students) and found no differences in outcomes. Both the online and the traditional section of the course were taught by the same instructor.

The discussion about differences in learning outcomes, when using different media as mode of delivery, is not novel. A considerable quantity of studies consistently showed that learning outcomes do not differ significantly when employing different media. This phenomenon is known as the “no significant difference phenomenon” (Russell, 1999). Media generally do not influence the learning outcomes that are measured in terms of grades and test scores. However, effective learning outcomes not only relate to grades, but also to key qualifications like teamwork skills, media competence, knowledge management skills, and the ability of self-regulated learning.

3.5.2 Communication and Collaboration: A Need for Blended Learning

A large number of articles focused on communication and collaboration (see table 3). The articles ranged from descriptive case studies up to randomized field experiments. The most pertinent results are discussed in the following.

Sumner and Hostetler (2002) investigated perceived advantages and disadvantages of face-to-face decision-making versus email conferencing. The participants, 48 students in a senior-level information systems design project

class at a US university, were randomly assigned to the two different groups, thereby eliminating the selection bias. Most of the advantages of face-to-face communication pertain to having an opportunity to clarify ideas, to establishing personal contact, to gaining immediate feedback that speeds up the decision-making process, and to convenient scheduling. Face-to-face communication reduces confusion, fosters the development of a common focus, and helps to clarify ideas in detail. Inconveniences associated with fixed meeting times were perceived as a disadvantage. In contrast, the advantages of email conferencing were associated with flexibility and convenience. The disadvantages related to a prolonged response time, technical complications, barriers to clarify ideas, and lack of personal interaction. In contrast, Viitala (2003) reported that students did not consider online discussions problematic in any way. The participants were students enrolled in Higher Vocational Teacher Education in Finland. At the beginning of the course, a face-to-face session was scheduled, which allowed students to become acquainted and to initiate group formation. The initial face-to-face session may explain the reported ease of computer conferencing. Once personal face-to-face contact has been established with fellow students, online interaction seems to be more natural, meaningful, and motivating (Viitala, 2003). Schmidt (2000) also reported that participants, being students enrolled in Applied Linguistics in a German university, had difficulties in collaboration with fellow students of a group when no prior face-to-face contact had occurred. Brunn and Frank (2002) also found similar results. Students in this study, being German university students, stated that misunderstandings were less likely to occur, when being personally acquainted with their fellow students.

A sense of community seems to be essential for collaboration. Song et al. (2004) reported that students complained about a lack of community of the given web based course at a US university. Several students indicated that having a face-to-face meeting in the beginning of the course would have facilitated the process of community-building. Mandl and Winkler (2002), Nistor and Mandl (1997), and Richardson and Turner (2000) also pointed out that the students in the given courses perceived a lack of personal contacts. Also in the study of Garreck et al. (2002) the loss of face-to-face learning opportunities was complained by several participants, being first year students of the Master of Continuing Education program at a Canadian university. Many students in the study of Schmidt (2000) and Yang

et al. (2003) missed lively discussions and personal exchange. In contrast, Vonderwell (2003) reported that participants, being undergraduate students at a US College of Education, stated that the online environment gave them the advantage of “anonymity”, which allowed them to pose more questions to the instructor. Thus, computer mediated communication improved the communication between the students and the instructor in the online class. This result corresponds to the study of Chester and Gwynne (1998). They examined anonymous collaboration by employing pseudonyms in the online environment. The participants in the given study were undergraduate students enrolled in a Liberal Arts program at an Australian university. The results indicated that, compared to face-to-face classes, two thirds of the students increased their participation relating to the subject matter. This indicates that online communication can give students a strong voice, especially those, who are more reluctant to make contributions in a large classroom.

When compared to virtual teams, Sumner and Hostetler (2002) found that face-to-face teams, enrolled in a US systems design project class, reported greater satisfaction with the decision-making process when working on their team assignments. The authors suggested that the higher level of satisfaction may be attributed to the personal relationships developed through the face-to-face meetings, and the opportunity to more quickly bring the process to a conclusion. Considering lacking personal relationships, the study of Brown (2001) pointed out that students utilizing computer mediated communication indicated that it generally took a longer period of time to create bonds of friendship, a sense of community or camaraderie, compared with face-to-face associations. The participants in the given study were graduate distance learning students at a US university. Mandl and Winkler (2002) also observed this phenomenon when investigating German university students enrolled in Empirical Pedagogy and Pedagogical Psychology. In the study of Brown (2001), the students who developed a sense of community, generally were these who achieved a satisfactory comfort level regarding technology, pedagogy, class content, and class mates. The students who did not feel comfortable with certain aspects of the course reported they had not developed a sense of community.

These results showed that computer mediated communication lacks important elements of communication related to social contact. However,

asynchronous discussions can promote reflective in-depth thinking. Sumner and Hostetler (2002) reported that teams using computer conferencing for accomplishing project activities significantly outperformed the face-to-face teams in all dimensions of performance. The dimensions of performance included decision quality, analytical strength, technical strength, research base for drawing conclusions, and effectiveness of the group presentation. In the given study, the group members were randomly assigned to two different groups (face-to-face or computer conferencing) including similar activities. Only the mode of communication differed between the groups. Thus, the results seem to be related to the process of decision-making in computer conferencing. Sumner and Hostetler explained this result in the following ways: First, electronic communications were recorded and provided a shared group memory. Second, the electronic transcripts of the computer conferences indicated that students spent more time constructing their ideas and reflecting on the issues being discussed. Nistor and Mandl (1997), Murphy et al. (1998), and Vonderwell (2003) also pointed out that students' communication in the virtual seminar were perceived to be more reflective than in traditional seminars. "Students expressed that writing in the asynchronous environment helped them to carefully construct and express their ideas" (Vonderwell, 2003). Moreover, online discussions seem to be more task oriented than face-to-face interactions. Serce and Yildirim (2003) examined online collaboration in a course offered in a graduate program at the Informatics Institute of a Turkish university. A document analysis revealed that discussions were task oriented and social interaction between the participants did not take place. All the students in Vonderwell's (2003) study also perceived communication in the online environment to be less personal than in face-to-face classes.

Generally speaking, it seems that blended learning scenarios are able to combine the advantages of both online collaboration and face-to-face meetings. Apparently, students still feel more comfortable with traditional classroom settings. This is not surprising, since virtual asynchronous communication does not correspond to previous learning experiences. Online communication requires skills which were not previously trained. These skills refer to time management, self-discipline, independent learning, active information seeking, and constructing knowledge (Stokes, 2000).

3.5.3 The Role of Faculty in a Collaborative Online Environment

Faculty in an collaborative online environment are expected to give immediate feedback (Serce & Yildirim, 2003; Garreck et al., 2002; Keeton, 2004; Vonderwell, 2003; Thomas & Whittington, 2004). Keeton (2004) assessed highly effective instructors regarding online teaching⁶ and found that students in online courses expect faculty to make themselves more promptly available than students in traditional courses. Students expect immediate feedback from questions, comments and assignments. Garreck et al. (2002) reported that participants, being first-year students at a Canadian university, considered the following points as critically important, specially for the first online course experience: (1) Create a balance between sharing the instructor's expertise and empowering students; (2) Communicate clear expectations; (3) Give timely feedback to questions; (4) Keep on top of the process of the course. These results accord to Serce and Yildirim (2003). They also pointed out the importance of immediate feedback, keeping discussion alive, monitoring group activities and motivating learners. Vonderwell (2003) found in her qualitative interviews with university college students, enrolled in an Educational Technology course, that the social and pedagogical presence of the instructor is essential for improved communication and learning. The findings of the study imply that instructors should be consistent with the lapse of time within which they provide feedback or respond to students. Inconsistency can cause student frustration and decrease their motivation. In the study of Keeton (2004), communication of students with the instructor was also a prevalent theme that emerged from analyzing the responses of the assessed instructors. Accessibility, responsiveness, and being organized in terms of communicating with students were perceived to be important by the instructors⁶.

All these results point to the importance of effective instructional design. Hara and Kling (2000) found that students needed clear instructions, background information, or even explicit definitions of terms. Students, enrolled in an Educational Technology course at a US university, wanted to know what was expected of them and they were frustrated and reported confusion and anxiety when they found ambiguous instructions. The instructor's intent was to give the students flexibility. However, students wanted more

⁶These online instructors had either received teaching excellence awards, or scored 4.75 or higher on students evaluations of instruction in the courses

structure and clear direction. Song et al. (2004) and Garreck et al. (2002) reported similar results, which indicated that it is important for students to have goals and objectives stated clearly. Keeton (2004) also found the instructional principle “make learning goals and one or more paths to them clear” to be actively used by instructors identified as highly effective regarding online teaching.

3.5.4 Flexibility and Self-Regulated Learning

Flexibility is one of the most frequently mentioned advantages of online learning. Plenty of articles reported that students liked the flexibility of the online course and perceived this as an advantage (Yang et al., 2003; Valenta et al., 2001; Stokes, 2000; Song et al., 2004; Mandl & Winkler, 2002; Konradt & Krebs, 2000; Müller, 2003; Kaiser & Taubmann, 2003). However, flexibility is linked to personal responsibility and self-directed learning. The findings in the study of Richardson and Turner (2000) imply that students need to have well-developed time-management practices and possess the skills for independent learning in order to benefit from the flexibility of an online environment. The authors found that students at a UK university who had developed sophisticated time-management practices tended to have a more positive perception toward using an online learning environment. Also, students who enjoyed independent learning activities had a more positive perception of learning through an online learning environment. Song et al. (2004) also reported that students perceived time management as contributing to the success in an online learning environment. The findings of Stokes (2000) suggested that students’ abilities related to time management, self-discipline, independent learning, active information seeking, and constructing knowledge must exist when taking online courses.

Yet, students’ self-regulated learning skills often seem to be poorly developed. The input evaluation of the VIROR-project, evaluating multiple web-based or web-enhanced courses of diverse German universities, showed that students generally were lacking skills of constructing knowledge through reflection (Horz et al., 2003). Accordingly, Stokes (2000) also reported that one of the two greatest frustrations of the students was learning to work independently in constructing knowledge. Müller (2003) also revealed that students, enrolled in a German university, had problems with independent learning and asked for more mandatory elements of the given virtual sem-

inar. The students' wish for a more mandatory use of the tools was also reported by Kaiser and Taubmann (2003). Holley (2002) identified a gap between instructors' guidance and students' autonomous learning. Even though in their third year of their studies, the undergraduate university students in the given study were not comfortable with a change towards independent learning. It is noteworthy that professional part-time students did not have these concerns.

3.5.5 Media Competence and Technology

Many authors have reported that some students experience challenges and problems with technology (Aufenanger, 2002; Hara & Kling, 2000; McAlpine & Goddard, 2002; Song et al., 2004; Gabriel & MacDonald, 2002; Allan & Lawless, 2003; Sumner & Hostetler, 2002) and lacked basic IT skills (Stokes, 2000; Holley, 2002; Schmidt, 2000; Gabriel & MacDonald, 2002). Garreck et al. (2002) reported that it was difficult for students to master the technology, while at the same time learning the content. Learners indicated that these tasks needed to be handled consecutively, not concurrently. Holley (2002) suggested that there is a need for IT training for students, even when they expressed confidence and were motivated. Accordingly, Thomas and Whittington (2004) identified a need for students' training in the use of the technology. Students expressed a desire to have some experience with the courseware before actually using it to receive instructions. In general, it seems that students still lack experience with online learning. However, more positively, McAlpine and Goddard (2002) reported that, as students progressed through several courses, their ability to work together in virtual teams improved.

3.6 Summary

The present review included 81 papers dedicated to evaluate online learning from all continents. The evaluated courses partially or exclusively utilized the internet as medium for teaching and learning and realized virtual communication and/or collaboration to some extent. Most of the studies were published as conference proceedings papers (49.4%), 38.3% of the papers were journal articles, and 12.3% were chapters of books compiled by editors. The studies were published from 1997 up to date. Most of the studies were

published in 2002 up to date (83.9%). Most authors came from universities of the USA (48.1%) and European universities (37.0%).

The purposes of the evaluation studies were multifaceted and ranged from overall course evaluations to issue-targeted studies. The most prevalent purpose of the studies was the assessment of university students' perceptions and attitudes, and experiences with the learning activity. Moreover, student satisfaction and student achievement were also frequently investigated. Communication and collaboration was also a prevalent purpose.

The research designs ranged from descriptive case studies up to randomized field experiments. The common methods of the studies were questionnaires, student performance measures, interviews, focus groups, observations, content-analysis, feedback sheets, verbal feedback, and learning diaries. Small scale case studies with about 20 participants or less were complemented by large scale studies of multiple courses with 100, 200, or more participants.

Although methods and evaluation objects differed, the results of the evaluation studies were relatively homogenous.

Comparing traditional and online courses, in the most cases, no differences in learning outcomes were found. However, online learning does have an effect on the learning process. Online learning is perceived to be flexible. A large number of papers reported that students liked the flexibility and convenience of online learning. Hence, flexibility causes more self-dependent and autonomous learning. Yet, the results showed that students still are not used to self-directed learning and they experience it as a challenge.

Interaction and collaboration between students is an important factor of online learning. Many articles focused on evaluating virtual communication and collaboration. The results showed that online learning is lacking important elements of communication concerning social contacts. Students are missing social contacts and relationships with fellow students. They have difficulties in virtual collaboration with fellow students they do not know personally. In a few studies, the students complained about the loss of face-to-face contacts. However, virtual collaboration has its advantages, besides flexibility and fostering self-dependent learning. It was shown that virtual collaboration can enhance deep and reflective engagement with the content. Online teams outperformed face-to-face teams in all of the dimen-

sions of performance, such as decision quality, analytical strength, technical strength, research base for drawing conclusions, and effectiveness of the group presentation.

It seems that blended learning is able to combine the advantages of online learning and face-to-face learning. Students still feel more comfortable with the traditional learning environment and a loss of face-to-face contacts negatively impacts student satisfaction.

Online instructors are expected to be more promptly available than it is expected from instructors in a traditional environment. Providing immediate feedback and responding to questions in a timely fashion seems to be essential for student satisfaction. Another critical aspect to consider is that online instructions have to be more explicit and clearly stated. The results showed that students depend on clear instructions and direction. Students want to know what is expected from them; otherwise they are likely to be confused and anxious.

Technology seems to present a challenge to a multitude of students. Many articles reported that students had technical difficulties and lacked important IT skills. The conclusion can be drawn that technical training is essential for online courses.

3.7 Conclusion: Principles of Effective Online Instruction

Presently, technology has taken a back seat in the literature discussion and the focus has moved towards pedagogy and didactics. The “no significant difference” discussion, shaped by Russell (see Russell, 1999), also clearly shows that media itself do not influence learning outcomes. It’s the pedagogy that counts, not the tools. As Serce and Yildirim (2003) concluded, “It is possible to fill the lacks in technology with instructional mode, but it is not possible to fill drawbacks in instruction with technology”.

Many articles in the current literature are concerned with the question of effective online pedagogy. A number of theories attempt to explain learning and thus are suggesting pedagogical settings (e.g. the Constructivist Learning Theory, raised in section 2.3). This section tries to summarize important findings for effective online learning. “Effective” in this context does not only imply specific learning outcomes that are associated with factual knowledge. Effective learning stands for a process, which enhances reflective thinking and application of factual knowledge to real-life problems and in-

creases the engagement with the subject matter. Moreover, effective online instruction ought to result in the development of important key skills, such as self-regulated learning and teamwork skills (Spiel et al., 2004).

Effective online instruction is based on the same principles as effective face-to-face teaching. The American Association of Higher Education developed seven principles for good practice (Chickering & Ehrmann, 1996, cited in Quilter & Weber, 2004; Chickering & Gamson, 1987, cited in Keeton, 2004):

- ▷ Encourage contacts between students and faculty.
- ▷ Develop reciprocity and cooperation among students.
- ▷ Use active learning techniques.
- ▷ Give prompt feedback.
- ▷ Emphasize time on task.
- ▷ Communicate high expectations.
- ▷ Respect diverse talents and ways of learning.

However, a great difference between face-to-face and online instruction, especially when asynchronous, is the need of students' self-regulation. According to Vonderwell (2003), students in online learning environments need to become active learners and develop active learning strategies. Hence, courses need to be designed to scaffold the development of learners' self-regulatory skills rather than just to achieve specific learning outcomes (McMahon & Oliver, 2001). Online learning, if properly designed, provides a good opportunity for fostering these skills. Reasonable online activities and resources that foster self-regulation are, for example, problem-based learning, assignments requiring reflective thinking, real-life problems, and complex resources including multiple perspectives, case studies and instructional games. Moreover, an important factor is support from peers through discussion and teamwork, and tutoring (McMahon & Oliver, 2001).

Especially for online learning, facilitating teamwork is a critically important dimension. Since online learners don't meet at fixed class times like traditional learners, the social presence of the instructor and the peers is diminished and the risk of feeling isolated is high. Hence, a decrease of motivation and involvement is likely, which in turn negatively affects the learning outcomes (Hiltz, 1998).

Considering the constructivist learning theory, collaborative teamwork increases the engagement with the subject matter through discourse, fosters reflective thinking, and thus helps to improve the learning process. Written asynchronous discourse with peers can improve critical and more reflective thinking (Sumner & Hostetler, 2002; Nistor & Mandl, 1997; Murphy et al., 1998; Vonderwell, 2003). Yet, a large number of studies showed that virtual communication lacks an important social dimension (Mandl & Winkler, 2002; Nistor & Mandl, 1997; Richardson & Turner, 2000; Garreck et al., 2002; Schmidt, 2000; Yang et al., 2003). For collaborative learning environments, personal contacts appear to be important in order to build a sense of community more easily (Song et al., 2004; Mandl & Winkler, 2002; Nistor & Mandl, 1997; Richardson & Turner, 2000). Face-to-face meetings can help avoiding subsequent difficulties in written asynchronous communication (Schmidt, 2000; Brunn & Frank, 2002).

Hence, many authors recommend a blended learning scenario, a thoughtful integration of the advantages of face-to-face and online communication. The focus of face-to-face meetings in blended learning scenarios must focus on interpersonal communication (Kerres & Petschenka, 2002) rather than on lecturing in the traditional “instructor-as-expert” and “student-as-recipient” fashion. An important goal of face-to-face sessions should be on building community and students’ becoming acquainted with each other (Garrison & Kanuka, 2004; Kerres & Petschenka, 2002; Viitala, 2003). As a result, the roles of students and faculty in interactive online courses change. Students become active in constructing knowledge rather than passively receiving information. Instructors, traditionally the lecturing experts, are becoming facilitators and coaches of the learning process (Strohmeier et al., 2003).

Instructors in online learning environments are expected to provide immediate feedback to questions, more than it is expected from instructors in traditional environments (Serce & Yildirim, 2003; Garreck et al., 2002; Keeton, 2004; Vonderwell, 2003; Lieblein, 2000). Availability and feedback should be provided in a timely fashion and inconsistency should be avoided. Inconsistency causes frustration and decreases students’ motivation (Vonderwell, 2003; Lieblein, 2000). Accessibility, responsiveness, and being organized in terms of communicating with students appear to be important factors for good instructional design (Keeton, 2004). Moreover, the

social and pedagogical presence of the instructor is essential for improved communication and learning (Vonderwell, 2003).

Effective online instructional design implies explicit and clear instructions. Online instructors do not have the possibility for on-the-fly adaption like in traditional settings. Ambiguity causes frustration, confusion, and anxiety (Hara & Kling, 2000). In online environments, it is critically important to very carefully design written instructions in order to provide a structure and communicate clear expectations and learning goals (Song et al., 2004; Garreck et al., 2002; Keeton, 2004).

Research has shown that, in most cases, students are not yet familiar with online learning and thus experience several difficulties, ranging from technical problems like lacking IT skills to problems with virtual communication and difficulties with self-regulated learning. Effective online instructional design considers students' preconditions and provides support in acquiring the required skills.

Table 5.*Sample Characteristics of Studies*

Author/Year	Sample Size	Institution & Sample Characteristics
Allan & Lawless, 2003	50	Two student cohorts of the Open University Business School, Milton Keynes, UK: 30 MBA students studying for a management diploma on a year long distance learning course; 20 students on a 18-day course as part of their management certificate program
Aufenanger, 2002	80	Students of a Teacher Education course at Hamburg University, Germany
Brown, 2001	24	21 distance learning graduate students, 3 distance learning faculty members, USA
Brunn & Frank, 2002	no info	Context of the project “Virtual Operations Research/Management Science (VORMS)”, Germany
Chester & Gwynne, 1998	20	Undergraduate students of a Liberal Arts program at the RMIT University, Melbourne

table continues

continued

Author/Year	Sample Size	Institution & Sample Characteristics
Cryan et al., 2004	42	Students enrolled in the Bachelor of Education in Early Childhood Education program at a US College of Education; traditional course: $n = 24$; web-based course: $n = 18$ The unequal sample sizes resulted from drop-outs
Gabriel & MacDonald, 2002	50	Students of an online MBA program of western Canada
Garreck et al., 2002	no info	First year students of the Master of Continuing Education program at the University of Calgary, Canada
Glenn et al., 2003	522	Eight course pairs of undergraduate college courses at the Utah Valley State College, USA; average enrollment of the online courses: $n = 32$; average enrollment of the traditional courses: $n = 33$
Hara & Kling, 2000	6	Educational Technology course (distance course) at a major US university

table continues

continued

Author/Year	Sample Size	Institution & Sample Characteristics
Holley, 2002	103	Students of a Purchasing and Logistics course; two student cohorts: third year undergraduate students and part-time students of procurement professionals
Horz et al., 2003	no info	multiple courses in the context of the project VIROR, German universities
Johnson et al., 2000	38	Students of a graduate level Instructional Design course for Human Resource Development professionals at the University of Illinois, USA; students of a traditional (on-campus, full time students: $n = 19$) and online section (distance students, $n = 19$) of a course
Kaiser & Taubmann, 2003	20	Students of a Gender Studies course; the students were enrolled at diverse German universities and a technical college (FH)
Keeton, 2004	8	Faculty members at University of Maryland University College, USA; these faculty members were instructors who had either received teaching excellence awards, or scored 4.75 or higher on students evaluations of instruction in the courses

table continues

continued

Author/Year	Sample Size	Institution & Sample Characteristics
Konradt & Krebs, 2000	25	undergraduate students enrolled in Psychology at a German university
Mandl & Winkler, 2002	no info	Students at the Institute of Empirical Pedagogy and Pedagogical Psychology at a German university
McAlpine & Goddard, 2002	no info	Master of Agribusiness program at University of Melbourne, Australia
Müller, 2003	10	Students enrolled in a political science course at the University of Fribourg, Germany
Murphy et al., 1998	10	9 graduate students and instructor of the class Management of Instructional Telecommunications Systems at the Texas A & M University
Neuhauser, 2002	62	Students of a Principles of Management undergraduate course of the School of Business at Madonna University, USA; traditional section: $n = 25$; web-based section: $n = 37$
Nistor & Mandl, 1997	16	Students of a seminar of the Institute of Pedagogical Psychology and Empirical Pedagogy at the University of Munich, Germany

table continues

continued

Author/Year	Sample Size	Institution & Sample Characteristics
Richardson & Turner, 2000	292	Students at Staffordshire University, UK, participants of several courses
Schmidt, 2000	376	Students of the Institute of Applied Linguistics at the University of Hildesheim, Germany
Serce & Yildirim, 2003	18	16 students, instructor, and assistant, enrolled in a course offered in a graduate program at the Informatics Institute at the Middle East Technical University, Ankara, Turkey
Song et al., 2004	76	Students at the University of Georgia, USA; 71 participants were aged 20–50 and 5 participants were over 50 years old
Stokes, 2000	13	Graduate students entering a Master of Science in Education degree program, Introductory Technology Skills course of the College of Education at Troy State University, USA
Sumner & Hostetler, 2002	48	Senior-level Information Systems Design project class, University of Illinois, USA

table continues

continued

Author/Year	Sample Size	Institution & Sample Characteristics
Thomas & Whittington, 2004	20	Participants of the Online Masters in Education program at the University of the West Indies Mona Campus, Central America
Valenta et al., 2001	74	Students from the University of Illinois Chicago: 20 traditional undergraduate students enrolled in an Introductory Psychology class (average age 19) and 54 non-traditional graduate students, Health Informatics specialization (average age 36)
Viitala, 2003	18	Students at the Oulu School of Higher Vocational Teacher Education, Finland
Vonderwell, 2003	22	Undergraduate Educational Technology course at the College of Education of a large midwestern university, USA
Yang et al., 2003	53	Graduate students of an Instructional Design course in the western area of the United States

4 Vienna E-Lecturing (VEL)

At present, the conditions of the Faculty of Psychology at the University of Vienna are characterized by an unfavourable ratio between faculty and the number of students. Large scale lectures and crowded lecture rooms are common. A fixed time schedule of courses prohibits the participation of students pursuing concurrent employment. As discussed in section 2.2, the learning outcomes of traditional lectures are not satisfying, since they concentrate on the achievement of mere factual knowledge and rarely include discourse of the subject matter. Traditional lectures do not focus on the process of knowledge construction and do not stimulate reflective and critical thinking. The application of factual knowledge to real-life problems and the acquisition of self-directed knowledge management skills as well as teamwork skills are not fostered.

In order to improve the quality of teaching, the dean of the Faculty of Psychology, Christiane Spiel, initiated the project “E-Lecturing für Massenvorlesungen”⁷ (“E-Lecturing for Large Scale Lectures”). In the context of this project, the former traditional lecture “Forschungsmethoden & Evaluation”⁸ (“Research Methods & Evaluation”) was changed to an e-lecturing format (**Vienna E-Lecturing**) in the winter semester 2001/02⁹. The migration to online learning promises to improve the quality of academic teaching.

Regarding content, both acquisition of factual knowledge and acquisition of practical knowledge are main goals. Factual knowledge corresponds to basic theoretical knowledge, whereas practical knowledge refers to its application (social knowledge and problem solving skills). The acquisition of self-regulated learning styles is also a main concern of VEL. As online learning provides flexibility regarding time and place, it fosters autonomous learning. Students are weaned off passive “consumption” of lectures. Instead, they are encouraged to develop self-directed knowledge management skills. Awakening interest in course content is also a main concern of VEL. It outlines an important motivational function and is the basis for self-directed learning. Furthermore, skills in virtual communication as well as teamwork

⁷head: C. Spiel, members of staff: A. Aichinger, S. Faradji, M. Schirz, D. Strohmeier, B. Zens

⁸University of Vienna, Faculty of Psychology, Educational Psychology & Evaluation (<http://www.evaluation.ac.at>)

⁹head: C. Spiel, tutors in the initial pilot phase 2001/02: D. Strohmeier, A. Aichinger, M. Schirz

are trained and promoted. Raising media competence of participating students is yet another objective. These skills are of great importance when it comes to subsequent professional development. In the following, these are referred to as “key qualifications”.

Online Learning changes the roles of students and faculty. As discussed in section 2.2, the role of the instructor changes from a lecturing expert towards that of a facilitator and coach (Strohmeier et al., 2003). Students in online learning courses have to construct knowledge actively and in a self-directed fashion, rather than passively receiving information as in traditional lectures.

The implementation of the didactical concept was realized by blended learning, whereas online modules and face to face units complemented one another. The purpose of face to face units was to train basic skills necessary for the new learning method. These skills refer to teamwork, self-directed knowledge management, and media competence. These basic skills were imparted in the form of face-to-face workshops.

While taking the online modules, the learning matter was acquired autonomously by the students, whereas the literature was partially provided on the learning platform. As an essential element of the course design, small teams of four to six students collaboratively had to complete practical assignments and apply the theoretical knowledge to practical real-life problems. In the initial semester of VEL, the number of online modules was ten. As a result of the initial evaluation, the number of modules was reduced to six in the subsequent semester.

In the winter semester 2001/02, the number of participants of the online course was 66, whereas in the summer semester 2002, 37 students attended the course. The instructional design of the initial pilot phase of VEL was optimized based on a formative and a summative evaluation in the winter semester 2001/02 (Faradji, 2003). Figure 2 shows the instructional designs of VEL in the initial winter and summer semester, as well as the design of the evaluation.

In the following section, objectives, method, main results, and consequences of the evaluation of the first semester of VEL (winter semester 2001/02) are summarized. The detailed results are presented by Faradji (2003).

Figure 2.

Instructional Design and Evaluation Design of VEL in the Initial Winter Semester 2001/02 and Subsequent Summer Semester 2002

Note: Face-to-Face sessions in the first semester: October: Kick-Off Plenum, Technical Workshop (introduction to the learning platform) November: workshop for identifying problems and optimizing the course, January: Plenum (Meet the Expert)
Face-to-Face sessions in the second semester: March: Kick-Off Plenum, Workshop Group Management, Workshop Knowledge Management, June: Plenum (Meet the Expert).

4.1 Evaluation of the Initial Pilot Phase of VEL**4.1.1 Purpose of the Study**

The main aim of the evaluation was to assess the achievement of the program's goals (summative evaluation) and to provide information on how to optimize the course (formative evaluation). The following objectives were defined in the run-up (originally in German, translated by B. Zens):

- ▷ Increased flexibility regarding time and place compared to traditional lectures¹⁰
- ▷ Promotion of self-directed and self-dependent working¹¹
- ▷ Increase of knowledge¹²
- ▷ Gain of media competence regarding working with the internet¹³

4.1.2 Participants

The participants of the study were undergraduate psychology students enrolled in the course "Research Methods and Evaluation" at the University of Vienna. One group of students participated in the traditional lecture format in the course of the summer semester 2001¹⁴ and one group ($n = 66$) participated in the new e-lecturing format in the course of the winter semester 2001/02. The students were in their third or fourth year of study, or higher.

¹⁰Mehr zeitliche und örtliche Flexibilität als bei traditionellen Lehrveranstaltungen

¹¹Förderung des selbständigen und verantwortlichen Arbeitens

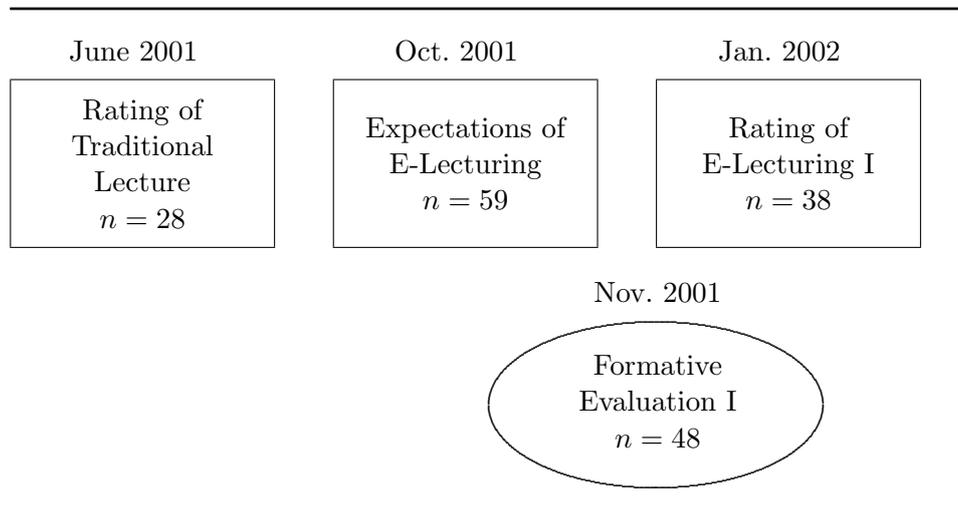
¹²Erhöhung des Wissens der Studierenden (im Vergleich mit traditionellen Vorlesungen)

¹³Erwerb von Internet-Kenntnissen

¹⁴Since attendance at the traditional lecture was not mandatory, the total number of participants is unknown. The total number of participants receiving a final grade is also not available

Figure 3.

Research Design of Summative and Formative Evaluation of VEL in the First Pilot Semester 2001/02 (Faradji, 2003)



The course was not mandatory, hence, the participants were a self-selected cohort of students. The participation rate of the surveys is summarized in figure 3.

4.1.3 Research Design

The research method of the summative evaluation consisted of a quasi-experimental design, comparing the traditional lecture with the e-lecturing format of the same course, both sections lasting one semester. The formative evaluation was conducted during the semester, concomitant to the e-lecturing course. The research design is presented in figure 3. The time schedule of the evaluation is summarized in figure 2.

Pre-post measures of the e-lecturing group (expectations of e-lecturing, ratings of e-lecturing) were conducted and the ratings of both sections (traditional vs. e-lecturing) were compared. Goal attainment was estimated by comparing the e-lecturing learning method with the equivalent traditional lecture. Differences between the two groups were calculated for the dimensions mentioned in section 4.1.1. In order to assess attainment of the goal “gain of media competence”, a pre-post comparison of media knowledge was conducted.

4.1.4 Research Instruments

Self-designed questionnaires with closed and open questions were used for both the summative and formative evaluation. The questionnaires were paper-pencil surveys, both for assessing the traditional lecture format and for exploring the expectations of the e-lecturing learning method. All other questionnaires were paper-pencil questionnaires distributed and returned by email.

The formative evaluation additionally included a workshop with the participating students. This workshop was performed in order to acquire qualitative and detailed information about students' difficulties and to develop solutions to these problems with the students. Advantages of this method are, first, the direct involvement of the students, which was presumed to have a positive effect on their commitment to participate in the evaluation, and second, the possibility to quickly implement the solutions to the presented problems.

For evaluating the increase of knowledge, both subjective assessments by the students and the marks of the final examination were used.

4.1.5 Results

Significant differences were found among the dimensions, i. e., "flexibility regarding time and place" and "self-directed learning". The descriptive data are presented in table 6. Flexibility and promotion of self-directed learning were attributed to the e-lecturing course to a significantly greater extent than to the traditional course. The goal "increase of knowledge" was partially met. Students of the e-lecturing course rated themselves significantly worse than participants of the traditional course. However, the comparison of the marks of the final examinations revealed that students of the e-lecturing course significantly outperformed students of the traditional course. Qualitative open questions, i. e., which elements of the course did you like/not like, what could be optimized, also pointed out a perceived lack of conveying essential theoretical knowledge. Students were swamped with practical tasks without fundamental theoretical knowledge.

Regarding media competence, significant improvement of the self-assessments was noted. Regarding efficiency, the e-lecturing format was rated

neutrally (see table 6). However, compared to the e-lecturing format, the traditional course was rated significantly better.

As presented in table 6, the data indicated that time requirements of VEL were rated to be excessive. Qualitative data underscore this result, pointing out that students requested modifications of time requirements. Students noted that managing their various responsibilities of their daily lives, and at the same time asynchronously completing weekly group assignments, constituted a great factor of stress. It was also pointed out that the extent of the group tasks should be reconsidered. Another concern related to the instructions specifying the assignments. Students complained about equivocality of instructions.

4.1.6 Discussion

The data indicated attainment of the goals “increased flexibility compared to traditional lectures”, “promotion of self-dependent working”, and “gain of media competence”.

The quantitative and qualitative data appear to indicate that students were not prepared for self-regulated learning and were overwhelmed by the respective new roles of students and faculty. Since the post-survey of the summative evaluation took place close to the final examination, it can be suggested that students right at that time became aware of their lack of factual knowledge and they did not perceive themselves to be well prepared for the examination. During the semester, they had solved practical tasks, while the final examination, in contrast, required factual knowledge.

The evaluation showed that the time allowed for virtual collaborative tasks must not be underestimated. Asynchronous virtual collaboration requires more time than face-to-face collaboration. Within one week, which initially was the time allowed for the group assignments, the students had to (1) acquire the factual knowledge background, (2) organize their study group, (3) collaboratively complete the assignment, and (3) post the group assignment on the platform. Since faculty did not expect time requirements to be as high, the actual time requirements exceeded the scheduled time requirements by far. Hence, the students had to meet various other responsibilities. As a result of time pressure, most of the teams didn't collaborate in its true sense (see section 2.3), but they simply cooperated by splitting the task in a number of sub-tasks or they arranged to split the tasks dis-

tributed over the whole semester. That meant that the members of these teams had great gaps in their knowledge of the subject matter. It can be suggested that this strategy contributed to the students' negative rating of their knowledge at the end of the semester.

Given the limitations of the study, generalizing the results to other courses should be handled cautiously, since selection bias and interfering variables like different questions of the exams may have interacted with the dependent variables.

4.1.7 Conclusion: Implemented Modifications of the Instructional Design

As a consequence of the results, the following modifications of the instructional design were implemented: Regarding time requirements, the time allowed for completion of the tasks was extended from one to two weeks. In addition, the goals of the tasks were explained in more detail. Furthermore, newly designed workshops regarding group and knowledge management were implemented in order to facilitate students in self-directed and efficient study skills, as well as to optimize team work and foster collaborative working, rather than simply splitting tasks among themselves as was done before. The initial and the modified design of VEL is summarized in figure 2 (initial design: October to January, modified design: March to June).

4.2 Evaluation of the Second Pilot Phase: Purpose and Objectives

Subsequent to the evaluation of the initial pilot phase of VEL, the main purpose of the study was to assess the achievement of the program's goals (outcomes) and to collect data for optimizing the instructional design (process). The objectives of VEL are discussed in chapter 4. Compared to Faradji (2003), the objectives were completed and rephrased to meet the whole range of the VEL-goals. The essential dimension "key qualifications" was added, as well as factors of motivation and stress. Since time requirements appeared to be a critical issue, the relation between effort and benefit was assessed in more detail.

Table 6.*Descriptive Data, Comparison between VEL and Traditional Lecture*

Items	E-Lecturing		Trad. Course	
	M	S	M	S
Perceived gain of factual knowledge ^a	2.5	1.0	4.4	0.7
Marks of final examination ^b	1.5	0.6	2.3	1.1
Time requirements during the semester ^c	5.6	0.7	3.2	1.2
Time requirements for examination ^d	5.6	0.7	4.4	1.3
Time requirements compared to other courses ^e	4.3	0.8	2.9	0.5
Efficiency compared to other courses ^f	2.8	1.1	3.9	0.9

Note: Summarized from *E-Learning - Unterrichtsmethode der Zukunft? Eine Evaluationsstudie der Pilotlehrveranstaltung "Evaluation und Forschungsmethoden"* [E-Learning: Learning Method of the Future? An Evaluation Study of the Pilot Learning Activity "Evaluation and Research Methods"], Faradji, 2003, p. 84, 85, 88, unpublished diploma thesis, University of Vienna. Items originally in German, translated by B. Zens

Since the dimensions "self-directed learning" and "flexibility regarding time & place" consisted of several items, they are not presented on this place. A descriptive analysis for the entire dimensions is not provided by Faradji.

^a(Insgesamt habe ich in dieser Vorlesung sehr viel gelernt) five point rating scale, 1 = lowest value 5 = highest value

^b(Endnoten) five point rating scale, 1 = highest value, 5 = lowest value

^c(Aufwand im Laufe des Semesters) six point rating scale, 1 = low time requirements, 6 = high time requirements

^d(Aufwand für die Prüfung) six point rating scale, 1 = low time requirements, 6 = high time requirements

^e(Aufwand für diese Lehrveranstaltung im Vergleich zu anderen Lehrveranstaltungen) five point rating scale, 1 = less time requirements, 5 = higher time requirements

^f(Effizienz im Vergleich mit anderen Veranstaltungen) five point rating scale, 1 = less efficient, 5 = more efficient

Information about trends is also very valuable. By analyzing trends over the whole academic year, it can be examined, whether the students' ratings of VEL improved over the time and whether students' expectations to the new learning methods were met or not. The detailed research questions of the study were the following:

Summative Evaluation:

I Were the objectives of VEL achieved?

The determined main objectives were the following:

1. Promotion of self-directed learning
2. Flexibility regarding time and place
3. Awaken interest in course content
4. Practical relevance of learning contents
5. Acquisition of knowledge
6. Promotion of key qualifications (teamwork skills, knowledge management skills, media competence)

II Was there an improvement of key qualifications (teamwork skills, knowledge management skills, self-regulated learning skills, media competence) and attitudes (towards teamwork, self-regulated learning, utilization of learning platforms, virtual communication/collaboration) by participating in VEL?

III Were there differences between the rating of VEL in the first and second semester? If so, what was the trend?

Differences between the first and the second semester of the program were analyzed in view of the objectives named above. In addition, the following dimensions, relevant for further optimizing the program, were explored.

- | | |
|--------------------------------|---------------------------|
| 1. Communication & cooperation | 5. Motivational factors |
| 2. Time requirements | 6. Factors of stress |
| 3. Efficiency | 7. Imparting of knowledge |
| 4. Support | 8. Overall benefit |

IV Were the expectations of VEL met across the entire academic year? If not, what was the trend?

V What was the relation between effort and benefit for the students?

VI What were the factors of motivation and stress?

VII Qualitative overall rating of VEL

Formative Evaluation:

How can the instructional design be optimized? The following elements of the instructional design were analyzed:

1. Face-to-face meetings
2. Group tasks & feedback to the tasks
3. Teamwork & communication
4. Utilization of the learning platform & online support
5. Time requirements

Part II

Evaluation of VEL in the Second Pilot Phase

5 Research Method

5.1 Participants

The participants of the study were undergraduate psychology students enrolled in the e-lecturing course “Research Methods and Evaluation II” (Vienna **E**-Lecturing) at the University of Vienna in the summer semester 2002. This subsequent section of VEL followed the introductory section in the winter semester 2001/02. Similar as in the first part of the course, the students were in their third or fourth year of study, or higher. The course was not mandatory; hence, the participants were a self-selected cohort of students. The drop-out rate between the first and the second part of VEL was 42.4% of the participants (28 students), hence, the number of participants in the second part of VEL was 38 students.

5.2 Research Design

The study follows the evaluation of the initial pilot phase of VEL during the winter semester 2001/02 (Faradji, 2003) and contains a concluding summative evaluation for assessing the program and a concomitant formative evaluation for optimizing the didactical concept.

In total, the summative evaluation included three inquiries across the entire academic year: The survey of expectations of the program (T1) and the student assessments after the first, and the second semester (T2 and T3). The data of the inquiries T1 and T2 were adopted from Faradji.

As discussed in chapter 4.1, Faradji used the equivalent traditional lecture as comparison group for evaluating the first pilot semester of VEL. The objectives were relative ones, such as “...compared to traditional lectures” and significant differences between VEL and the traditional lecture indicated achievement of the objectives. In this study, predefined criteria for interpreting achievement of the objectives were employed (see section 1.2). The traditional lecture as comparison group was not included for the following reasons:

- ▷ The traditional lecture is not comparable with the e-lecturing learning activity due to their different goals. To give a few examples, it is obvious that a traditional lecture does not promote self-directed learning, flexibility and acquisition of teamwork-skills. Relative goals, such as

“...compared to traditional lectures” in this context, do not appear to be meaningful. They provide findings which are quite evident.

- ▷ Concerning increase of knowledge, it seems to be methodically problematic to conclude achievement of a goal on the basis of differences between two groups. In this case, the statement can be made that one group achieves higher values than the other one, but no conclusion can be drawn whether the goal actually was achieved. For that purpose, exact criteria of achievement have to be defined. Moreover, the exams of the traditional lecture and VEL were not the same.

The concomitant formative evaluation was conducted during the second semester of the program (formative evaluation II). A graphical illustration of the evaluation design is presented in figure 4, figure 2 in section 4.1 illustrates the evaluation design of both semesters.

Both the data collection of the third investigation of the summative evaluation (T3) and the formative evaluation II were performed by online surveys presented to students participating in VEL. In order to reduce time involved for handling the data and to facilitate completing the surveys with minimal time and effort required, online surveys were employed, whereby data automatically were added to an electronic database. Missing values as well as errors when entering the data were thus eliminated.

The data collection of T1 and T2 were conducted by Faradji (2003) using paper-pencil questionnaires (T1) and questionnaires sent by email (T2), see section 4.1.4.

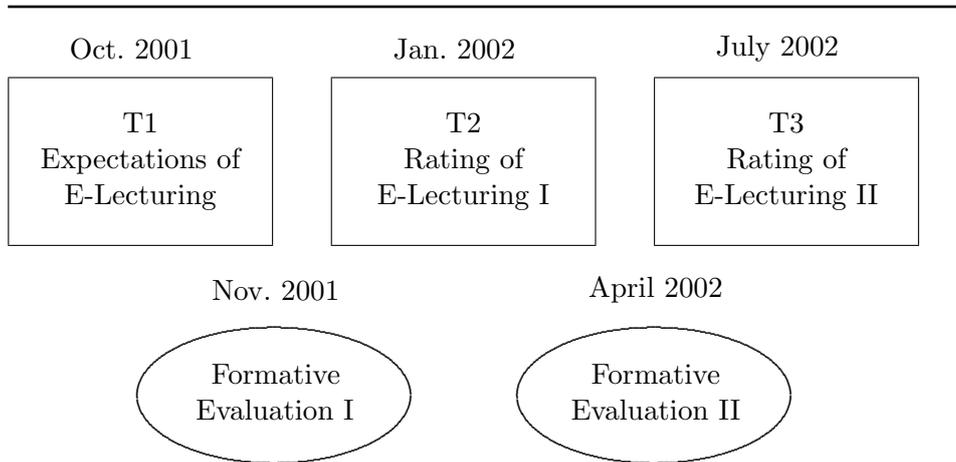
5.3 Research Instruments

For this study, self-designed surveys that included closed and open questions were presented to the students. The surveys are attached to the appendix, part B, as well as online at <http://homepage.univie.ac.at/birgit.zens/thesis> (march 2005). Because features of the specific lecture were investigated, questionnaires were newly constructed.

In order to enable comparability of the items, the questionnaire of the summative evaluation largely had to be adopted from Faradji (2003). The questionnaire consisted of 64 Items. The dimensions were composed by content related criteria of the items. Subsequently, the expected dimensions were examined by conducting estimates of reliability. The dimensions and

Figure 4.

Research Design of Summative and Formative Evaluation of VEL in the Second Pilot Semester 2002



Note: The surveys at points T1 and T2 (evaluation I, first semester) were conducted by Faradji

item listings are included in the appendix, part A.1. In order to ease comparison of the items, the response format was also adopted from Faradji. Both, six point rating scales and five point rating scales were used. As a five point rating scale is well known among students, additional new items of the survey were also scored on a five point rating scale.

Item examples for the six point rating scales¹⁵: “To what extent do the following statements regarding key qualifications apply to the lecture ‘Research Methods & Evaluation II’ in summer semester (does absolutely not apply - applies absolutely):”

- ◇ “Acquisition of teamwork-skills in virtual teams”
- ◇ “Acquisition of technical know-how regarding utilization of learning platforms”
- ◇ “Acquisition of work techniques of applied knowledge management”

Item examples for the five point rating scales:

¹⁵All items were originally in German, they only were translated for better understanding of the dimensions. All the collected data derived from German language items. Original items are presented in the appendix, part A.1 and B.

- ◇ “How do you estimate the time requirements for the learning activity during the semester? (little time required - much time required)”
- ◇ “Compared to traditional lectures, the guidance and support in this learning activity is (much better/much worse)”

Furthermore, to acquire qualitative data, both questions with multiple answers and open questions were presented to students. Example for a question with multiple answers: “If the migration [to the new learning method e-lecturing] was difficult, which areas were especially challenging for you? (multiple answers possible)”: “unfamiliar learning method”, “time requirements”, “self-directed learning method”, “pressure of time”, “teamwork”, “technical aspects”, “others (please specify below)”. Example of an open question: “What did you like about the learning activity? What should definitely be maintained? Please make tangible suggestions!”.

For investigating increase of knowledge, additionally to students’ self-assessments, the marks of the final examination were employed.

Since specific aspects of VEL in the summer semester were analyzed, the questionnaire of the formative evaluation was completely redesigned. It contained 84 items relating to specific elements of VEL:

- ▷ Face to face meetings (introductory unit, workshops)
- ▷ Tasks
- ▷ Feedback to the tasks
- ▷ Teamwork
- ▷ Communication within teams
- ▷ Utilization of the learning platform
- ▷ Support
- ▷ Time requirements

The response format consisted of a five point rating scale, ranging from “very good” to “insufficient”. In addition, for acquiring qualitative data, open questions were presented for each issue. Examples: “How do you judge the face to face units: introductory unit” (very good - insufficient). “tangible suggestions and feedback for the introductory unit” (open question).

Properties of the Instruments

In order to examine homogeneity of the assumed dimensions in the questionnaire, reliability was estimated by means of Cronbach Alpha. Many dimensions had to be adapted by content related criteria, as the estimate of reliability was low. In many cases, single items had to be used for further analysis. A detailed listing of the items of the primary and of the new dimensions (before and after conducting the estimate of reliability) is presented in the appendix, part A.1.

In the following, the results of the estimate of reliability are presented for each dimension at each measuring point (expectations to e-lecturing, rating of e-lecturing I, rating of e-lecturing II, research design see figure 4).

1. Key qualifications (3 items)

$\alpha = 0.67$ (rating of e-lecturing II)

In spite of high reliability, the scale was fragmented into single items for subsequent analysis due to explanatory power.

2. Self-directed learning (6 items)

$\alpha = 0.38$ (expectations to e-lecturing)

$\alpha = 0.77$ (rating of e-lecturing I)

$\alpha = 0.83$ (rating of e-lecturing II)

New dimension: Promotion of self-directed and self-dependent working:
(3 items)

$\alpha = 0.56$ (expectations to e-lecturing)

$\alpha = 0.72$ (rating of e-lecturing I)

$\alpha = 0.79$ (rating of e-lecturing II)

3. Communication and cooperation (4 items)

$\alpha = 0.71$ (expectations to e-lecturing)

$\alpha = 0.72$ (rating of e-lecturing I)

$\alpha = 0.47$ (rating of e-lecturing II)

New dimension: Possibility of information exchange with fellow students
(2 items)

$\alpha = 0.78$ (expectations to e-lecturing)

$\alpha = 0.65$ (rating of e-lecturing I)

$\alpha = 0.72$ (rating of e-lecturing II)

4. Flexibility regarding time and place (4 items)

 $\alpha = 0.64$ (expectations to e-lecturing) $\alpha = 0.56$ (rating of e-lecturing I) $\alpha = 0.72$ (rating of e-lecturing II)

The scale was left unmodified.

5. Time requirements (3 items)

 $\alpha = 0.33$ (expectations to e-lecturing) $\alpha = -0.56$ (rating of e-lecturing I) $\alpha = -0.17$ (rating of e-lecturing II)

As items correlated partially negatively, further analysis was based on single items.

6. Support (4 items)

 $\alpha = 0.66$ (rating of e-lecturing II)

The scale was left unmodified.

7. Awaken interest in course content (3 items)

 $\alpha = 0.81$ (rating of e-lecturing II)

The scale was left unmodified.

8. Imparting of knowledge (3 items)

As interpreting the original scale was difficult, two single items were used for further analysis: “practical relevance”, and “imparting coherence”.

9. General assessment (3 items)

 $\alpha = -0.33$ (rating of e-lecturing II)

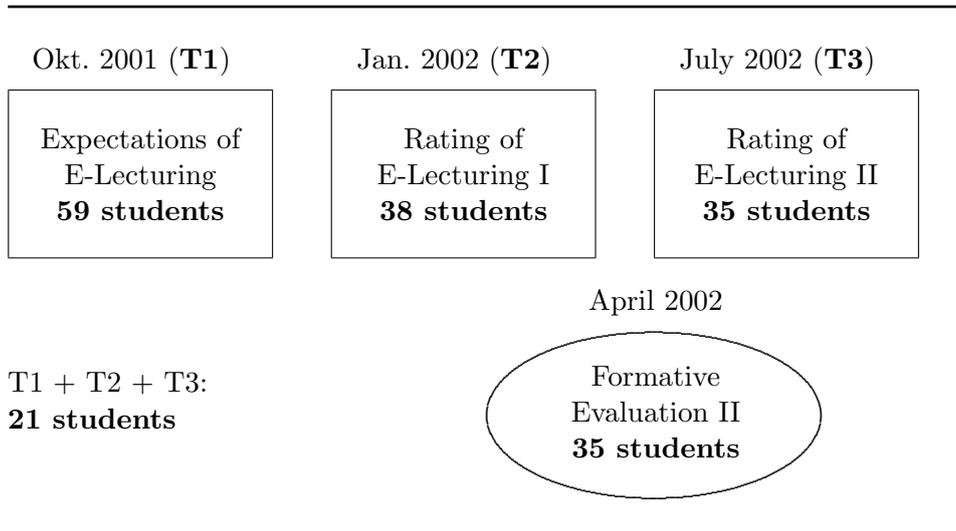
As the items apparently measured different aspects, single items were used for subsequent analysis.

5.4 Description of Procedures

The investigation was performed as scheduled. Since the drop-out rate of the participants for the course between the winter and summer semester was high (42.4%, 28 individuals), the sample size for comparing survey T3 with survey T1 and T2 was very small. Only 21 students participated in all of the three surveys. A graphical illustration of the questionnaire rate of return is displayed in figure 5. The rate of return of the questionnaires

Figure 5.

Questionnaire Rate of Return for all Surveys of the Summative and Formative Evaluation of VEL



for the formative evaluation II and for the third survey of the summative evaluation (rating of e-lecturing II) was 95 % ($N = 37, n = 35$).

Fifty-nine students (89.4 % of the students participating in VEL in the first semester) took part in the survey T1, i. e., expectations of e-lecturing. Only 38 students (57.6 % of the students participating in VEL in the first semester) replied to the questionnaire at measuring point T2, i. e., the rating of VEL after the first semester. Thirty-five participants (95 % of the students participating in VEL in the second semester) took part at survey T3, i. e., the rating of VEL after the whole academic year.

5.5 Treatment of Data

The analysis of data was conducted with the statistic program SPSS for Windows, version 11.01. For answering the research questions, three major approaches were employed: (1) Criteria oriented approach; (2) direct measurement of change; (3) indirect measurement of change. Advantages and disadvantages of these approaches are discussed in section 1.2. Additionally, the qualitative data were analyzed qualitatively and quantitatively.

1. Concerning the criteria oriented approach, criteria indicating success had to be developed in the run-up. The respective procedures are discussed below. For this approach, descriptive statistical methods were used.
2. Concerning the direct measurement of change, descriptive statistical methods were used. Additionally, inferential statistical methods (one-sample t-tests) were employed for analyzing significant improvements (improvements regarding key qualifications, attitudes, and interest).
3. Concerning indirect measurement of effects, inferential statistical methods were used (analyses of variances). Additionally, the data were analyzed by descriptive methods.
4. The qualitative data of the open questions were analyzed qualitatively and quantitatively by classification into categories.

Since the drop-out rate of participants between part I and part II of VEL was very high, the drop-outs were analyzed by inferential statistical methods (analyses of variances) in order to ascertain that the results of the second semester were not distorted by a positive self selection of participants.

Procedures of Developing Criteria Indicating Success

In the run-up to collecting and analyzing the data, criteria indicating success were established (see table 7). For determining these criteria, the following considerations were reflected:

1. Due to explanatory power, differentiated steps of goal achievement were recorded.
2. No mean values were used, since these would not sufficiently differentiate success when the variance of the items is high. To specify a percentage of the best values appeared reasonable, because medium and poor values would not distort the results.
3. The criteria of success was to be defined strictly, but realistically.

The criteria indicating success for a six point rating scale were established on the basis of the considerations mentioned above:

1. Three steps appeared insufficient to measure success. In this case, the spacing between the values would be too large so that the interpretation

would be inexact. A four point rating of success appeared to be adequate in this case: great success, moderate success, slight success, no success.

2. For determining success, on a six point rating scale, the specification of the two highest (best) values by the students were used (values 5 and 6: applies and applies absolutely). Employing only the best value appeared to be unreasonable because of a general tendency for marking medium values and avoiding extreme values. When using dimensions consisting of multiple items, mean values of each item were used resulting in a new variable for each dimension.
3. If the two best values were used for determining success, the percentage of the individuals indicating these values had to be relatively high. For determining “great success”, a percentage of 60 % seemed to be adequate in regards to the general tendency for avoiding extreme values. It was decided to assign the rating “no success” when 30 % or less of the persons indicated the two best values. These content related considerations were controlled by descriptive analysis and by plotting of test data, which illustrated various possible distributions.

In order to determine the increase of knowledge by the result of the examination, the criteria indicating success were transformed from a six point rating scale to a five point rating scale (marks are assigned on a 5 point scale). Also in this case, the two best values were used. On this account, both scales are not comparable on a one to one basis. This fact has to be considered when interpreting the results.

Accordingly, for classifying “great success”, 50 % of the persons or more had to achieve the two best marks (1 and 2), for classifying “no success”, the percentage was 25 % . For “moderate success”, 38 - 49 % of the students had to achieve the two best marks, and 26 - 37 % were required to be classified as “slight success”.

5.6 Summary

The research method of the summative evaluation in the second pilot semester of VEL consisted of a quasi-experimental design with multiple measures within the same group: Expectations of VEL, ratings after the first semester, and ratings after the second semester. Data were collected by newly developed online questionnaires with closed and open questions, whereas qualita-

Table 7.
Criteria Determining Success

Values 5 & 6 Indicated ^a	Category
$\geq 60\%$	Great Success
45–59%	Moderate Success
31–44%	Slight Success
$\leq 30\%$	No Success
Values 1 & 2 Achieved ^b	Category
$\geq 50\%$	Great Success
38–49%	Moderate Success
26–37%	Slight Success
$\leq 25\%$	No Success

^a6 point rating scale: The criteria of success were determined by using the percentage of the two best values 5 and 6.

^b5 point rating scale: The criteria of success were determined by using the percentage of the two best values 1 and 2.

tive open answers helped to strengthen the quantitative results and improve the interpretation.

The dimensions of the instrument were tested by conducting estimates of reliability. Subsequently, most of the dimensions had to be redesigned, and for a few dimensions, single items had to be used. Because the drop-out rate between the first and the second semester was very high, a missing analysis was conducted to test for significant differences of drop-outs and remaining students regarding pertinent variables.

Four approaches were employed to analyze the data: Criteria oriented approach, direct measurement of change, indirect measurement of change, and classification of qualitative data. In order to assess goal attainment of VEL, specific criteria of success were determined in the run-up, and compared to the actual state at the end of the course. Regarding the direct measurement of change, descriptive methods were employed. Additionally, inferential statistical methods were used to assess the significance of improvements. Indirect measurement of effects was done by comparing the students' ratings at all three measuring points, whereas significant differences between the measuring points were analyzed by inferential statistical methods. A descriptive data analysis helped to interpret the results.

The questionnaire of the formative evaluation included closed and open questions concerning the main elements of VEL. Since specific features of VEL were assessed, a new questionnaire was developed. The focus was on qualitative data and on descriptive analysis. Qualitative data were analyzed qualitatively and quantitatively by classification into categories.

6 Results

6.1 Sample

In total, 66 students who participated in VEL in the academic year of 2001/02 took part in the inquiries of the summative evaluation. Only 21 students participated in all of the three surveys. The rate of participation is discussed in chapter 5.4, also see figure 5.

The sample of the summative evaluation at point T3 consisted of 35 students. 28 students (30.4%) were female, seven (7.6%) were male. The majority of the participants were aged between 21 and 25 (71.4%), five students (5.5%) were over 30 years old. Regarding subsequent data analyses, the following demographic data of the participants appeared to be relevant:

- ▷ Employment
- ▷ Enrollment in a second degree program
- ▷ Experience with e-learning courses

A total of 27 among 35 persons who participated in survey T3 (77.14%) were employed. In the majority of cases this employment was determined to be minor in nature ($n = 12$). Eleven students worked part-time and three students were employed full-time. One student was involved with raising children, and one other participant was concurrently both raising children and working.

Out of a total of 35 participants, 12 students (34%) concurrently attended a second degree program in addition to studying psychology. Out of a total of 35 participants, 27 students (77.1%) had no prior experiences with e-learning courses.

6.2 Answers to Research Questions

6.2.1 Were the Objectives of the E-Lecturing Achieved?

Concerning the question whether the goals of VEL were achieved, a criteria-oriented approach was employed. A detailed description of the procedures for developing the criteria indicating success is presented in section 5.5. For this descriptive analysis, the data of measuring point T3 (rating of e-lecturing II) were used.

In case of dimensions including multiple items, mean values were calculated resulting in a new variable for each dimension. In order to identify

the percentage indicating the two best values easily (5 or 6 on a six point rating scale, 1 and 2 on a five point rating scale), dichotomous variables were calculated from these dimensions. Values 5 through 6 were coded as 1, values less than 5 were coded as 0. Subsequently, frequencies for these new dichotomous variables were calculated.

The results are presented in table 8 and 9. All objectives of VEL were achieved with great success, with the exception of the issue “acquisition of applied knowledge management” which reached slight success. In order to determine the achievement of the goal “increase of knowledge”, self-assessments of the students were used. In addition, the marks of the final examination were analyzed by calculating an overall score of the results of the examination I and II (winter and summer semester). Since marks were assigned on a five point rating scale, the criteria of success were transformed from a six point rating scale to a five point rating scale (details for this procedure see section 5.5). However, since for both the 5 point and the 6 point scale, the percentage of the two best values was used for interpreting the results, both scales cannot be compared on a one to one basis. This deficiency is not of great importance, as the limit of the category “great success” is exceeded by far.

6.2.2 Was there an Improvement of Key Qualifications, Attitudes, and Interest?

Improvement of key qualifications, attitudes, and interest were measured by direct queries. Advantages of this approach are addressed in section 1.2.

The assessed key qualifications were the following: Teamwork skills, knowledge management skills, self-regulated learning skills, and media competence. Furthermore, changes of attitudes in the following dimensions were also queried directly: Attitudes regarding teamwork, self-directed learning, utilization of learning platforms, and utilization of virtual communication tools. For all dimensions, the question was raised whether participation in VEL effected any change. Improvement of interest was also queried directly. The following dimensions were assessed: Change of interest in evaluation and research methods, teamwork, and e-lecturing.

The dimensions were calculated using mean values of all items of the respective dimension. The data were analyzed by descriptive methods. Ad-

Table 8.
Extent of Goal Attainment on a Six Point Rating Scale

Objectives	Criteria for success		
	31 - 44 %	45 -59 %	≥ 60%
1. Promotion of self-directed learning	-	-	62.9 %
2. Flexibility regarding time and place	-	-	68.6 %
3. Awakening interest in course content	-	-	71.4 %
4. Practical relevance of learning contents	-	-	65.7 %
5. Increase of knowledge (self assessment)	-	-	68,6 %
6a. Acquisition of teamwork-skills	-	-	71.4 %
6b. Acquisition of technical know how	-	-	74.3 %
6c. Acqu. of knowledge management skills	34.3 %	-	-

Note: The percentage of the two best values on a six point rating scale was used for determining success. The percentage ≤ 30 of the two best values indicated was determined as no success, 31-44 % as slight success, 45-59 % as moderate success, and $\geq 60\%$ was classified as great success. In case of dimensions including multiple items, mean values were calculated resulting in a new variable for each dimension.

Table 9.
Extent of Goal Attainment on a Five Point Rating Scale

Objective	Criteria for success			
	≤ 25 %	26 - 37 %	38 -49 %	$\geq 50\%$
Increase of knowledge (final exam)	-	-	-	74.3 %

Note: The percentage of the two best values on a five point rating scale was used for determining success. The percentage ≤ 25 of the two best values indicated was determined as no success, 26-37 % as slight success, 48-49 % as moderate success, and $\geq 50\%$ was classified as great success.

ditionally, in order to assess whether a given improvement was significant, a one sample t-test was calculated for each item (changes of skills, attitudes, and interest). The test value was 3, indicating “remained the same”.

The descriptive results are summarized in table 10, 11, and 12. The results of the one sample t-tests are presented in table 13, 14, and 15. Regarding key qualifications, the queried skills slightly improved. The improvement was statistically significant. The change of attitudes regarding self-directed learning, utilization of learning platforms, and utilization of virtual communication tools also improved slightly, but significantly. The attitudes regarding teamwork did not improve significantly. The individuals who indicated a deterioration of their attitudes attributed this to the following reasons: problems within the team, lack of social contacts, problems with virtual communication, and problems with the learning platform.

The direct measurement regarding interest also showed a significant improvement of interest regarding the dimensions “interest in evaluation and research methods” and “interest in e-lecturing”. The interest in teamwork did not improve significantly.

6.2.3 Were there Differences Between the Rating of VEL in the First and Second Semester?

In order to analyze differences between the ratings of VEL in the first and the second semester, and to assess whether the expectations of the participants were met, a univariate repeated measures analysis of variances for each dimension was calculated. The factor for each analysis was “time” with three levels: survey T1, T2, and T3 (research design see figure 4). No multivariate method was used for following reasons: The sample size was extremely small (max. 21 persons), correlation of the dimensions was not assumed, interactions between the dimensions were not of interest, and risk of augmentation of the error Type I was not present when calculating multiple univariate repeated measures analyses of variances for different dimensions.

The following dimensions and single items respectively were analyzed¹⁶:

- ▷ Promotion of self-directed and self-dependent working

¹⁶These dimensions differ from the primarily assumed dimensions, because modifications had to be performed after obtaining the estimates of reliability. A detailed listing of the dimensions and items as well as a detailed comparison of the items between all of the three surveys is presented in the appendix part A.1 and A.3.

Table 10.

Direct Measurement: Change of Key Qualifications by Participating in VEL

Change of key qualification	n	M	S
Skills of teamwork	35	2.63	0.646
Skills of knowledge management	35	2,54	0.505
Technical know-how	35	2.00	0.686
Skills of self-directed learning	35	2.60	0.497

Note: All items score on a five point rating scale, 1 = improved very much, 5 = degraded very much.

Table 11.

Direct Measurement: Change of Attitude by Participating in VEL

Change of attitude towards...	n	M	S
Teamwork	35	2.83	0.923
Self-directed learning	35	2.60	0.604
Utilization of learning platforms	35	2.26	0.886
Virtual communication	35	2.40	0.812

Note: All items score on a five point rating scale, 1 = improved very much, 5 = degraded very much.

Table 12.

Direct Measurement: Change of Interest by Participating in VEL

Increase of interest in...	n	M	S
Evaluation & research methods	35	4.71	1.467
Teamwork (virtual/face-to-face)	35	4.43	1.501
E-lecturing	35	3.94	1.474

Note: All items score on a six point rating scale, 6 being highest

Table 13.
Significant Improvement of Key Qualifications

Change of key qualification	Test Value = 3		
	T	df	p (two tailed)
Skills of teamwork	-3.404	34	.002
Skills of knowledge management	-5.351	34	.000
Technical know-how	-8.624	34	.000
Skills of self-directed learning	-4.761	34	.000

Note: Test value 3 = remained the same.

Table 14.
Significant Changes of Attitudes

Change of attitude towards...	Test Value = 3		
	T	df	p (two tailed)
Self-directed learning	-3.919	34	.000
Utilization of learning platforms	-4.961	34	.000
Virtual communication	-4.373	34	.000

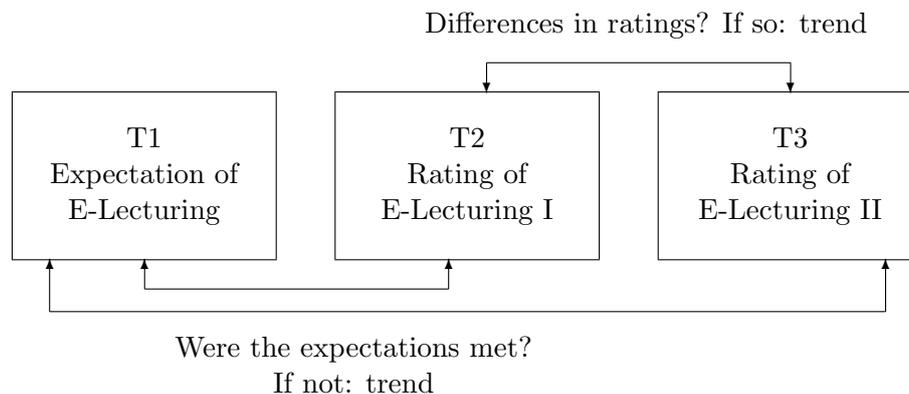
Note: Test value 3 = remained the same. Change of attitude towards teamwork was not significant.

Table 15.
Significant Increase of Interest

Increase of interest in...	Test Value = 3.5		
	T	df	p (two tailed)
Evaluation & research methods	4.898	34	.000
E-lecturing	3.661	34	.001

Note: Test value 3.5 = remained the same. Change of interest in teamwork was not significant.

Figure 6.
Illustration of Research Questions III and IV



- ▷ Flexibility regarding time and place
- ▷ Practical relevance of learning contents
- ▷ Increased information flow when compared to traditional lectures
- ▷ Possibility of information exchange with fellow students
- ▷ Availability of social contacts with other students
- ▷ Time requirements during the semester
- ▷ Time requirements in preparation for the final examination
- ▷ Time requirements when compared to traditional lecture
- ▷ Efficiency when compared to traditional lecture
- ▷ Availability of immediate responses to inquiries
- ▷ Imparting coherence related to the subject matter
- ▷ General increase of knowledge

In the case of a significant difference, the trend was analyzed by descriptive methods (i. e., do the ratings of VEL exceed the expectations, or were the expectations not achieved?). A graphical illustration is displayed in figure 6.

The ratings of VEL between the first and second semester differed significantly on the following dimensions:

Table 16.

Descriptive Data for Dimensions Displaying Significant Differences Between Various Measuring Points

Scales	n	Expectation		Rating I		Rating II	
		(T1)		(T2)		(T3)	
		M	S	M	S	M	S
1	13	4.08	0.760	3.08	0.954	3.92	0.954
2	20	5.00	0.725	3.70	1.455	4.70	1.418
3	21	4.33	1.197	2.90	1.411	4.29	1.102
4	21	4.35	1.080	4.96	0.819	5.17	0.649
5	21	5.24	1.044	3.90	1.375	4.05	1.532

Note: The dimensions scored on a six point rating scale, 1 = does not apply at all, 6 = applies completely. Dimensions: 1: Efficiency in comparison to traditional lectures, 2: Availability of immediate responses to inquiries, 3: Imparting coherence, 4: Flexibility regarding time and place, 5: Increased information flow when compared to traditional lectures, 6: Perceived gain of factual knowledge.

- ▷ Efficiency when compared to traditional lectures, significant at the .05 level of confidence.
- ▷ Availability of immediate responses to inquiries, significant at the .01 level of confidence.
- ▷ Imparting coherence related to the subject matter, significant at the .01 level of confidence.

On all of these three dimensions, student ratings after completion of the entire academic year were significantly better than the ratings after the first semester. Statistical details of the analyses of variances are presented in table 17 and 18, for descriptive data see table 16. All other analyzed dimensions did not differ significantly.

Table 17.

Repeated Measures Analysis of Variances for Dimensions Displaying Significant Differences Between Measuring Points

Scales	n	Pillai Spur		
		F	df	p
Efficiency compared to traditional lectures	13	4.988	2	.029
Availability of immediate responses	20	6.887	2	.006
Imparting coherence rel. to the subject matter	21	10.270	2	.001
Flexibility regarding time & place	21	4.265	2	.030
Increased information flow	21	15.912	2	.000

6.2.4 Were the Expectations of the E-Lecturing Fulfilled across the Entire Academic Year?

Two dimensions showed a significant difference between expectations of VEL and ratings after the entire academic year. Statistical details of the analyses of variances see table 17, for descriptive data see table 16.

- ▷ Flexibility regarding time and place, significant at the .05 level of confidence.
- ▷ Increased information flow when compared to traditional lectures, significant on a .01 level of confidence.

As presented in table 16, the expectations were exceeded on the dimension “flexibility regarding time and place”, whereas they were not fulfilled on the dimension “increased information flow when compared to traditional lectures”.

In addition, it is interesting to look at the differences between the expectations and the ratings after the first semester, in comparison with the ratings after the entire academic year. On three of the 13 dimensions, the expectations were not fulfilled after the first semester. However, after the entire academic year, the ratings increased again and no differences between expectations and ratings were noted. Such a V-shaped relationship appeared

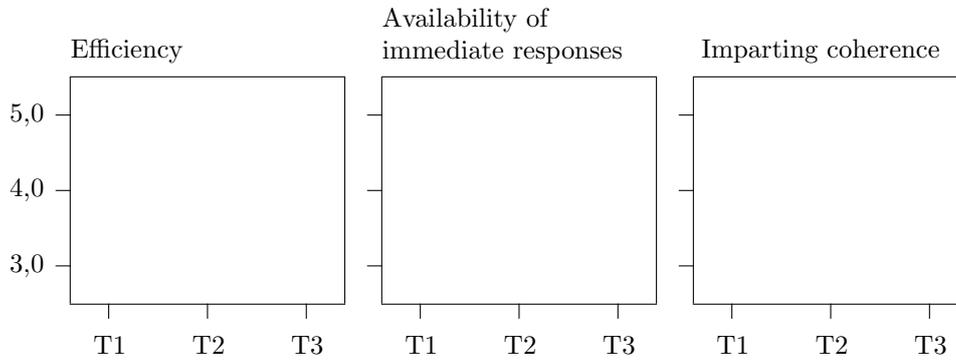
Table 18.

Multiple Comparison Test of Dimensions Displaying Significant Differences Between Measuring Points

Scales	Multiple Comparison Test		
	Time	Time	p
Efficiency compared to traditional lectures	T1	T2	.021
	T2	T3	.014
Availability of immediate responses	T1	T2	.001
	T2	T3	.019
Imparting coherence rel. to the subject matter	T1	T2	.000
	T2	T3	.001
Flexibility regarding time & place	T1	T2	.046
	T1	T3	.010
Increased information flow comp. to trad. lectures	T1	T2	.000
	T1	T3	.001

Note: T1: Expectations to VEL, T2: Rating after the first semester of VEL, T3: Rating of VEL after the entire academic year.

Figure 7.
V-Shaped Relation of Significant Differences between Measuring Points



Note: On the dimensions “efficiency”, “availability of immediate responses”, and “imparting coherence”, the expectations were not fulfilled after the first semester. Yet, after the entire academic year, the ratings increased again and no differences between expectations and ratings were noted.

in the following dimensions (illustration see figure 7, statistical details of the analyses of variances see table 17 and 18):

- ▷ Efficiency compared to traditional lectures, significant at the .05 level of confidence.
- ▷ Availability of immediate responses, significant at the .01 level of confidence.
- ▷ Imparting coherence related to the subject matter, significant at the .01 level of confidence.

6.2.5 What Was the Relation Between Effort and Benefits for the Students

The question of time requirements and resulting benefits was analyzed by descriptive methods. The items “time requirements during the semester”, “time requirements in preparation of the final examination”, and “time requirements when compared to traditional lectures” were discussed separately, since the estimate of reliability revealed that these items correlated partially negative with each other. In addition, a paired sample t-test was performed in order to examine statistically significant differences between

the variables “time requirements during the semester” and “time requirements in preparation of the final examination”. The mean values of the two variables were thus compared within the same group.

A further analysis focused on differences between groups in their assessment of time requirements. Differences between employed and unemployed students, between students who were enrolled in a second degree program and students who were only enrolled in psychology, were explored. For this purpose, three univariate analyses of variances were calculated for both the factors “job” and “enrollment in a second degree program”. In one analysis, the dependent variable was the assessment of time requirements during the semester. In the second analysis, the dependent variable was the assessment of time requirements in preparation of the final examination, and in the third analysis, the dependent variable was the rating of time requirements compared to traditional lectures.

No multivariate method was used, because the dependent variables did not correlate with each other and interactions between these variables were not of interest. In order to adjust the Error Type I, a correction after Bortz (Bortz, 1999) was calculated. This adjustment is less conservative than a Bonferoni Correction and suitable for a small number of repeated analyses: $\alpha' = (1 - \alpha)^{\frac{1}{n}}$. In the given case, $\alpha' = 0.017$.

As presented in table 19, the time requirements for VEL were estimated rather high across all the three items. As can be seen from the paired sample t-test, the difference between time requirements during the semester and the time requirements in preparation of the final examination was statistically significant, $t = 3.174$, $df = 34$, $p < .003$ (2-tailed). This result indicated that the time requirements during the semester scored significantly higher than the time requirements in preparation of the final examination. Compared to traditional lectures, the time requirements of VEL were rated significantly higher (item “time requirements compared to traditional lectures”), $T = 3.489$, $df = 34$, $p < .001$ (two tailed), test value = 3.

When the data were divided by employment and enrollment in an additional degree program, no significant differences were noted. This indicated that regarding time requirements for VEL, the ratings of students who were employed did not differ from the ratings of students who were not employed. Also, the ratings of students who were enrolled in an additional degree pro-

Table 19.
Time Requirements and Benefits of VEL

Time requirements & benefit	M	S
Time requirements during the semester ^a	4.14	0.733
Time requirements for preparation for the exam ^a	3.57	0.850
Time requirements compared to traditional lecture ^b	3.77	1.308
General benefit of the e-lecturing learning activity ^c	1.74	0.852
Recommendation ^d	1.89	1.132

Note: The items score on a five point rating scale, n = 35.

^a1 = low time requirements, 5 = high time requirements

^b1 = less time requirements, 5 = much more time requirements

^c1 = very useful, 5 = not useful at all

^d1 = highly recommend, 5 = highly disadvice

gram did not differ significantly from the ratings of students who were only enrolled in psychology.

As summarized in table 19, the general benefit was rated high as well. Out of a total of 35 students, 45.7% rated VEL to be very useful, 40% determined it to be useful. Following the experiences during the entire academic year, 19.6% of the students noted that they would highly recommend the course, 22.9% of the students indicated that they would recommend the course, and 14.3% were indecisive and noted that they would neither recommend nor advice against taking the course.

6.2.6 Factors of Motivation and Stress

The factors of motivation and stress were examined by using closed and open questions. The following factors of stress were surveyed: unfamiliar learning method, time requirements, self-directed learning, time pressure, teamwork, technical aspects, and other factors (open category). Investigated motivational factors were as follows: teamwork, self-dependent working, working on practical tasks, utilization of the learning platform, utilization of virtual communication tools, and other factors (open category).

The analysis was conducted by descriptive methods. Additional, differences between participants with and without experience in e-learning courses were calculated. For this purpose, two multivariate analyses of variances were calculated for both the factors of motivation and stress at a time. The dependent variables were the factors of motivation and stress discussed above; independent variable was the experience with e-learning. Multiple univariate analyses of variances would have required seven univariate analyses of variances for the factors of stress and six for the factors of motivation. This would have greatly increased the error Type I. Therefore, a multivariate method was performed even though the sample size was rather small ($n = 35$).

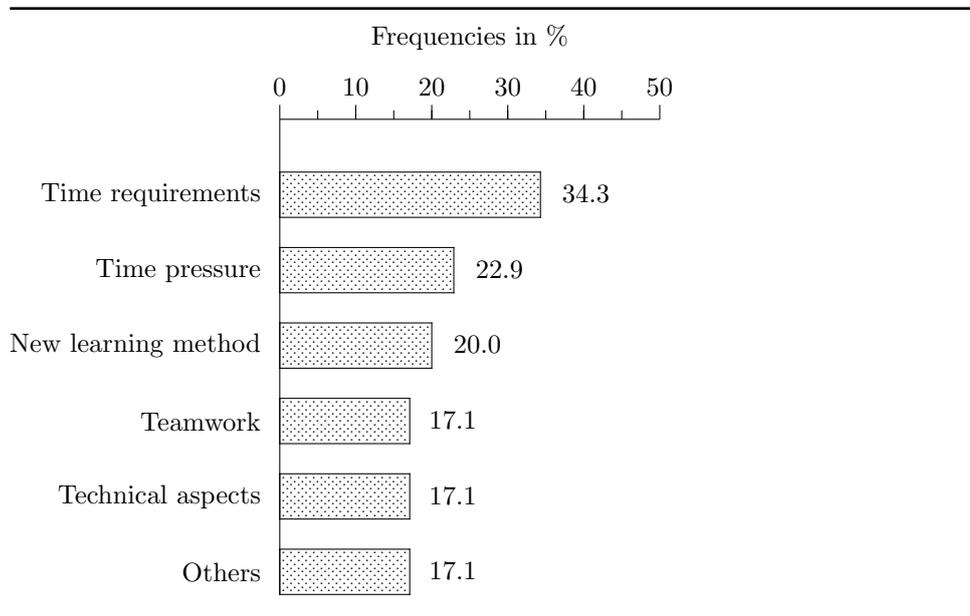
As presented in figure 8, time requirements were indicated as most frequent factor of stress, followed by time pressure. On the third place students indicated that they experienced the new learning method as a strain. Finally, the factors teamwork, technical aspects, and other factors of stress were noted.

The open answers were very heterogeneous and specific. Among others, students mentioned the following factors of stress: Understanding English literature, screen handling, few social contacts, too little imparting of practical expert knowledge, and problems with the tasks.

As can be seen in figure 9, regarding motivational factors, working on practical tasks and virtual communication ranked highest. In the second place, utilization of the learning platform was noted, followed by self-directed learning. Finally, students indicated that they found teamwork to be motivating. Students also noted other motivational factors. For example, the participation in the pilot project was also experienced as motivating. Experiencing a new learning method as well as identifying one's deficits through the course was also noted as motivating.

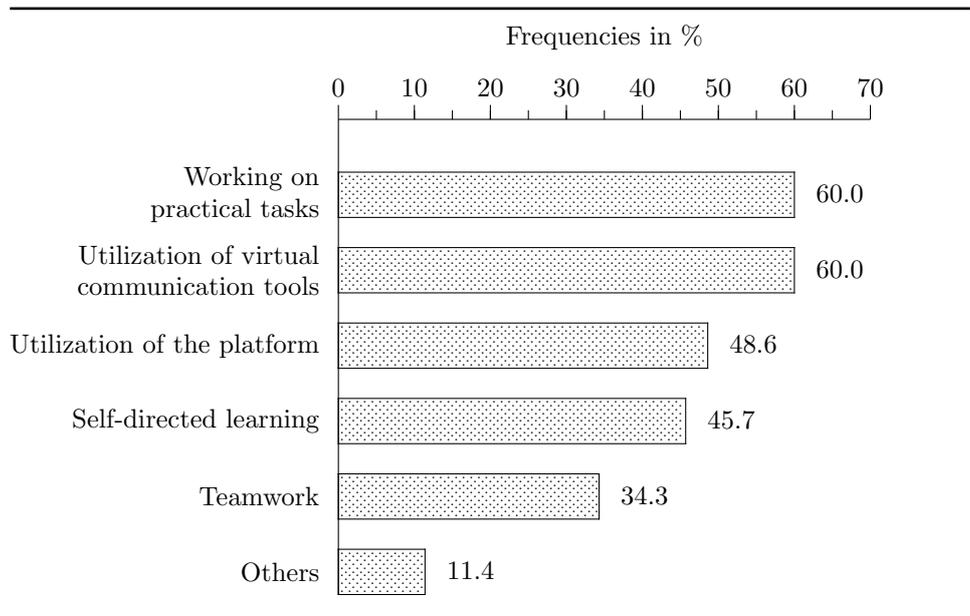
When the data were divided by experience with e-lecturing, no significant differences among the students regarding factors of motivation and stress were found. This indicates that the ratings of students who participated in an e-lecturing course for the first time did not differ significantly from the ratings of students who had prior experience with this learning method.

Figure 8.
Factors of Stress for VEL



Note: n = 35

Figure 9.
Motivational Factors for VEL



Note: n = 35

6.2.7 Qualitative Overall Rating of VEL

The questionnaire of the summative evaluation of the summer semester (T3) contained the following open questions: “Which elements of the course did you enjoy? What should be definitely be maintained?”, “Which elements of the course did you not like? What could be improved?”. In addition, for investigating positive and negative aspects of the new learning method, open questions concerning advantages and disadvantages of e-lecturing courses in general were addressed. In each case, the data were analyzed qualitatively and quantitatively by categorizing the responses.

Thirty-one participants responded to the query that probed participants to identify aspects of VEL that were highly liked and should definitely be maintained in future. The dedication of the tutors in supporting students, both on the learning platform and in the face-to-face workshops, was especially emphasized. In the second rank, the group tasks with their practical relevance were mentioned. It was also mentioned that teamwork was experienced positively and motivating. Furthermore, the learning method e-lecturing in general, self-directed learning, and the subject matter in general were also mentioned. The frequencies are presented in table 20.

The comments in response to the question which aspects of the course were disliked and should be modified were multifaceted and specific. The major points were the following (frequencies are presented in table 21):

1. The communication on the learning platform among students and among the teams respectively should be fostered and inspired. A feature allowing for better use of the chat component should be created.
2. The instructor should make herself more available to the students and should impart her expertise.
3. The time requirements should be reconsidered.
4. If possible, another learning platform should be used.
5. A few students had problems within their respective teams. In order to prevent subsequent problems within the teams, the suggestion was made to facilitate interaction in the initial phases of team formation.
6. An introduction to the subject matter should be given.
7. The tasks should be formulated more precisely.
8. The feedback to the tasks should be optimized (more detailed and more frequent)

The question regarding the advantages of the learning method e-lecturing indicated that flexibility regarding time and place ranked first by far. Far behind, the following advantages were also mentioned (frequencies are displayed in table 22):

- ▷ Experiencing new media (computer, internet, virtual communication)
- ▷ Ease of communication among participants (increased information flow, expanded exchange, possibility to pose questions etc.)
- ▷ E-lecturing is viewed as an individual learning method (opportunity to take an active part, self-directed learning, and individual learning tempo)
- ▷ Working efficiently
- ▷ Necessitates active involvement with the subject matter
- ▷ Key qualifications are fostered (teamwork, knowledge management)
- ▷ Information is available on the learning platform
- ▷ Practical relevance for subsequent profession
- ▷ E-lecturing has a great potential for the future

Regarding the disadvantages of the learning method e-lecturing, the lack of personal contacts ranked first, followed by the deficiencies of virtual communication. Lively discussions are not possible, virtual communication is less effective, asynchronous discussions take time, chat is tedious, lack of non-verbal communication expression, communication problems, inhibition of expressing oneself on the platform, were all noted. Furthermore, the lack of commitment within the teams and subsequent troubles with passive participants were also mentioned to be problematic. Students also frequently noted dependence on media and technical equipment. Less frequently, the following points were specified (frequencies are presented in table 23):

- ▷ Insufficient personal contact with the lecturer, learning from the expertise of the lecturer is not possible
- ▷ Time requirements for all parties concerned
- ▷ Lack of opportunities for social interaction, and in the long run, possible loss of social competence in personal contact
- ▷ Problems when individuals have limited knowledge of computer and internet
- ▷ Controlling teams is challenging

Table 20.

Which Elements of the Course Did You Like? What Should Definitely Be Maintained in Future Learning Activities?

Category	Individuals	%
Dedication of tutors in supporting students	15	48.4
Practical relevance of group tasks	13	41.9
Learning method e-lecturing	8	25.8
Teamwork	7	22.6
Feedback to the tasks	4	12.9
Subject matter	3	9.7
Self-directed learning	3	9.7
Others	9	29.0

Note: n = 31. The category “others” contains very specific and heterogeneous answers.

6.2.8 Formative Evaluation

The data of the formative evaluation II were analyzed by descriptive methods. In addition, the qualitative data of the open answers were classified. The following areas were analyzed:

- ▷ Face to face meetings (introductory unit, workshops)
- ▷ Tasks & feedback to the tasks
- ▷ Teamwork & communication
- ▷ Utilization of the learning platform & online support
- ▷ Time requirements

For all areas, quantitative closed questions as well as qualitative data using open questions were surveyed. Additional significance tests were employed regarding improvement of teamwork compared to the previous semester, regarding improvement of group organization through the workshop “Group Management”, and regarding modifications of time requirements compared to the previous semester. In these cases, the improvement and decrease,

Table 21.
Which Elements of the Course Did You Not Like? What Should Be Changed?

Category	Individuals	%
Communication among students	7	24.1
Lecturer should be more available to the students	6	20.7
Face to face units, workshops	5	17.2
Time requirements should be reconsidered	5	17.2
Group tasks should be optimized	5	17.2
Another learning platform should be used	4	13.8
Feedback to the tasks	4	13.8
Teamwork: Problems with the team	3	10.3
Introduction into the subject matter should be given	2	6.9
Support through tutors on the platform	2	6.9
Others	6	20.7

Note: n = 29. The category “others” contains very specific and heterogenous answers.

Table 22.
Advantages of E-Lecturing

Category	Individuals	%
Flexibility regarding time and place	23	76.7
Experiencing new media	8	26.7
Possibility of communication among participants	7	23.3
Individual	5	16.7
Working efficiently	4	13.3
Information is available on the platform	3	10.0
Active preoccupation is necessary	3	10.0
Key qualifications are fostered	3	10.0
Practical relevance for subsequent profession	2	6.7
Up to date	2	6.7
Others	6	20.0

Note: n = 30. The category “others” contains very specific and heterogeneous answers.

Table 23.
Disadvantages of E-Lecturing

Category	Individuals	%
Lack of personal contacts	8	27.6
Deficiencies of virtual communication	7	24.1
Dependence on media and technical equipment	5	17.2
Lack of commitment within teams	5	17.2
Insufficient contact to lecturer	3	10.3
Time requirements for all parties concerned	3	10.3
Loss of social skills in personal contact	2	6.9
Problems when only little knowledge of computer & IT	2	6.9
Controlling teams is difficult	2	6.9
Others	3	10.3

Note: n = 28. The category “others” contains very specific and heterogeneous answers.

respectively, was analyzed by one sample t-tests. The test value was 3, which was the value for “remained the same”.

Consequently to the results of the formative evaluation, important modifications of the initial didactical concept were implemented. The following section will outline the major results of the formative evaluation. The subsequent modifications that were implemented in the winter semester 2002/03 are discussed in chapter 7.

Face-to-Face Units

The evaluated face-to-face units included the introductory unit, the workshop “Group Management” and the workshop “Knowledge Management”. Both workshops were implemented consequently to the evaluation results of the winter semester 2001/02. The introductory unit reached a mean of 1.97 ($S = 0.684$) on a five point rating scale (1 being highest), the workshop “Group Management” was rated with a mean of 2.32 ($S = 0.900$). The workshop “Knowledge Management” averaged 2.48 ($S = 0.962$). A detailed description of the workshop see table 24. The response to the question, how helpful the workshop “Group Management“ was for the own group organization, was rated neutrally with a mean of 3.34 ($S = 1.514$). The qualitative data revealed information about positive and negative aspects of the evaluated lessons. The most important results of the qualitative data for the introductory unit were as follows:

- ◇ The focus should be not only on organizational but also on content related issues.
- ◇ The teams should be given the chance of getting to know each other.

For the workshop “Group Management”, in summary, the students indicated the following:

- ◇ In order to facilitate working effectively in the entire group, the presence at workshops should be mandatory
- ◇ The theoretical input should be extended with real life, practical experiences.
- ◇ The group arrangements, which are worked out by the teams, are to be expanded upon in more detail.

Table 24.

Details for the Workshops “Group Management” and “Knowledge Management”

Workshop “Group Management” workshop tasks	M ^a	S
Individual reflection: my role in the team	2.28	1.061
Group arrangement: developed by each team	2.16	0.943
Analysis of the teams: development of relevant dimensions	2.32	1.029
Theoretical input: criteria for effective teams	2.16	0.898
Global rating	2.32	0.900
Workshop “Knowledge Management” workshop tasks	M ^b	S
Theoretical input: knowledge management in organisations	2.26	0.965
How to do: work techniques in teams	2.39	1.116
Development of a guideline: “applied knowledge management”	2.94	1.124
Global rating	2.48	0.962

^a_n = 25

^b_n = 31

For the workshop “Knowledge Management” following suggestions for improvement were given:

- ◇ Specific, practical suggestions for applied knowledge management should be given, for example, on how to search and select relevant literature.
- ◇ More time should be reserved for the theoretical input, or, alternatively, the theoretical input should be shortened.
- ◇ The development of the guideline for applied knowledge management should be optimized. This task was ambiguous and the gain of information was considered low.

Group Tasks & Feedback to the Tasks

The group tasks were rated regarding increased knowledge, practical relevance, and time requirements for students. Time requirements were rated

rather high. The ratings of the time requirements increased with each additional task given during the summer semester. Frequencies are summarized in table 25. The items “increased knowledge” and “practical relevance” were rated quite well for all tasks. A descriptive analysis of these items suggested that, between the tasks, there was no difference between the ratings of the items “increased knowledge” and “practical relevance”. An analysis of variances confirmed this assumption. Pillai Spur is not significant in both cases ($p = .112, F = 2.162, df = 5, n = 35$ for increase of knowledge; $p = .739, F = .421, df = 5, n = 35$ for practical relevance). On this account, the mean of the task ratings was calculated. On a five point rating scale (1 being the best value), “increased knowledge” averaged 2.06 ($S = 0.763$), “practical relevance” reached a mean of 1.76 ($S = 0.742$).

The qualitative data confirmed the results that the time requirements for completing the tasks were rather high. It was also mentioned that the tasks were chosen very well, that they were interesting, and relevant for practical work. Furthermore, it was noted that being provided with a two week period for working on the tasks was helpful.

On a five point rating scale (1 being the best value), with a mean of 2.09 ($S = 0.786$), the feedback to the tasks given by faculty was rated quite good. The open answers strengthen this result. It was mentioned that feedback to the tasks was important and helpful. It was also noticed that individual feedback, tangible suggestions for improvement, and examples for solutions to the tasks, were also desirable.

Teamwork & Communication

On average, the teamwork within the groups was judged positively with a mean of 2.03 ($S = 1.20$) on a five point rating scale (1 being the best value). Compared to the previous winter semester, the teamwork within the groups improved slightly (direct query of change). The improvement was statistically significant, $T = -2.144, df = 34, p < .039$ (two tailed), test value = 3, $M = 2.71, S = 0.789$ on a five point rating scale, 1 = improved very much. Only two students indicated that teamwork within their groups had degraded very much (value 5), all others rated teamwork positively or neutrally. The question whether the workshop “Group Management” was helpful for the actual group organization of the teams was rated neutrally and no significant improvement was noted ($p < .198$).

Table 25.
Time Requirements for the Tasks

	n	M	S
Task 1: Operationalization “smoking”	34	2.91	1.061
Task 2: Development of a research design for the Evaluation of a smoking cessation program	32	3.31	0.965
Task 3: Data acquisition methods for Registering school violence	32	3.59	1.011
Task 4: Sample design	31	3.94	0.964

Note: The items score on a five point rating scale, 1 = low time requirements, 5 = high time requirements.

An analysis of variances pointed out significant differences between the various modes of communication ($p < .000$, $F = 113.9$, $df = 14$, $n = 33$). The primary mode of communication definitely was by email. Sometimes, students communicated face to face. Phone interaction as well as the communication tools of the learning platform was used rarely. Means and standard deviations are listed in table 26.

Utilization of the Learning Platform & Online Support

The learning platform was provided by msn communities of Microsoft (available at <http://groups.msn.com/>). It was free of charge and funded by advertisement. Even though the structure of the platform allowed for only minor adaptation for creating content, its transparency was judged to be quite good, with a mean of 2.51 ($S = 0.818$) on a five point rating scale (1 being the best value). The majority of students used the learning platform several times per week (71.4%). Twenty percent of the students indicated using the platform at least once a week, 5.7% used the platform less than once a week, and 2.9% of the students indicated using the platform daily.

The technical problems with the platform were within acceptable levels: 31.4% of the students had technical problems sometimes, 8.6% often, and only one person (2.9%) very often. Largely, the problems were capac-

Table 26.
Communication Mode within the Teams

Communication mode	n	M	S
Email	35	3.314	0.867
Face to Face	34	1.824	0.999
Platform	34	0.824	0.936
Phone	35	1.229	1.114
Chat	33	0.061	0.242
Others	33	0.182	0.465

Note: The items score on a five point rating scale, 0 = never, 1 = barely, 2 = sometimes, 3 = often, 4 = very often.

ity overload of the server which denied access, problems with file up- and download, and long loading time.

The discussion board was used by 77.1% of the students. Most frequently, students used the discussion board for content related messages (54.3%¹⁷) and organizational questions (51.4%). Technical issues were rarely posted (8.6%). The discussion board was used almost as often as during the previous semester of the course ($M = 2.83$ on a five point rating scale where 5 = much more often, $S = 0.891$).

During the entire course, tutors provided online support to students, whereas “support” refers to content related, organizational, and technical assistance. Students judged the support to be quite good, the mean was 1.77 on a five point rating scale, 1 being the best value ($S = 0.770$).

Time Requirements

Students differed extremely in the amount of time they devoted to the course. Students were asked to estimate the minimum and the maximum of weekly time invested for this semester, up to the measuring point. The minimum of time invested averaged 1.78 hours ($S = 1.96$, min = 0, max = 10),

¹⁷Percentages calculated by students who used the discussion board

Table 27.
Time Requirements for VEL

Time requirements compared to previous semester for... ^a	M	S
Group organization	2.71	1.017
Completion of tasks	3.26	1.010
Research of literature	2.54	0.780
Time requirements in general	2.83	0.785
Estimating time requirements for... ^b	M	S
Group organization	1.14	0.430
Completion of tasks	1.51	0.612
Research of literature	1.14	0.355
Time requirements in general	1.37	0.547

^afive point rating scale: 1 = much less time requirem. 5 = much more time requirem.

^bthree point rating scale: 1 = accurate; 2 = slightly too much, 3 = too much

the maximum averaged 7.89 hours ($S = 5.64$, $\min = 1.5$, $\max = 30$). As can be seen, the standard deviation of these items was very high.

Students were also asked to compare the amount of time invested for this semester of VEL with the previous semester. This was done on a five point rating scale (1 = much less time required, 5 = much more time required). A significant decrease of the time requirements was noted on the dimensions "time requirements for research of literature", $T = -3.467$, $df = 34$, $p < .001$ (two tailed), test value = 3). All other dimensions did not change significantly. The descriptive data are presented in table 27.

As can be seen from table 27, time requirements for the entire course were judged to be adequate. Also, time devoted for group organization, for research of literature, and for completion of tasks, were all rated to be acceptable.

6.2.9 Analysis of Drop Outs

Because of the high rate of dropouts, a missing analysis had to be performed for examining systematic differences between dropouts and remaining students regarding pertinent variables. Dropouts refer to termination of the course after the first semester, and a refusal of completing the questionnaires at measuring point T2 and T3. The following variables were analyzed: rating of general increase of knowledge, time requirements during the semester, time requirements for the examination, time requirements when compared to traditional lectures, and marks of the examination. An analysis was conducted in order to determine whether the participation pattern interfered with the students' ratings of all the variables mentioned above at survey T1 and T2. A graphical illustration of the participation patterns is displayed in figure 10.

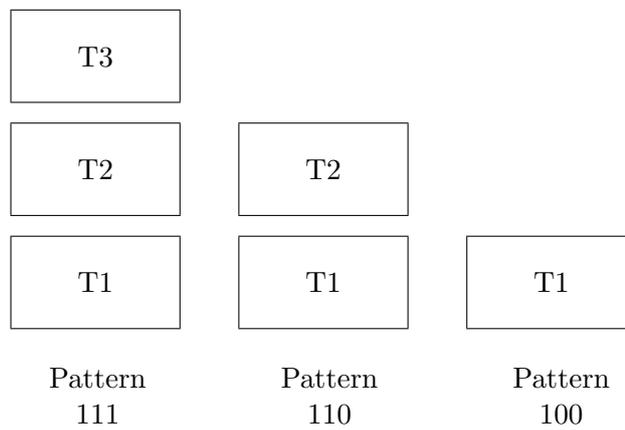
For this purpose, two multivariate analyses of variances were calculated: impact of participation pattern on ratings at surveys T1 and T2. Dependent variables were the above mentioned items; independent variable was the participation pattern in each case. Although some of the items did not correlate with each other, a multivariate method was used, since calculation of multiple univariate analyses of variances would have highly increased the risk of error Type I in this case. The sample size containing 51 individuals was adequate.

Concerning the investigated variables (grade, expectation and rating concerning effort, rating of knowledge increase), the missing analysis did not reveal any systematic differences between the remaining students and the drop outs. None of the variables showed significant differences between the participation patterns. These data indicated that the drop-outs did not cause a systematic bias in the indirect measurement of effects over the whole academic year.

6.3 Summary

In total, 66 students who participated in VEL in the academic year 2001/02 took part in the inquiries of the summative evaluation. Only 21 students participated in all of the three surveys. Thirty-five students completed the questionnaire at measuring point T3, i. e., the rating of the second semester of VEL.

Figure 10.
Participation Patterns for the Missing Analysis



Note: T1 = expectations to the e-lecturing learning activity, T2 = ratings after the first semester, T2 = ratings after the entire academic year. Participation pattern 111 means students participated in all of the three surveys, participation pattern 110 means students participated in survey T1 and T2, and participation pattern 100 means students participated only at the first survey T1.

The summative evaluation of the second pilot phase of VEL in the summer semester 2002 indicated that, with one exception, all of the objectives were achieved with great success. The dimensions were: promotion of self-directed learning, flexibility regarding time and place, awaken interest in course content, practical relevance of learning contents, acquisition of knowledge, and acquisition of key qualifications (teamwork skills, media competence, and knowledge management skills). The only dimension with only slight success of goal attainment was “acquisition of knowledge management skills”.

In nearly all of the investigated dimensions, the expectations of VEL could be met after completing the entire academic year. These were: promotion of self-directed working, practical relevance of course contents, possibility of information exchange with fellow students, availability of social contacts with other students, time requirements, efficiency when compared to traditional lectures, availability for posing direct queries, imparting coherence related to the subject matter, and general increase of knowledge. The ratings concerning the flexibility of VEL regarding time and place, taken after the entire academic year, significantly exceeded the expectations at the beginning of the course. However, the ratings on the dimension “increased information flow when compared to traditional lectures” were not met.

The ratings of the first and the second semester of VEL differed significantly on three dimensions: efficiency when compared to traditional lectures, availability of immediate responses to inquiries, and imparting coherence related to the subject matter. On all of the three dimensions, student ratings after the whole academic year were significantly better than after the first semester. The results revealed a V-shaped relationship between the ratings of the dimensions “efficiency”, “availability of immediate responses to inquiries”, and “imparting coherence related to the subject matter”. On all of the three dimensions, the expectations of VEL were not achieved after the first semester, but were met after completing the entire academic year.

The missing analysis showed no significant differences between dropouts and the remaining students regarding pertinent variables. These data indicated that student variables causing program termination did not distort the results of the indirect measurement of effects over the entire academic year.

The direct measurement of change regarding key qualifications indicated significant improvement on all of the dimensions, such as teamwork, knowledge management, technical know how regarding utilization of learning platforms, and self-directed learning. The attitudes regarding utilization of learning platforms, utilization of virtual communication tools, and self-directed working, also improved significantly, whereas attitudes regarding teamwork remained unchanged. Interest in the subject matter evaluation & research methods and interest in e-lecturing also increased significantly, whereas interest in teamwork did not change.

The time requirements of VEL were rated to be rather high across all three items (time requirements during the semester, time requirements for the final examination, and time requirements compared to traditional lectures), whereas the time requirements during the semester were rated significantly higher than the time requirements for the final examination. Controlling for interfering personal variables did not change this result. However, the overall benefit of VEL was rated high as well.

The most frequent factors of stress were in this order: time requirements, time pressure, and new learning method. Teamwork and technical aspects were mentioned as well. The most frequent factors of motivation were the practical tasks and the utilization of virtual communication tools. The utilization of the learning platform, self-directed learning, and teamwork were also frequently mentioned. Controlling for students' experience with e-lecturing did not change the results.

The qualitative overall rating of VEL indicated that students highly appreciated the support by the tutors. In the second rank, the practical group tasks were highly liked. It was also frequently mentioned that teamwork was experienced positively and motivating. The learning method e-lecturing, self-directed learning, and the subject matter in general, were also mentioned. The elements of VEL which were disliked were very specific. The most important issues were the high time requirements, the lacking presence of the lecturer, and the wish for an introduction to the subject matter.

The formative evaluation of the second semester of VEL pointed out that the focus of the introductory face-to-face unit should be reconsidered. The focus should be not only on organizational but also on content related issues, and the team members should be given the chance of get-

ting acquainted with each other in order to avoid subsequent problems with virtual collaboration.

The time requirements for the group tasks was rated rather high. The qualitative data confirmed this result. The qualitative data also revealed satisfaction with the tasks, which were perceived to be interesting, chosen very well, and relevant for practical work. Faculty feedback to the tasks was also rated quite high. The qualitative data strengthen this result by pointing out that the feedback was very important and helpful.

The teamwork was rated positively. When compared to the previous semester, a statistically significant improvement of teamwork was noted. The primary mode of communication between students was by email. Sometimes, students commmunicated face-to-face.

The technical problems when using the learning platform were within acceptable levels and occured rarely.

7 Discussion

In this section, the results of the study, referring to the main goals of VEL, are discussed with regards to the literature, reviewed in part I. First, the promotion of flexibility and self-regulated learning are discussed, second, the changed students' expectations regarding faculty availability and the desire for immediate feedback are addressed. Third, the results regarding virtual collaboration, an essential element of VEL, and the characteristics of asynchronous communication are examined. Furthermore, the promotion of media competence is discussed. Finally, limitations of the study are outlined and an outlook to modifications of the didactical design of VEL is provided.

7.1 Flexibility and Self-Directed Learning

The promotion of key qualifications like self-directed learning skills is one of the main aims of online learning. Online learning is more flexible than traditional teaching (Yang et al., 2003; Valenta et al., 2001; Stokes, 2000; Song et al., 2004; Mandl & Winkler, 2002; Konradt & Krebs, 2000; Müller, 2003; Kaiser & Taubmann, 2003) and lacks direct personal contacts and scheduling of class times. Thus, students are empowered to become more active and more responsible for their own learning than in traditional environments (Dringus, 2000, cited in Lieblein, 2000). The roles of students and teachers are transformed from the traditional "teacher-as-expert" and "student-as-recipient" roles, to more student-centered modes of delivery, where students are actively constructing knowledge (Strohmeier et al., 2003).

Likewise, as primary goals, the VEL-project was initiated to foster self-regulated learning skills of the students and to change the traditional roles of lecturer and students of traditional lectures. The results of the evaluation of the first year of VEL indicated that VEL promotes self-regulated learning and flexibility regarding time and place to a great extent. The results also indicated that students had difficulties with self-directed learning, and were lacking the required self-regulated learning skills. This experience corresponds to several studies that point out that students are lacking skills of independent learning (Müller, 2003) and knowledge construction (Horz et al., 2003; Stokes, 2000). In order to benefit from the flexibility of an online environment, students need to have well-developed time-management practices and related skills of independent learning (Richardson & Turner, 2000).

On this account, it is necessary to help students to acquire the required skills. As a result of the formative evaluation of the first semester of VEL, a workshop dedicated to promote students knowledge management skills was implemented. However, the goal “acquisition of knowledge management skills” was rated lowest of all dimensions and was achieved with only slight success. Yet, the direct measurement of change regarding self-regulated learning and knowledge management skills revealed slight but significant improvements. These results show that e-lecturing has a great potential for improving independent learning skills.

The students’ expectations regarding promotion of self-directed learning after the whole academic year were met. No significant differences between expectations and ratings were found. Yet, the trend moved towards increased ratings. Moreover, the expectations at the beginning of VEL were high. Regarding flexibility, the ratings of VEL significantly exceeded the expectations, even though the expectations were already high. The fulfillment of expectations is an important factor for satisfaction. Hence, it can be viewed as success, when students’ high expectations are met.

An interesting result is the trend of the item “imparting coherence related to the subject matter” over the whole academic year. The relatively high expectations were met after the second semester, but could not be reached after the first semester. This result indicates that students struggled with self-regulated learning at the beginning and were overwhelmed by the requirements. They had to solve practical tasks and lacked basic factual knowledge. Thus, they did not perceive coherence of the subject. After acquiring a basis of knowledge, the students were able to perceive coherence at the end of the second semester. Similar results were found in respect of efficiency. On this dimensions as well, this kind of V-shaped relation occurred.

7.2 Faculty Availability and the Desire for Immediate Feedback

The lack of direct personal interaction and scheduled class times make the availability of the instructor even more essential. Faculty are expected to be more readily and promptly available than in traditional courses (Keeton, 2004) and they are expected to provide immediate feedback (Serce & Yildirim, 2003; Garreck et al., 2002; Keeton, 2004; Vonderwell, 2003;

Thomas & Whittington, 2004). The necessity of continuous online support and feedback to inquiries was also emphasized by the evaluation of VEL. Especially during the period of preparation for the final examination, students demanded prompt feedback to inquiries. Students had very high expectations regarding availability of immediate responses. These were not met after the first semester, but were met after the whole academic year. This can be interpreted to indicate that students reassessed their perceptions of feedback to questions. Additionally to continuous online support, students received general feedback for every task, pointing out positive and negative aspects of the team assignments in a differentiated fashion. The feedback was rated positively. The qualitative data strengthen this result, indicating that the feedback to the tasks was important and helpful.

According to Garreck et al. (2002), it is critically important to create a balance of sharing the instructor's expertise and empowering students. Accordingly, the qualitative data of the evaluation of VEL pointed out that the lecturer was not adequately present for the students. The lecturer's role changed towards a manager and facilitator of a lecturing team, and students had barely contact with her. Some students commented that they attended the course because they liked the lecturing capability of the instructor, and were frustrated because they missed her face-to-face lectures. Online support and workshops were performed by the tutors. This support and the engagement of the tutors were highly appreciated by the students, and were specially emphasized in the qualitative overall rating of VEL. However, students missed the expert who imparts knowledge. This result is not surprising, and indicates that students still feel more comfortable with traditional lecturing, the teaching method they are used to. These results can be linked to the students' lack of self-regulated learning skills.

7.3 Learning Through Collaboration

An essential element of effective online delivery is collaboration. Collaboration increases the student involvement with the subject matter (Hiltz, 1994, cited in Hiltz, 1998), enhances the engagement in the learning process (Harasim, 1990, cited in Hiltz, 1998), and has a positive effect on students' achievement (Leung & Chung, 1997; Slavin, 1993, Johnson & Johnson, 1991, cited in Wessner, 2003, Rezaei & Katz, 2003 and cites therein). The modern constructivist learning theory suggests that learning is constructed by

humans through collaboration (see e.g. Slavin, 1993; Baumgartner, 1998; Gros, 2002). True collaboration requires well-designed learning activities (Rezaei & Katz, 2003; Kerres & Petschenka, 2002). An essential element of the instructional design of VEL is virtual collaboration in small teams and problem-solving of practical real-life tasks. The application of factual knowledge to new situations thus is promoted. The results of the summative evaluation showed high student achievement in terms of grades and self-assessments. Most students (84.6 %) reached the grades 1 and 2 in their final examination, calculated from the grades of the first and the second semester. The self-assessments also indicated high student achievement. The majority of the students (68.6 %) indicated that they benefited substantially from course attendance. Likewise, the collaborative group tasks were rated high regarding increased knowledge.

In the second semester of VEL, the students already gained enough knowledge to benefit from the practical tasks and to enjoy them. Working on practical tasks was the most frequently indicated motivational factor (60 % of the students). The qualitative data strengthen this result by pointing out that the tasks with their practical relevance were highly appreciated, that the tasks were chosen very well, and that they were interesting and relevant for practical work. These results are aligned with the model of self-regulation of McMahon and Oliver, (2001) which suggests that, in order to enhance the level of student motivation, activities should be grounded in authentic and relevant situations. Accordingly, the criteria oriented approach to assess practical relevance of the learning contents showed goal achievement with great success.

As a result of the evaluation of the first semester, the period of task completion was prolonged from one to two weeks in order to enable true collaboration and reduce time pressure. It became evident that virtual group organization takes more time than face-to-face collaboration. Though the time period was prolonged, the tasks were rated high regarding time requirements, whereas the time requirements increased with each task during the second semester. The tasks were getting more and more demanding and hence required more time for completion. Accordingly, time requirements and time pressure were the most frequent factors of stress. The qualitative data also pointed out that the time requirements were high and should be reconsidered. The students had many other daily responsibilities and in

many cases struggled with balancing them. The actual time requirements of the course exceeded the scheduled time requirements by far. In contrast to traditional lectures, the effort during the semester was high whereas the effort for the final examination was rated significantly lower. Subsequently, in order to prevent time pressure and stress, the time requirements for VEL should be clearly communicated to students.

In addition to improving engagement with the content and improving learning outcomes, collaboration can enhance group organization and teamwork skills (Kerres & Petschenka, 2002), essential for professional development. It is a main goal of VEL to promote teamwork skills as an essential key qualification. The results of the study showed that this goal was reached with great success. The direct measurement of change also pointed out a slight but significant improvement of actual teamwork skills. The formative evaluation showed that the teamwork within the respective teams was rated positively. Compared to the previous semester, the students also indicated a slight but significant improvement of their teamwork. These results appear to indicate that, corresponding with McAlpine and Goddard (2002), the ability to work together in virtual teams improves as students gain experience. However, teamwork was both a factor of motivation (34.3 % of the students) and a factor of stress (17.1 %). Likewise, the qualitative overall rating of VEL showed a very positive picture of the experience with teamwork. Nevertheless, a few students had problems within their teams and struggled with passive peers.

7.4 Asynchronous Communication and the Social Dimension of Communication

Several studies pointed out that asynchronous written communication is lacking an important social dimension of communication (Richardson & Turner, 2000; Schmidt, 2000; Yang et al., 2003). The process of community building in asynchronous communication takes longer than in traditional face-to-face environments (Brown, 2001; Mandl & Winkler, 2002). Correspondingly, the results of the evaluation of VEL indicated that the availability for social contacts in the e-lecturing environment was perceived to be low. In contrast, the possibilities for information exchange were perceived to be significantly higher. Moreover, fast information flow was also rated significantly higher than the perceived social dimension. This result

corresponds with the media synchronicity theory (Dennis & Valacich, 1999), which suggests that the process of distributing information is enhanced by asynchronous computer conferencing, whereas the social aspect of communication is low. Thus, it is important that students have the opportunity to become acquainted with each other as early in the semester as possible and interact with each other face-to-face. This need is met by the blended learning design of VEL and the newly designed workshop “Group Management” at the beginning of the course. The workshop was rated positively by the students. However, the answers to the question whether the workshop was helpful for the own group organization was rated neutrally, and no significant improvement was noted.

It appears that the acquisition of key qualifications is a long-term goal and cannot be met within a few months. Workshops supporting key qualifications like “Group Management” and “Knowledge Management” should be implemented into the whole curriculum, in order to provide a basis for subsequent online learning activities.

7.5 Media Competence and Technology

Many authors reported that some students experienced challenges and problems with technology (Aufenanger, 2002; Hara & Kling, 2000; McAlpine & Goddard, 2002; Song et al., 2004; Gabriel & MacDonald, 2002; Allen et al., 2002; Sumner & Hostetler, 2002) and lacked basic IT skills (Stokes, 2000; Holley, 2002; Schmidt, 2000; Gabriel & MacDonald, 2002). The students in VEL experienced few technical problems. Only a few students reported frequent technical problems. Accordingly, 17.1% of the students indicated technical aspects as a factor of stress. The goal “acquisition of technical know how” was achieved with great success. More than 70% of the students indicated that VEL promotes the acquisition of technical know how regarding working with learning platforms. The direct measurement of change revealed a highly significant improvement of media competence. Utilization of virtual communication tools was a factor of motivation for the majority of the students (60%) and the utilization of the learning platform in general was motivating for 48.6% of the students. These results appear to indicate that the application of the technology corresponded with the pedagogical

objectives of VEL and met the students' needs to accomplish the respective learning goals (Aufenanger, 2002; Jechle, 2003).

The overall rating of VEL showed that the perceived benefit was rated high. More than 80 % of the students estimated VEL to be highly useful or useful. This result also suggests that the pedagogical design of VEL met the students' needs in order to benefit from the course.

7.6 Limitations of the Study

Due to the small sample size of the study and self-selected participants, it is possible to generalize the results only to a limited extent. Furthermore, self-ratings of students and measures on a single-item basis may also diminish the validity of the results. However, most of the results correspond with the findings of many evaluation studies in the current literature, pointing to the importance of deliberate and theoretically sound pedagogical design that is based on educational research.

7.7 Outlook

Based on the results of the evaluation of the pilot year of VEL, the following modifications of the didactical realisation were implemented in the second year:

- ▷ In order to provide the opportunity for students to become acquainted with each other, the workshop "Group Management" was scheduled as early in the semester as possible.
- ▷ In order to support students in their self-regulated learning skills, the workshop "Knowledge Management" was also scheduled early in the semester.
- ▷ The workshops were redesigned and a compulsory attendance was required.
- ▷ Another learning platform (ILIAS) was used that provides the possibility for collaborative teamwork and structured presentation of content.
- ▷ The structure of the learning modules was divided into two steps: acquisition of factual knowledge (individual learning, first week of each module) and application of the acquired knowledge (teamwork, second week

of each module). The acquisition of factual knowledge was supported by students' self-tests in a multiple choice format, providing immediate, automated feedback of the results. It is hoped for that the implementation of the "self-learning period" will prevent difficulties with practical tasks that are due to a lack in basic theoretical knowledge.

- ▷ In order to prevent confusion and provide clear directions, the tasks were formulated more precisely.
- ▷ In order to promote virtual communication, specific tasks were implemented that required the use of the discussion board for collaboration.

8 Summary

In order to improve the quality of teaching and learning, the former traditional lecture “Research Methods & Evaluation”, at the Faculty of Psychology at the University of Vienna, was changed to an e-lecturing format (Vienna **E**-Lecturing) in the winter semester 2001/02. Essential elements of VEL were self-directed learning and virtual collaboration within small teams. Both a summative and a formative evaluation were conducted to assure the quality of the program and to optimize the didactical concept.

Self-designed questionnaires with open and closed questions were presented to students. Qualitative data thus complemented quantitative ratings. The surveys were presented online. The summative evaluation consisted of three measuring points over the entire academic year: expectations of VEL, ratings after the first, and after the second semester. The number of participants was 36 in the second semester, whereas only 21 participated in all of the three investigations conducted over the course of the entire academic year. Learning outcomes were measured both in terms of grades and subjective students’ assessments.

In order to assess whether VEL reached its goals, a criteria oriented approach was employed. Second, a direct measurement of change was used to investigate improvement of key qualifications, attitudes, and interest. Third, an indirect approach to measuring trends over the entire academic year was conducted. The question was, whether students’ expectations were fulfilled after the first, and after the second semester.

The results indicated that VEL fostered flexibility and self-regulated learning to a high degree. The learning outcomes also indicated great success. The direct measurement approach revealed a significant improvement of key skills, such as knowledge management, teamwork, and media competence. Attitudes regarding virtual communication and utilization of learning platforms improved significantly, whereas attitudes regarding teamwork remained unchanged. Interest in the subject matter and interest in e-lecturing also increased significantly. The time requirements of VEL were rated to be excessive. Also, time requirements during the semester were significantly higher than time requirements in preparation for the final examination. Hence, the most frequently noted factor of stress was time requirements and time pressure. The most frequent factors of motivation were practical

group tasks and utilization of virtual communication tools. Technical problems were kept within acceptable limits and occurred rarely. Finally, faculty support was highly appreciated by the students.

The results correspond with the findings of many evaluation studies in the current literature, pointing to the importance of deliberate and theoretically sound pedagogical design that is based on educational research.

Based on the results of this evaluation study, a few modifications of the didactical realisation of VEL were implemented. A subsequent evaluation study will be presented.

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Part III

Appendix

A Research Instruments

A.1 Original Questionnaire Dimensions for Evaluating the Course

All items were originally in German, they were only translated for better understanding of the dimensions. All the collected data derived from German language items.

1. Key qualifications

Investigates whether and to what extent VEL imparts key qualifications (goal 6):

- | | |
|---|---|
| ◇ Acquisition of teamwork-skills in virtual teams | ◇ Erlernen von Fähigkeit zur Teamarbeit in virtuellen Gruppen |
| ◇ Acquisition of technical know how regarding utilization of learning platforms | ◇ Erlernen von technischem Know How bezüglich Arbeiten auf Internet-Plattformen |
| ◇ Acquisition of work techniques of applied knowledge management | ◇ Erlernen von Arbeitstechniken zum angewandten Wissensmanagement |

2. Self regulated learning

Investigates whether and to what extent VEL promotes self-directed learning skills (goal 1):

- | | |
|---|---|
| ◇ Promotion of self-directed and active involvement in the subject matter | ◇ Förderung von selbständiger und aktiver Auseinandersetzung mit den Lehrveranstaltungsinhalten |
| ◇ Promotion of self-discipline in one's course of studies | ◇ Förderung hinsichtlich Selbstdisziplin im Studium |
| ◇ Promotion of personal responsibility for studying | ◇ Förderung hinsichtlich Eigenverantwortung im Studium |

- | | |
|--|---|
| ◇ Possibility to employ individual work styles | ◇ Möglichkeit, individuelle Arbeitsweisen einzusetzen |
| ◇ Promotion of know how and the subsequent continuation of self-directed involvement in the subject matter | ◇ Vermittlung von Kenntnissen, die das eigenständige Weiterbeschäftigen mit dem behandelten Stoff ermöglichen |
| ◇ Encourages critical thinking regards to the subject matter | ◇ Anregung zum kritischen Hinterfragen des Stoffes |

3. Communication and cooperation

Investigates the potential modes of communication within the learning activity:

- | | |
|---|---|
| ◇ Possibility of exchanging important information | ◇ Möglichkeit, mit anderen Studierenden wichtige Informationen auszutauschen |
| ◇ Possibility of discussion | ◇ Möglichkeit zur Diskussion |
| ◇ Availability of social contacts with other students | ◇ Möglichkeit für soziale Kontakte mit anderen Studierenden |
| ◇ Increased information flow compared to traditional lectures | ◇ Schnellere Kommunikationsmöglichkeiten als in traditionellen Frontalvorlesungen |

4. Flexibility regarding time and place

Investigates whether VEL allows flexibility regarding time and place (goal 2):

- | | |
|---|---|
| ◇ Allows students who live far from the university to participate in the course | ◇ Möglichkeit von Teilnehmern besucht zu werden, die von der Uni weit entfernt wohnen |
| ◇ Allows employed students to participate | ◇ Möglichkeit von Berufstätigen absolviert zu werden |

- ◇ No time overlapping to other courses
- ◇ Keine zeitlichen Überschneidungen mit anderen Lehrveranstaltungen
- ◇ Opportunity to study independently from one's location of residence
- ◇ Möglichkeit ortsunabhängig zu studieren

5. Time requirements

Estimation of time requirements for students when participating in the e-lecturing learning activity VEL:

- ◇ How do you estimate the time requirements for the learning activity during the semester?
- ◇ Wie schätzt du den Aufwand der LV im Laufe des Semesters ein?
- ◇ How do you estimate the time requirements for this learning activity in preparation of the final examination?
- ◇ Wie schätzt du den Aufwand in dieser LV zur Prüfungsvorbereitung ein?
- ◇ This learning activity requires (less/more) time than traditional lectures
- ◇ Diese Lehrveranstaltung ist (weniger aufwändig / viel aufwändiger) als traditionelle Frontalvorlesungen

6. Efficiency

- ◇ Compared to traditional lectures, time in this learning activity is used in a (much more efficient/less efficient) fashion
- ◇ In dieser LV wird die Zeit (viel effizienter / weniger effizient) genutzt als in traditionellen Frontalvorlesungen

7. Factors of Stress

Assessment of stress arising from the migration to the new learning method e-lecturing.

- ◇ What was your overall experience with the migration to the new lecturing method?
- ◇ Wie ist es dir bei der Umstellung auf die neue Lernmethode des E-Lecturing insgesamt gegangen?
- ◇ If the migration was difficult, which areas were especially challenging for you? (multiple answers possible)
- ◇ Wenn die Umstellung schwierig war, welche Bereiche sind dir schwer gefallen? (Mehrfachantworten möglich)

8. Support

Examines how students experienced support offered within the learning activity.

- ◇ Support by the tutors in workshops (face to face)
- ◇ Unterstützung durch die Tutorien (face-to-face)
- ◇ Support by the tutors on the learning platform
- ◇ Unterstützung durch die TutorInnen auf der Plattform
- ◇ Availability for posing direct queries
- ◇ Möglichkeit für direkte Rückfragen
- ◇ Compared to traditional lectures, the guidance and support in this learning activity is (much better/much worse)
- ◇ Die Betreuung & Unterstützung in dieser LV ist im Vergleich zu traditionellen Frontalvorlesungen (viel besser / viel schlechter)

9. Awaken interest in course content

Queries an increased interest in the subject matter “research methods & evaluation”, in teamwork, and in e-lecturing (goal 3).

- ◇ The content of the learning activity was of great interest to me even before attending the learning activity
- ◇ Die Inhalte der Lehrveranstaltung haben mich bereits vor dem Lehrveranstaltungsbesuch sehr interessiert

- | | |
|--|--|
| <ul style="list-style-type: none"> ◇ By attending the lecture, my interest in evaluation and research methods increased | <ul style="list-style-type: none"> ◇ Durch den Besuch der Vorlesung hat sich mein Interesse für Evaluation und Forschungsmethoden vergrößert |
| <ul style="list-style-type: none"> ◇ By attending the lecture, my interest in teamwork increased (virtual/face-to-face) | <ul style="list-style-type: none"> ◇ Durch den Besuch der Vorlesung hat sich mein Interesse für Teamarbeit (virtuell/face-to-face) vergrößert |
| <ul style="list-style-type: none"> ◇ By attending the lecture, my interest in e-lecturing increased | <ul style="list-style-type: none"> ◇ Durch den Besuch der Vorlesung hat sich mein Interesse für E-Lecturing vergrößert |

10. Imparting of knowledge

Queries various content related aspects:

- | | |
|---|--|
| <ul style="list-style-type: none"> ◇ Imparting coherence related to the subject matter | <ul style="list-style-type: none"> ◇ Vermittlung von Zusammenhängen in Bezug auf die Stoffinhalte |
| <ul style="list-style-type: none"> ◇ Practical relevance of learning contents | <ul style="list-style-type: none"> ◇ Praxisrelevanz der Lehrinhalte |
| <ul style="list-style-type: none"> ◇ Overview of the addressed subject matter | <ul style="list-style-type: none"> ◇ Überblick über das behandelte Stoffgebiet |

11. Motivational factors

Captures the motivational factor of enjoyment of the various aspects of the learning experience:

- | | |
|---|--|
| <ul style="list-style-type: none"> ◇ Where there any aspects of the learning experience that were enjoyable? | <ul style="list-style-type: none"> ◇ Gab es Bereiche der LV, die dir Spaß gemacht haben? |
| <ul style="list-style-type: none"> ◇ If so, what were those? (multiple answers possible) | <ul style="list-style-type: none"> ◇ Wenn ja, welche waren das? (Mehrfachantworten möglich) |

12. General assessment

Included is an overall assessment of the learning activity, an assessment of

the overall benefits, as well as open-ended questions about what was liked or disliked, i. e. what should be changed and should remain unchanged:

- ◇ All in all, I have learned a lot by attending this learning activity
 - ◇ After experiencing the e-lecturing learning activity, would you recommend it to fellow students as well, or would you discourage them from attending this or similar learning activities?
 - ◇ How do you rate the overall benefit of this learning activity?
 - ◇ What did you like about the learning activity? What should definitely be maintained? Please make tangible suggestions!
 - ◇ What did you dislike about this learning activity? What should be improved? Please make tangible suggestions!
 - ◇ What do you regard as the advantages of e-lecturing? Please add tangible remarks!
 - ◇ What do you regard as the disadvantages of e-lecturing? Please add tangible remarks!
- ◇ Insgesamt habe ich in dieser Vorlesung sehr viel gelernt
 - ◇ Würdest du nach den Erfahrungen mit der E-Lecturing-Lehrveranstaltung KollegInnen die Teilnahme an ähnlichen Veranstaltungen empfehlen oder ihnen davon abraten?
 - ◇ Wie beurteilst du den Gesamtnutzen des E-Lecturing?
 - ◇ Was hat dir an der Lehrveranstaltung gut gefallen? Was sollte unbedingt beibehalten werden? Bitte konkrete Anmerkungen machen!
 - ◇ Was hat dir an der Lehrveranstaltung nicht gefallen? Was könnte man besser machen? Bitte konkrete Anmerkungen machen!
 - ◇ Wo siehst du Vorteile des E-Lecturing? Bitte konkrete Anmerkungen machen!
 - ◇ Wo siehst du Nachteile des E-Lecturing? Bitte konkrete Anmerkungen machen!

A.2 Modified Questionnaire Dimensions after Obtaining the Estimate of Reliability

1. After conducting the estimate of reliability of the following original scales it was necessary to resort back to the individual items (item listings see above, chapter A.1).
 - Time requirements
 - Imparting of knowledge
 - General assessment
2. The following scales were separated into new scales:
 - Self-directed learning
 - Communication and cooperation

The following new scales were constructed:

- + Promotion of self-directed and self-dependent working
 - Promotion of self-directed and active involvement in the subject matter
 - Promotion of self-discipline in one's course of studies
 - Promotion of personal responsibility for studying

The items "Possibility to employ individual work styles" and "Promotion of know how and the subsequent continuation of self-directed involvement in the subject matter" might query something unrelated.

- + Possibility of information exchange with fellow students.
 - Possibility of exchanging important information
 - Possibility of discussion

The items "Increased information flow compared to traditional learning activities" and "Availability of social contacts with other students" are single items and were addressed separately.

3. The following scales remained unchanged (items see above, chapter A.1):
 - Flexibility regarding time and place
 - Awaken interest in course content

- Support
 - Key qualifications
4. The following areas originally consisted of individual items and were not subjected to an estimate of reliability:
- Efficiency
 - Factors of stress
 - Motivational factors

A.3 Item Comparison of the Summative Evaluation

Note: The item comparison between the points in time T1, T2, and T3 is only available in German.

Table 28.

Item Comparison Between Measuring Points T1, T2, and T3

Erwartungen an E-Lecturing (T1)	Bewertungen I (T2)	Bewertungen II (T3)
Aufwand		
Geringer Aufwand im Laufe des Semesters	Geringer Aufwand im Laufe des Semesters	Wie schätzt du den Aufwand der LV im Laufe des Semesters ein?
Geringer Aufwand für die Prüfung	Geringer Aufwand für die Prüfung	Wie schätzt du den Aufwand in dieser LV zur Prüfungsvorbereitung ein?
Diese LV wird [viel aufwendiger/weniger aufwendig] als andere Lehrveranstaltungen	Diese LV ist [viel aufwendiger/weniger aufwendig] als andere Lehrveranstaltungen	Diese LV ist [weniger aufwendig/viel aufwendiger] als traditionelle Frontalvorlesung

table continues

continued

Erwartungen an E-Lecturing (T1)	Bewertungen I (T2)	Bewertungen II (T3)
Effizienz		
In dieser Veranstaltung wird die Zeit [viel effizienter/weniger effizient] genützt als in anderen Veranstaltungen	In dieser Veranstaltung wird die Zeit [viel effizienter/weniger effizient] genützt als in anderen Veranstaltungen	In dieser LV wird die Zeit [viel effizienter/weniger effizient] genützt als in traditionellen Frontalvorlesungen
Förderung von selbständigem und eigenverantwortlichn Lernen		
Förderung der Studenten hinsichtlich Eigenverantwortung im Studium	Förderung der Studenten hinsichtlich Eigenverantwortung im Studium	Förderung hinsichtlich Eigenverantwortung im Studium
Förderung der Studenten hinsichtlich Selbstdisziplin im Studium	Förderung der Studenten hinsichtlich Selbstdisziplin im Studium	Förderung hinsichtlich Selbstdisziplin im Studium
Die Förderung von selbständiger und aktiver Auseinandersetzung mit den Veranstal- tungsinhalten	Die Förderung von selbständiger und aktiver Auseinandersetzung mit den Veranstal- tungsinhalten	Die Förderung von selbständiger und aktiver Auseinandersetzung mit den Lehrver- anstaltungsinhalten
zeitliche und örtliche Flexibilität		

table continues

continued

Erwartungen an E-Lecturing (T1)	Bewertungen I (T2)	Bewertungen II (T3)
Möglichkeit, auch von Berufstätigen absolviert zu werden	Möglichkeit, auch von Berufstätigen absolviert zu werden	Möglichkeit von Berufstätigen absolviert zu werden
Möglichkeit, auch von Studenten absolviert zu werden, die von der Uni weit entfernt wohnen	Möglichkeit, auch von Studenten absolviert zu werden, die von der Uni weit entfernt wohnen	Möglichkeit von Teilnehmern absolviert zu werden, die von der Uni weit entfernt wohnen
Keine zeitlichen Überschneidungen mit anderen Lehrveranstaltungen	Keine zeitlichen Überschneidungen mit anderen Lehrveranstaltungen	Keine zeitlichen Überschneidungen mit anderen Lehrveranstaltungen
Ermöglicht ortsunabhängig zu studieren	Ermöglicht ortsunabhängig zu studieren	Ermöglicht ortsunabhängig zu studieren
Praxisrelevanz der Lehrinhalte		
Herstellen einer Verbindung zur Praxis	Herstellen einer Verbindung zur Praxis	Praxisrelevanz der Lehrinhalte
Möglichkeit für soziale Kontakte		
Möglichkeit für soziale Kontakte mit anderen Studenten	Möglichkeit für soziale Kontakte mit anderen Studenten	Möglichkeit für soziale Kontakte mit anderen Studierenden
Möglichkeit zum Informationsaustausch		

table continues

continued

Erwartungen an E-Lecturing (T1)	Bewertungen I (T2)	Bewertungen II (T3)
Möglichkeit, mit anderen Studenten wichtige Informationen austauschen zu können	Möglichkeit, mit anderen Studenten wichtige Informationen austauschen zu können	Möglichkeit, mit anderen Studenten wichtige Informationen austauschen zu können
Möglichkeit zur Diskussion	Möglichkeit zur Diskussion	Möglichkeit zur Diskussion
Schnellere Kommunikationsmöglichkeiten		
Schnellere Kommunika- tionsmöglichkeiten als in traditionellen Lehrveranstaltungen	Schnellere Kommunika- tionsmöglichkeiten als in traditionellen Lehrveranstaltungen	Schnellere Kommunika- tionsmöglichkeiten als in traditionellen Frontalvorlesungen
Vermittlung von Zusammenhängen		
Vermittlung von Zusammenhängen	Vermittlung von Zusammenhängen	Vermittlung von Zusammenhängen in Bezug auf die Stoffinhalte
Betreuung		
Möglichkeit für direkte Rückfragen	Möglichkeit für direkte Rückfragen	Möglichkeit für direkte Rückfragen
Wissenszuwachs		
Insgesamt wird man aus dieser Vorlesung sehr viel lernen	Insgesamt habe ich aus dieser Vorlesung sehr viel gelernt	Insgesamt habe ich aus dieser Vorlesung sehr viel gelernt

B Questionnaires

B.1 Summative Evaluation

The questionnaires for both the summative and formative evaluation were presented by online surveys. The surveys were not designed to be printed; hence, the hardcopies appear distorted. The surveys can be located online at <http://homepage.univie.ac.at/birgit.zens/thesis> (March 2005).

B.2 Formative Evaluation

The questionnaires for both the summative and formative evaluation were presented by online surveys. The surveys were not designed to be printed; hence, the hardcopies appear distorted. The surveys can be located online at <http://homepage.univie.ac.at/birgit.zens/thesis> (March 2005).

C Curriculum Vitae

Personal Data

Name: Birgit Zens
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Education

1994 Matura (Abitur)
since 1994 Undergraduate studies in Psychology, Faculty of Psychology, University of Vienna

Employment

since April 2005: Project “Microteaching”, RWTH Aachen University. External Evaluation of the project, Department of Educational Psychology & Evaluation, Faculty of Psychology, University of Vienna.

since Aug. 2003: Computer Center of the University of Vienna, Department of New Media. Technical support, training, and consulting service in e-learning for faculty and students.

July 2003 – Feb. 2004: Project “E-Lecturing: Self Regulated Learning in Higher Education”, Department of Educational Psychology & Evaluation, Faculty of Psychology, University of Vienna.

Feb. 2002 – Dec. 2003: “New Media” - project of the University of Vienna. Analysis of the current state relating to the employment of new media.

Oct. 2002 – Feb. 2004: E-Tutor in the VEL-project

July – Dec. 2002: Pilot project “E-Lecturing für Massenvorlesungen” (“E-Lecturing for Large Scale Lectures”) Department of Educational Psychology & Evaluation, Faculty of Psychology, University of Vienna.

Internships

May – June 2001: Children’s Hospital Gottfried Preyer

July – Oct. 2001: Pro Mente Wien (association for psychosocial health)

Personal Interests

- ▷ Dancing! Practice in Modern Free Dance (based on a dance technique by R. Chladek) and Authentic Movement. Experience in Contact Improvisation, Modern Dance, and Dance Therapy. Long-time training in Ballroom Dancing.
- ▷ Unicycling

Publications

- ▷ Spiel, C., Strohmeier, D., Faradji, S., Schober, B., Gradinger, P., Zens, B., Aichinger, A. & Reimann, R. (2004). Selbstreguliertes Lernen durch Vienna E-Lecturing (VEL). Konzept, Umsetzung und Evaluation [Self-regulated learning through the Vienna E-Lecturing (VEL). Concept, implementation, and evaluation]. In W. Fröhlich & W. Jütte (Eds.), *Qualitätsentwicklung in der postgradualen Weiterbildung. Internationale Entwicklungen und Perspektiven*. Münster: Waxmann.

Presentations

- ▷ Strohmeier, D., Spiel, C., Faradji, S. & Zens, B. (2003). *Formative Evaluation als Instrument der Programmentwicklung und -optimierung: Anwendung bei der Implementierung des “Vienna E-Lecturings (VEL)”* [Formative evaluation: An instrument of developing and optimizing programs]. 6th Conference of Methods and Evaluation in September 2003. University of Vienna.

- ▷ Hrachovec, H., Zens, B. (2003). *ILIAS at Vienna University - Bottom Up and Top Down*. International ILIAS-Conference in October 2003. University of Cologne.
- ▷ Zens, B., Jirasko, M., Ecker, A., Zwiauer, C. (2003). *Ist-Stand-Analyse Neue Medien an der Universität Wien* [Analysis of the current state relating to the employment of new media at the University of Vienna]. 1st Day of New Media in May 2003. University of Vienna.
- ▷ Spiel, C., Strohmeier, D., Faradji, S., Zens, B., Gradinger P., Aichinger A., Reimann, R. & Schober, B. (2003) *Selbstgesteuertes Lernen durch E-Lecturing: Qualitätsoptimierung durch Evaluation* [Self-directed learning through E-Lecturing: Optimizing quality through evaluation]. 2nd International Conference of Quality Development in Postgraduate Training in May 2003. Donau-Universität Krems.

Poster Presentations

- ▷ Aysner, M. Spiel, C., Wagner, P., Zens, B. & Tzanetakis, R. (2003). *Trait versus State oder wie sinnvoll ist die Erfassung allgemeiner Verhaltensweisen? - ein Plädoyer für situationsspezifische Erhebungen am Beispiel von Lernstrategien* [Trait versus state, or: Does it make sense to assess general behaviors? A plea for situation-dependent assessment, using learning strategies as example]. 6th Conference of Methods and Evaluation in September 2003. University of Vienna.