Literature study – Guidelines to design ICT-support in the educational and/or collaborative domain.

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Context literature study –- This literature study is carried out within the context of PhD-research: 'Towards a framework for designing ICT-support to facilitate reflective learning activities in multiprofessional, competency-based education'.

Short description of the method:

- Broad set of search terms: (design) guidelines, (design) principles, education, learning, educational design, instructional design, instructional technology, online learning, e-learning, computer mediated, technology supported, ICT, ICT-supported, computer supported, computer augmented, collaborative learning/work, cooperative learning/work, team work, collaboration, cooperation, CSCL, online community, computer-mediated communication, virtual team, groupware, heuristics, heuristic evaluation, usability, learnability, learner-centred design
- Sources: *Omega* (Omega is a search engine developed by Utrecht University Library); *ERIC* (the Digital library of The Education Resources Information Center), *GoogleScholar Beta* (Searches the web specifically for scholarly literature) and *ACM Portal* (– included later, the Digital library of the Association for Computing Machinery).
- Search period 12/04 – 02/05
- Search result when necessary restricted to: >1995, relevancy-level, publication-types and domain (social science).
- Main selection criterion: clearly discernible set of guidelines in collaborative or collaborative + educational domain
- In total 6794 search results were considered, 28 articles were selected, with in total 271 guidelines.

Follow-up activities: the results presented here are not the final results. Follow-up activities are planned like for example: refine the selection criteria and classify the selected guidelines.

Download the (preliminary) results: The annotated references, which include (a summary of) the guidelines, can be downloaded in Word-format from www.ilyazitter.info.

Do you miss a reference? Please send an e-mail to ilya.zitter@hvu.nl and thank you in advance!

References of selected articles:

1. Baker, K. et al. (2002). Empirical Development of a Heuristic Evaluation Methodology for Shared Workspace Groupware. *CSCW* (pp. 96-105). New Orleans, Louisiana, USA.
2. Cockburn, A. & Jones, S. (1995). Four principles of groupware design. *Interacting with Computers, 7*(2), 195-210.
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   Reeves, T. et al. (2002). Authentic learning activities and online learning. In A. Goody et al. (Ed.), *Proceedings of the 2002 Annual International Conference of the Higher Education Research and Development Society of Australasia (HERDSA)* Perth, Western Australia: Higher Education Research and Development Society of Australasia, Inc.
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19. Tolmie, A. & Boyle, J. (2000). Factors influencing the success of computer mediated communication (CMC) environments in university teaching: a review and case study. *Computers & Education, 34*, 119-140.
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Annotated references:

Source	Baker, K. et al. (2002). Empirical Development of a Heuristic Evaluation Methodology for Shared Workspace Groupware. *CSCW* (pp. 96-105). New Orleans, Louisiana, USA.
Description	8 heuristics for real time groupware.
Guidelines (summary)	– Heuristic 1: Provide the means for intentional and appropriate verbal communication – Heuristic 2: Provide the means for intentional and appropriate gestural communication – Heuristic 3: Provide consequential communication of an individual's embodiment – Heuristic 4: Provide consequential communication of shared artifacts (i.e. artifact feedthrough) – Heuristic 6: Manage the transitions between tightly and loosely-coupled collaboration – Heuristic 7: Support people with the coordination of their actions – Heuristic 8: Facilitate finding collaborators and establishing contact

Source	Cockburn, A. & Jones, S. (1995). Four principles of groupware design. *Interacting with Computers, 7*(2), 195-210.
Description	Principles for the design of groupware.
Guidelines (summary)	– Maximise personal acceptance – Minimise requirements – Minimise constraints – External integration

Source	Descantis, G., Fayard, A., Roach, M. & Jiang, L. (2003). Learning in Online Forums. *European Management Journal, 21*(5), 565-577.
Description	'General guidelines for groups as they endeavour to experience collaborative learning inside e-based venues.'
Guidelines (complete)	– Aim for *frequent interaction*. Frequent communication facilitates formation of the network and helps to sustain it over time. E-venues that are vibrant with ongoing communication are more likely to experience declarative and procedural information exchange, transactive learning, and sense-making. Regular contribution to the conversation, even if just 'checking in,' signals a group member's presence in the group and will improve the retention rate in the network. – Foster a mindset of viewing the technology not so much as a conduit that links distributed people or sites but as a platform for group discourse — a *media space* for interaction. In this way, the venue exists not so much to link nodes into a network but to provide a shared context in which group learning evolves. – Over time, aim for *deep discussion*, that is, for discussion that includes not only information seeking and providing but also discussion of group members' capabilities and changing needs, and discussion that includes challenge, reflection, and debate. These latter types of discussion are dense and will move the group toward transactive learning and sense-making. Note that deep discussion takes time to develop. Even in rich, video-linked media spaces, dense discussion rarely happens early on but rather after the network is established. – Emphasize the importance *of speech that is positive and respectful* in tone. Learning is more likely to be nourished if the conversational atmosphere is tolerant and people feel a comfortable degree of co-presence. Even when conversations include criticism and debate, communication can be positive. Mutual respect is critical to development of a healthy learning network, and more sense-making will occur in groups that exhibit a consistently respectful tone in their online conversation. – Recognize the importance of *facilitators*, especially emergent facilitators. Some facilitators serve as technology 'translators' who are willing to help with adaptation of new technology to collaborative work (Mackay, 1990; Nardi and O'Day, 1999; Orlikowski et al., 1995). They buffer group members from difficulties in operation of the technology and encourage learning-oriented communication within the group. Other facilitators act as leaders or moderators of the online conversation. Both types of facilitators contribute to the success of the learning network. – Work to develop a relatively large *core group* of participants who provide stability in the network and foster growth. Avoid insularity or a core group that is too small in size to foster learning. – Recognize the importance of *routines* for interaction (e.g., regular online contribution, turn-taking, productive debate or challenging one another). Conversational routines provide structure that facilitates participation and aids interpretation of knowledge as it is shared inside the group. Specific routines can be advocated (e.g., asking people to say something about their work backgrounds in advance of commenting on an issue), but most routines cannot be fully defined in advance. Soft (pliable) routines are more conducive to learning than rigid conversational routines. Routines should evolve over time as a function of group needs and preferences. – Encourage groups to *experiment* with the technology and the conversations they conduct within it. Through experimentation groups can discover social practices that meet their unique needs and interests.

Source	Grudin, J. (1994). Groupware and social dynamics: Eight challenges for developers. *Communications of the ACM, 37*(1), 92-105.
Description	'Eight major problems that stem from the social dynamics of groups, drawn from developer experiences, descriptions of short-lived products and research prototypes, and experimental and modelling studies in the literature.'
Guidelines	1. **Disparity in work and benefit.** Groupware applications often require additional work from individuals who do not perceive a direct benefit from the use of the application. A groupware application is expected to provide a collective benefit, but some people must adjust more than others. Ideally, everyone benefits individually, even if some benefit more; however, this ideal is rarely realized. Most groupware requires some people to do additional work to enter or process information that the application requires or produces. *Addressing the problem*: Demonstrating an application's collective and indirect benefits can help. One promising approach is to design, along with the technology, processes for using it that create benefits for all group members. 2. **Critical mass and Prisoner's dilemma problems.** Groupware may not enlist the "critical mass" of users required to be useful, or can fail because it is never to any one individual's advantage to use it. Most groupware is only useful if a high percentage of group members use it. *Addressing the problem*: Designers can reduce the work required of all users, build in incentives for use, and suggest a process of use that provides or emphasizes individual and collective benefits. 3. **Disruption of social processes**. Groupware can lead to activity that violates social taboos, threatens existing political structures, or otherwise demotivates users crucial to its success.Groupware may be resisted if it interferes with the subtle and complex social dynamics that are common to groups. The computer is happiest in a world of explicit, concrete information. Central to group activity, however, are social, motivational, political and economic factors that are rarely explicit or stable. Often unconsciously, our actions are guided by social conventions and by our awareness of the personalities and priorities of people around us, knowledge not available to the computer. *Addressing the problem*: Recognizing the magnitude of the problem and avoiding the common assumption of a "rational" work environment are first steps. Developers need sophisticated understandings of prospective users' workplaces. 4. **Exception handling**. Groupware may not accommodate the wide range of exception handling and improvisation that characterizes most group activity. Work processes can usually be described in two ways: the way things are supposed to work and the way they do work. Software designed to support standard procedures can be too brittle. *Addressing the problem*: To avoid the pitfall of supporting rational "myths," learn how work is actually done. Tailorable systems are a good step to providing flexibility, but now to tailor effectively is a challenge, because people are not conscious of detailed organizational functioning and how changes will affect other people. 5. **Unobtrusive accessibility**. Features that support group processes are used to relatively infrequently, requiring unobtrusive accessibility and integration with more heavily used features.If "to a hammer, everything looks like a nail," then to a groupware designer, every work situation calls out for communication or coordination support. Work has important social elements that can use support, but groupware features will be used less frequently than many features supporting individual activity. This has two important implications. First, groupware features will fare better if integrated with features that support individual activity. This leads to the second point: Design to be unobtrusive yet accessible. Infrequently used groupware features must not obstruct more frequently used features, yet they must be known and accessible to users. *Addressing the problem*: If possible, add groupware features to an already successful application rather than launch a new application with a fanfare that creates expectations of heavy use. Ultimately, creating

	awareness of and access to infrequently used features could require systems that take the initiative to educate users over time. 6. **Difficulty of evaluation**. The almost insurmountable obstacles to meaningful, generalizable analysis and evaluation of groupware prevent us from learning from the experience. Task analysis, design, and evaluation are much more difficult for multi-user applications than for single-user applications. *Addressing the problem*: Development managers must enlist the appropriate skills, provide the resources, and disseminate the results. 7. **Failure of intuition**. Intuitions in product development environments are especially poor for multiuser applications, resulting in bad management decisions and an error-prone design process. Decision-makers rely heavily on informed intuition. Most product development experience is based on single-user applications, for which intuition can be a more reliable guide. *Addressing the problem*: Recognition of this problem was a factor in the emphasis on user involvement in the sociotechnical and Scandinavian collective resource approaches to IS development. 8. **The adoption process**. Groupware requires more careful implementation (introduction) in the workplace than product developers have confronted. *Addressing the problem*: By adding groupware features to existing applications, this problem is sidestepped. Stand-alone groupware must first be designed to meet the real needs of group members. Developers who understand the work environment well enough to design successfully will be in a good position to help design strategies for supporting adoption as well.

Source	Herrington, J..&.Oliver, R. (1995). Critical Characteristics of Situated Learning: Implications for the Instructional Design of Multimedia. *Ascilite* Melbourne, Australia. Herrington, J. & Oliver, R. (2000). An instructional design framework for authentic learning environments. *Educational Technology Research and Development, 48*(3), 23-48. Reeves, T. et al. (2002). Authentic learning activities and online learning. In A. Goody et al. (Ed.), *Proceedings of the 2002 Annual International Conference of the Higher Education Research and Development Society of Australasia (HERDSA)* Perth, Western Australia: Higher Education Research and Development Society of Australasia, Inc.
Description	Characteristics of (online) situated and authentic learning.
Guidelines (complete)	1. *Authentic activities have real-world relevance* Activities match as nearly as possible the real-world tasks of professionals in practice rather than decontextualised or classroom-based tasks. 2. *Authentic activities are ill-defined, requiring students to define the tasks and sub-tasks needed to complete the activity* Problems inherent in the activities are ill-defined and open to multiple interpretations rather than easily solved by the application of existing algorithms. Learners must identify their own unique tasks and sub-tasks in order to complete the major task. 3. *Authentic activities comprise complex tasks to be investigated by students over a sustained period of time* Activities are completed in days, weeks and months rather than minutes or hours. They require significant investment of time and intellectual resources. 4. *Authentic activities provide the opportunity for students to examine the task from different perspectives, using a variety of resources* The task affords learners the opportunity to examine the problem form a variety of theoretical and practical perspectives, rather than allowing a single perspective that learners must imitate to be successful The use of a variety of resources rather than a limited number of preselected references requires students to detect relevant from irrelevant information. 5. *Authentic activities provide the opportunity to collaborate* Collaboration is integral to the task, both within the course and the real world, rather than achievable by an individual learner. 6. *Authentic activities provide the opportunity to reflect* Activities need to enable learners to make choices and reflect on their learning both individually and socially. 7. *Authentic activities can be integrated and applied across different subject areas and lead beyond domain-specific outcomes* Activities encourage interdisciplinary perspectives and enable diverse roles and expertise rather than a single well-defined field or domain. 8. *Authentic activities are seamlessly integrated with assessment* Assessment of activities is seamlessly integrated with the major task in a manner that reflects real world assessment, rather than separate artificial assessment removed from the nature of the task. 9. *Authentic activities create polished products valuable in their own right rather than as preparation for something else* Activities culminate in the creation of a whole product rather than an exercise or sub-step in preparation for something else. 10. *Authentic activities allow competing solutions and diversity of outcome* Activities allow a range and diversity of outcomes open to multiple solutions of an original nature, rather than a single correct response obtained by the application of rules and procedures.

Source	Hewitt,J. & Scardamalia, M. (1998). Design Principles for Distributed Knowledge Processes. *Educational Psychology Review, 10*(1), 75-96.
Description	'Design principles interweaving computer support and new educational practices to bring about a more effective use of distributed resources in the classroom.'
Guidelines (summary)	1. Support Educationally Effective Peer Interactions 2. Integrate Different Forms of Discourse 3. Focus Students on Communal Problems of Understanding 4. Promote Awareness of Participants' Contributions 5. Encourage Students to Build on Each Other's Work 6. Emphasize the Work of the Community

Source	Johnson, S. & Aragon, S. (2003). An Instructional Strategy Framework for Online Learning Environments. *New Directions for Adult and Continuing Education, 100*, 31-43.
Description	'Seven principles of quality online learning environments.'
Guidelines (summary)	1. address individual differences 2. motivate the student 3. avoid information overload 4. create a real-life context 5. encourage social interaction 6. provide hands-on activities 7. encourage student reflection.

Source:	Lockhorst, D. (2004). *Design Principles for a CSCL Environment in Teacher Training*. Utrecht University.
Description	'Principles for effective design of a CSCL environment, in which student teachers learn collaboratively.'
Guidelines (summary)	Task Instruction 1. In order to increase participation in CSCL, use tasks focused on student teachers' own teaching practice. 2. In order to stimulate participation and a deeper level of content discussion, use tasks aimed at exchange of information and discussion of own teaching experiences. 3. In order to enhance the participation and the students' focus on content, use challenging and creative tasks in CSCL. 4. In order to stimulate participation, use tasks that require shared end-products, giving no room for simply compiling individual sub-products at the end, without thorough discussion. 5. In order to stimulate the student teachers' participation, interaction on task related content and their level of discussion, use debating type of tasks with built-in controversy. Task structure 6. In order to stimulate participation, interaction and discussions on content, use a pre-imposed structure with built-in controversy. When the teacher/designer anticipates the students lack motivation for the task, a pre-imposed structure without built-in controversy also assists students in performing the task. 7. In order to help students collaborate, task instruction should include organizational role-taking, particularly the role of group leader to divide the task, plan activities, and feeling responsible for the group. 8. In order to stimulate participation and to keep a CSCL group 'alive', stimulate students to communicate regularly, for instance by including clues in the task instruction for an effective frequency for responding. Compulsory or Voluntary participation 9. Intrinsic motivated student teachers increase the participation in CSCL. Voluntary participation in assignments is a way to involve motivated student teachers in CSCL. Period of Time Available for Assignment 10. In order to establish a constructive discussion on the task, CSCL assignments should have a duration of 10-14 weeks, which for our student teachers proved to be an effective period of time for responding to each other and bringing the assignment to a successful end. Blended Learning 11. If teambuilding or a complementing combination of F2F and online education are not aimed for, blended learning (here the combination of F2F and online learning) may decrease students' participation in CSCL and the learning effects of the students' online discussions. Scheduling within Teacher Training Programme 12. In order to prevent decreased students' participation and attention to task content, do not schedule the CSCL assignment parallel to F2F courses or parts of the teacher training programmes requiring much attention of the student teachers. If parallel scheduling is unavoidable, take extra actions to keep students involved. Group Composition 13. Use groups with student teachers with similar teaching backgrounds and experiences. 14. Use groups in which members know each other well, as this is experienced by student teachers as stimulating the collaborative process. 15. In a situation in which students do not know each other, at the start include F2F

	meetings for teambuilding activities as student teachers prefer to work with group members they know. Functionalities of Online Environment 16. Use groupware with only those functionalities that are needed to perform the CSCL task at hand, keeping groupware usage simple. 17. When there is no F2F contact between student teachers and teacher educators for a longer period of time (e.g. during teaching practice periods or in virtual teacher training programmes), the CSCL-ware should include more functionalities (such as a chat facility, a private mail option and a social area) than in other online training situations. 18. A chat facility can be used in CSCL environments to discuss practical problems or to get quick view on group members' opinions. Usability of the Online Environment 19. CSCL environments need functionalities to support the organization of the online communication, such as notification of all changes in the environment or automatically sent email with information on changes or notifying the addressee that particular actions are needed. 20. To effectuate threaded discussions in CSCL environments, thread usage should be stimulated, for instance by training students in using threads. The Design Context 21. In order to stimulate a well-functioning CSCL process, the student teachers need a good technical situation (well-functioning hardware, groupware and access to the Internet), preferably at home. 22. In CSCL, the designer should take the ICT skills of the students into account and act accordingly, by training less ICT skilled students (see earlier), addressing the dominance of ICT skilled students, and composing groups of only ICT skilled students to prevent them becoming dominant in groups with less ICT skilled students. Teachers' Guidance – Frequency of Interventions 23. In order to increase the student teachers' participation and interaction in CSCL, an active role of the teacher educator may be of assistance. 24. In order to have student teachers participate, interact, and focus on the content of a CSCL assignment, an active role of the teacher educator is not required, provided a teacher educator' passive role is compensated by other design elements, such as elements of the task instruction, or elements ensuring intrinsically motivated students. Content of interventions 25. In order to stimulate students to participate in and (re)start discussions, the teacher educator should send notes including directive communication in the beginning of the assignment period. 26. In order to get participants acquainted with each other do use evaluative F2F meetings. Do not use evaluative F2F meetings for increasing the students' communication on task content, but use other means, such as particular types of tasks. Training and Technical Assistance 27. In order to have ICT skilled student teachers work in a CSCL environment, a short training session focused on developing the students' technical skills and the performance of the assignment is sufficient. 28. In order to increase students' participation in a CSCL task, the task should be explained and practiced in a training session prior to the course. 29. In order to support participation of the students, quick, helpful and dedicated technical assistance, for instance by phone, email or even house calls, should be available during the entire course.

Source	Makrakis, V. (1998). Guidelines for the Design and Development of Computer-Mediated Collaborative Open Distance Learning Courseware. *ED-MEDIA/ED-TELECOM World Conference on Educational Multimedia and Hypermedia & World Conference on Educational Telecommunication* Freiburg, Germany.
Description	'A set of guidelines for the design of computer-supported distance multimedia that enables collaborative and open distance learning' (ODL).
Guidelines (complete)	– Consider the "lost in hyperspace" problem by organising the instructional material in an appropriate way and structure, avoiding unnecessary breaking of topics, grouping small topics whenever possible, limiting the number of links, providing standard links whenever possible and avoiding special links that seem unpredictable. – Courseware should include questions for discussion or response, rather than simply presenting one way transmission of "knowledge". – Include a table of contents, an alphabetical index of key topics, questions and assignment that enable students to present, analyse, discuss and synthesise problems or issues. Connect the course materials to current events or to students' experiences. – Decide what, where and how to display items. Special consideration must be given to highlighting items, text legibility and the structure of the instructional material in a coherent pattern and sequence. – Avoid hyperinteractivity and cognitive overload. Do not overload the user with meaningless animation, video, pictures, in term of learning. – Balance the needs of multimedia effects (graphics, text, sound, video, animation, color etc.) by taking into consideration the nature an the priorities of the topic, the preferences, characteristics, styles, age, knowledge and perceptions of users, the instructional goals and objectives, the context of learning, the previous research and the costs of various media. – Include on-line and off-line collaborative interactions that allow students to present drafts of written assignments to one another, critique one another's drafts, and then revise the draft on the basis of suggestions and reactions from the other students (peer-group assessment). Students may be divided into teams to present opposing viewpoints or conflicting views or different aspects on same topics or issues, perhaps with some members of the ODL class acting as respondents and judges". – Provide opportunities to students by giving them responsibility for monitoring and making judgements about aspects of their own learning (self-assessment). Students, for example, may be guided to prepare a self-assessment schedule. This is a document that student prepare towards the end of a course in which they summarise their learning and make judgements about it. – Define overall and specific instructional and learning objectives clearly and measurable for each unit and sub-unit of the courseware. – Include one or more "seminar" type segments in the courseware and let students do more than simply read instructional material. In other words, turn students as equal partners in the ODL collaborative interaction by giving them space to add links between existing topics, add new topics and annotations.

Source	Mandviwalla, M. & Olfman, L. (1994). What Do Groups Need? A Proposed Set of Generic Groupware Requirements. *ACM Transactions on Computer-Human Interaction, 1*(3), 245-268.
Description	'Generic groupware design requirements that are synthesized from survey of work group literature.'
Guidelines (summary)	GR 1 Support multiple group tasks GR 2 Support multiple work methods GR 3 Support the development of the group GR 4 Provide interchangeable interaction methods GR 5 Sustain multiple behavioral characteristics GR 6 Accommodate permeable group boundaries GR 7 Adjustable to the group's context

Source	McLoughlin, C..&.McCartney, B. (2000). If Going Online is the Answer, What are the Questions that Guide the Design Process? *Moving Online Conference* Gold Coast, Australia.
Description	'In designing activities for real-world professional learning online, these principles can be offered to teachers as design guidelines': – 7 Design principles for constructivist learning environments – Design recommendations for self-regulation and professional learning – 4 Explicit design recommendations based on experience in developing learning enviroments
Guidelines (complete)	1. Learning is an active process of constructing meaning 2. Many world views are possible, therefore awareness of multiple perspectives must be cultivated 3. Knowledge is context dependent, so learning should occur in contexts in which it is relevant 4. Learning is supported and mediated by tools and signs 5. Learning is a social-dialogical activity 6. Learners are distributed, multidimensional participants in a socio-cultural process 7. Knowing how we know is the ultimate human accomplishment. – Create a community of learners to create a motivating context. . – Provide modelling and scaffolding to support the development of. – Foster multiple perspectives in order to foster application of knowledge to real life situations – Contextualise learning activities to develop strategic knowledge – Enable articulation of ideas and reasoning processes to develop process knowledge. – Focus on learning processes, not products to cultivate deeper understanding – Design problem-based learning tasks to foster mastery of a propositional knowledge base. – Support reflection to enable learners to challenge personal assumptions. 1. Propositional information needs to be proceduralised through application to real life scenarios. 2. Learning tasks should develop strategic skills through their experience with novel tasks. 3. Students should develop process knowledge by communicating about the cognitive strategies they apply to a particular problem. 4. Tasks should be goal directed and enable students to redefine them and formulate their own criteria for successful integration into prior experience.

Source	Notess, M., Plaskoff, J. & Lilly, E. Preliminary Heuristics for the Design and Evaluation of Online Communities of Practice Systems. *ACM eLearn Magazine.*
Description	Set of heuristics drawn from published academic research into online communities of practice. These heuristics may be used to inform design, or they can be used as heuristics in an evaluation process.
Guidelines (summary)	1. **Support for ideation and the evaluation of brainstormed alternative**. An important aspect of communities is the ability to communally generate and evaluate new ideas about the processes within the practice as well as the function of the community. 2. **Structured information and interaction**. Participants will more actively engage in electronic collaboration if the interactions are structured in time, space, and scope. 3. **Unifying purpose and focus**. A community thrives on the ability of its members to believe in and articulate its purpose and goals. 4. **Dynamic information and structure**. Communities constantly evolve. Both the information and the people that participate in them are constantly in a state of flux. The space needs the ability to add, change, or delete information or functionality in response to community changes. 5. **Individual and group identity construction and maintenance**. Identity is critical to a community. Communities and the individuals in them must have vehicles for expressing how they are unique, what role they play in a larger scheme, and what maintains the bonds of the members. Identity is established through the roles of the members, the rituals of the group, and the history that they create together. 6. **Oversight—an appropriate level of control and moderation**. A community should allow for an adequate level of control and moderation. The ability to provide feedback about members' participation in dialog and other activities enables the environment to serve as a tool for instilling and maintaining the social norms of the group. 7. **A rich set of discussion tools, including support for dialog, negotiation, and collaborative problem-solving**. Tools in the environment should not only be structured around a particular purpose but also be rich and varied. A variety of different types of dialog take place in a community: negotiation, problem-solving, sharing, debate, and socializing, for example. Every effort should be made to limit members' feelings that the tools in the environment limit their communication styles. 8. **Mechanisms for regular stimulation toward increased growth and learning**. Communities evolve and grow over time, and the tools they use must not only accommodate this change but foster it as well. Learning is the key mechanism by which the community grows and evolves. 9. **Effective connections to live, offline community activities**. Communities generally have both online and offline activities. Often, communities will hold get-togethers, members will network in person, or collaborate on problems outside the context of the electronic space.

Source	Oliver, R. (2000). When teaching meets learning: design principles and strategies for Web-based learning environments that support knowledge construction. In R. Sims et al. (Ed.), *17th Annual ASCILITE Conference* Learning to choose: Choosing to learn (pp. 17-28). Lisomore, NSW: Southern Cross University Press.
Description	Design principles and strategies for web-based learning settings that exemplify constructivist learning settings.
Guidelines (summary)	1. Choose meaningful contexts for learning 2. Choose the learning activities ahead of the content 3. Choose open-ended and ill-structured tasks 4. Make the resources plentiful 5. Provide supports for the learning 6. Use authentic assessment activities

Source	Pelz, B. (2004). (My) Three principles of effective online pedagogy. *Journal of Asynchronous Learning Networks, 8*(3), 33-46.
Description	Effective online pedagogy with online examples.
Guidelines (summary)	– Principle #1: Let the students do (most) of the work – Principle #2: Interactivity is the heart and soul of effective asynchronous learning. – Principle #3: Strive for presence: *Social presence*: when participants in an online course help establish a community of learning by projecting their personal characteristics into the discussion – they present themselves as "real people". *Cognitive presence*: the extent to which the professor and the students are able to construct and confirm meaning through sustained discourse (discussion) in a community of inquiry. *Teaching presence*: "Teaching presence is the facilitation and direction of cognitive and social process for the realization of personally meaningful and educationally worthwhile learning outcomes".

Source	Quinn (Quinn, C. (1996). Pragmatic Evaluation: Lessons from Usability. *ASCILITE Conference 1996* Making new connections (pp. 437-445). Adelaide, Australia) in Albion, P. (1999). Heuristic evaluation of educational multimedia: from theory to practice. *16th Annual ASCILITE Conference* Responding to Diversity Brisbane, Australia.
Description	9 educational design heuristics.
Guidelines (complete)	– *Clear goals and objectives.* The software makes it clear to the learner what is to be accomplished and what will be gained from its use. – *Context meaningful to domain and learner.* The activities in the software are situated in practice and will interest and engage a learner. – *Content clearly and multiply represented and multiply navigable.* The message in the software is unambiguous. The software supports learner preferences for different access pathways. The learner is able to find relevant information while engaged in an activity. – *Activities scaffolded.* The software provides support for learner activities to allow working within existing competence while encountering meaningful chunks of knowledge. – *Elicit learner understandings.* The software requires learners to articulate their conceptual understandings as the basis for feedback. – *Formative evaluation.* The software provides learners with constructive feedback on their endeavours. – *Performance should be 'criteriareferenced'.* The software will produce clear and measurable outcomes that would support competency-based evaluation. – *Support for transference and acquiring 'self-learning' skills.* The software supports transference of skills beyond the learning environment and will facilitate the learner becoming able to self-improve. – *Support for collaborative learning.* The software provides opportunities and support for learning through interaction with others through discussion or other collaborative activities.

Source	Reeves, T., Benson, L., Elliot, D., Grant, M., Holschuh, D., Kim, B., Kim, H., Lauber, E..&.Loh, C. (2002). Usability and Instructional Design Heuristics for E-Learning Evaluation. *ED-MEDIA 2002 World Conference on Educational Multimedia, Hypermedia & Telecommunications* Proceedings 14th Denver, Colorado.
Description	Modified and refined version of Nielsen's protocol [Nielsen, J. (1990). Ten Usability Heuristics] for evaluating e-learning programs.
Guidelines (summary)	1. **Visibility of system status**: The e-learning program keeps the learner informed about what is happening, through appropriate feedback within reasonable time. 2. **Match between system and the real world**: The e-learning program's interface employs words, phrases and concepts familiar to the learner, rather than system-oriented terms. Wherever possible, the e-learning program utilizes real-world conventions that make information appear in a natural and logical order. 3. **Error recovery and exiting**: the e-learning program allows the learner to recover from input mistakes and provides a clearly marked "exit" to leave the program without having to go through an extended dialogue. 4. **Consistency and standards**: When appropriate to the content and target audience, the e-learning program adheres to general software conventions and is consistent in its use of different words, situations, or actions. 5. **Error prevention**: The e-learning program is carefully designed to prevent common problems from occurring in the first place. 6. **Navigation support**: The e-learning program makes objects, actions, and options visible so that the user does not have to remember information when navigating from one part of the program to another. Instructions for use of the program are visible or easily retrievable. 7. **Aesthetic and minimalist design**: Screen displays do not contain information that is irrelevant, and bells and whistles are not gratuitously added to the e-learning program. 8. **Help and documentation**: The e-learning program provides help and documentation that is readily accessible to the user when necessary. The help provides specific concrete steps for the user to follow. all documentation is written clearly and succinctly. 9. **Interactivity**: The e-learning program provides content-related interactions and tasks that support meaningful learning. 10. **Message Design**: The e-learning program presents information in accord with sound principles of information-processing theory. 11. **Learning Design**: The interactions in the e-learning program have been designed in accord with sound principles of learning theory. 12. **Media Integration**: The inclusion of media in the e-learning program serves clear pedagogical and/or motivational purposes. 13. **Instructional Assessment**: The e-learning program provides assessment opportunities that are aligned with the program objectives and content. 14. **Resources**: The e-learning program provides access to all the resources necessary to support effective learning. 15. **Feedback**: The e-learning program provides feedback that is contextual and relevant to the problem or task in which the learner is engaged.

Source	Simons, P. (2002). Digitale didactiek: hoe (kunnen) academici leren ICT te gebruiken in hun onderwijs.
Description	7 digital-didactical principles.
Guidelines (summary)	1. het oproepen van diepgaand leren bij studenten in een elektronische leeromgeving vraagt taakformuleringen die hen uitnodigen om onderzoek te doen en samen te werken. 2. begeleiders moeten studenten leren hoe zij in elektronische discussies op elkaar aan kunnen sluiten zodat er meer gemeenschappelijk begrip ontstaat. 3. begeleiders moeten de elektronische discussies tussen studenten volgen en op tijd ingrijpen. 4. de begeleider van elektronische samenwerking moet zich richten op de onderlinge tutoring van de studenten. 5. de ontwerper van een leeromgeving moet op zoek gaan naar optimale combinaties van synchrone, asynchrone en fysieke communicatie. 6. voor virtuele samenwerking zijn expliciete rollen en stappenplannen belangrijke vormen van ondersteuning voor het collectieve leren. 7. voor virtuele samenwerking zijn expliciete rollen en stappenplannen belangrijke vormen van ondersteuning voor het collectieve leren.

Source	Squires, D. & Preece, J. (1999). Predicting quality in educational software: Evaluating for learning, usability and the synergy between them. *Interacting with Computers, 11*, 467-483.
Description	Possible relationships between Nielsen's usability heuristics [Nielsen, J. (1990). Ten Usability Heuristics.] and the notions of cognitive and contextual authenticity form the basis for a set of 'learning with software' heuristics.
Guidelines (complete)	1. A need for a *match between designer and learner models* is implied by considering intrinsic feedback and the relationship between learner and designer models. At some level of system definition, intrinsic feedback should provide a legitimate and understandable representation of cognitive tasks which ensures that the model formed by learners will be consistent with the designer's model. A low level representation close to the core language of a system will probably be confusing. Representation at too high a level will result in a superficial model, which will not be of genuine use, and may even be misleading. The designer and learner models do not need to be the same, but there should be no differences between them, which would cause misconceptions in the learner's model of the relationship between the interface and the system. 2. A requirement for *navigational fidelity* is apparent when navigational structure, cosmetic authenticity, limited representation of the world and superficial complexity are considered. Interface designs that provide good usability may compromise authenticity by providing simplistic representations of the real world. The use of elaborate multimedia features may result in superficially complex interfaces which focus interaction on incidental navigation, rather than intended learning tasks. 3. The need to consider *appropriate levels of learner control* follows from a consideration of learner control and shared responsibility, self directed learning, tailoring and consistent protocols. A socio-constructivist view emphasises that learners should have a sense of ownership of their learning. This implies that they should have the maximum amount of control while still working in a supportive learning environment. The locus of control among peers during collaborative work is important. 4. The need for the *prevention of peripheral cognitive errors* is implied by the relationship between complexity and error prevention. Cognitive errors should be relevant to the major learning issues. Peripheral usability related errors should be anticipated and avoided. Where possible, novice versions of an application should be provided. 5. The requirement for *understandable and meaningful symbolic representation* follows from a consideration of representational forms and the use of symbols within and across applications. Learners should not be burdened with having to learn and remember arcane forms of interaction. The interface should place a low cognitive demand on the learner and functionality should be obvious. The same symbols, icons and names used to represent educational 'objects' and concepts should be used consistently throughout an application. 6. The need to *support personally significant approaches to learning* follows from a consideration of multiple representations, learners' support materials and metacognition. It should be clear what learning styles are supported and which aspects of an application's design relate to learning style characteristics. 7. The need for *strategies for the cognitive error recognition, diagnosis and recovery cycle* is implicit from the discussion of pedagogical techniques. Established strategies to promote the cycle of recognition, diagnosis and recovery should be used, e.g. cognitive conflict, scaffolding, and bridging. 8. That there is a clear need for a *match with the curriculum* is evident from a consideration of curriculum relevance and teacher customisation

Source	Tolmie, A. & Boyle, J. (2000). Factors influencing the success of computer mediated communication (CMC) environments in university teaching: a review and case study. *Computers & Education, 34*, 119-140.
Description	The literature also provides strong leads as to which factors, and which levels of these, are associated with `successful' CMC resources.
Guidelines (summary)	1. Size of group: smaller is better 2. Knowledge of other participants: it is better if participants know each other. 3. Student experience: it is better if students are experienced communicators under the task conditions involved. 4. Clarity about task: it is better if students understand how to go about the task they are engaged in, especially if this understanding is shared. 5. Ownership of task: it is better if students have the chance to negotiate what the task is to involve. 6. Need for system: it is better if there is a clear function for CMC which cannot be served more easily in another way. 7. Type of system and (8) prior experience of CMC. These may be factors, but the important levels are unclear.

Source	Veldhuis-Diermanse, A. (2002). *CSCLearning? Participation, Learning, Activities and Knowledge Construction in Computer-Supported Collaborative Learning in Higher Education*. Wageningen Universiteit.
Description	Conditions to increase the effective use of CSCL in university courses.
Guidelines (complete)	Before the course (preparation): – Determine the function of CSCL in the course clearly. What is the added value of CSCL?; – Integrate CSCL into other activities in the course; students must see the relevance of using CSCL; – Formulate unambiguous learning goals; students want to know where they stand; – Organise the course well and give students a schedule; – Take care of the basics the students need to follow the course; – Choose for a transparent and user-friendly CSCL-system; – Create a complex, open-ended task in which information can be discussed from multiple perspectives and problems can be solved in many different ways; – Consider the period of using the CSCL-system; search for a balance between enough time to learn to use the system and flagging interest; – Use task structures that regulate organisational and planning issues; – Consider moderating discussions: why, how, when? During the course (facilitating and monitoring): – Introduce to students the basics of the opportunities given by the system; – Arrange heterogeneous group compositions; – Provide students with different discussion roles; – Let students work in small groups; – Give students time to learn to use the CSCL-system and to understand the task; – Organise regularly (once a week) a face-to-face meeting; – Do not use e-mail, but communicate on-line by using the CSCL-system only; – Organise clear discussion threads; – Support the use of clear titles when sending contributions and suggest a list with keywords typifying the sort of note; – Do not present the task at once but present parts of the task distributed over the period; – Let students brainstorm about the task individually first and compare their ideas and debate differences in understanding next; – Let students summarise contributions between times; – Evaluate the progress of the course between times; – Show involvement by reading notes regularly, reserve enough time to log in daily; – If you have decided to moderate discussions, maintain the moderation; – Report between times on the progress of the course. After the course (assessment): – Assess the participation, learning activities used and knowledge construction in the CSCL-system; – If an additional test is needed, use a test that fits the learning goals best; – Prevent that students distribute tasks.

Source	Verdonschot, S. (2003). Borderless Learning Experiences-Development of design guidelines for collaborative distance learning environments. University of Twente. Also: Verdonschot, S., Kwakman, K., & Simons, P.R.J. (in preparation). Borderless learning experiences: the development of design guidelines for collaborative distance learning environments.
Description (summary)	'Meta-guidelines': by tracing underlying concepts in examples of design guidelines for learning environments for collaborative distance learning that were found in literature on CSCL environments, communities of practice and the learning organization, fourteen themes emerged. These themes offer insight in the most important characteristics of an ideal learning environment for collaborative distance learning.
Guidelines	1. User friendliness of the environment: The extent to which technology within the learning environment is well functioning. This theme stresses the importance of a technological environment not becoming a burden for its users. 2. Development of the environment: The extent to which the technological environment is able to develop during the course of time. This has both to do with the development of the environment due to use by learners (when, at some point in time, learners may want to use one or two electronic 'rooms' more intensively, the environment should support that) and with adaptations a system must make in order to meet secondary users-needs (needs that exceed primary needs such as well-functioning technology). 3. Group cohesion: The extent to which learners have built up a social connection with fellow learners. 4. Position of individual within the group: The extent to which the individual recognizes himself as autonomous and as someone who has something to attribute to others in the group. 5. Didactics: The extent to which general points of attention, concerning the instructional design of the learning process, are taken care of within the learning environment. 6. Learning situation mirrors the work environment: The extent to which the learning environment resembles aspects of the environment the learner is daily involved in, his work environment. 7. Involvement of the outside world: The extent to which people outside the learning environment are involved in the learning process in order to enrich the learning process with their views and opinions. This ought to prevent the environment from becoming an isolated and artificial entity. 8. Initiative: The extent to which learners are encouraged to take initiatives and to feel responsible for these initiatives, so that they feel ownership. 9. Motivation: The extent to which the learner feels enticed to contribute to the learning process within the environment. 10. Motivation by passion (a specific form of the theme 'motivation'): The extent to which the learner is intrinsically motivated. That means the extent to which learners' interests, motivations, and passions are touched. 11. Role of time: The extent to which time is used properly within the learning environment. Both the time used for particular activities and the time structure during the entire process is addressed within this theme. 12. Negotiation of meaning: the extent to which learners are supported in the process of exchanging frames of reference and opinions in order to create new knowledge. 13. Reflection: the extent to which learners are encouraged to look back both on actions undertaken and on the way they mix with fellow learners in the environment. 14. Willingness to invest is the extent to which learners want to contribute to the learning process based on what they expect to get in return. Reciprocal relations within the environment stimulate the learner to contribute to the process.

Source	Vrasidas, C. (2004). Issues of Pedagogy and Design in e-learning Systems. *SAC2004, ACM Symposium on Applied Computing* Nicosia, Cyprus: ACM.
Description	Learning principles for effective online learning.
Guidelines (complete)	– Learner-centered: Learners organize information and knowledge, take control of their learning, act as autonomous individuals who plan and execute learning tasks. An LMS should provide tools that allow learners to organize information, contribute content, and engage in learning activities. – Engaged and Active: Learners engage in interesting activities that motivate them and employ active learning principles to solve class problems. An LMS should provide tools that support active learning and problem solving. – Constructive: Learning is a constructive process during which students co-construct knowledge and meaning while interacting with peers, tools, and content. An LMS should provide tools that support various kinds of student-teacher and student-student interactions. – Situated and Contextual: Learning is situated in real world contexts where it gets its actual meaning. An LMS should provide tools that enable students and teachers to seamlessly integrate real-world authentic activities within class schedule. – Social and Collaborative: Learning is a social activity and students learn best when they interact frequently with teachers and peers. An LMS should allow learners to interact by providing synchronous and asynchronous communication tools. – Reflective: Learners engage in reflective thinking about their actions, skills, competencies, knowledge, and meta-learning skills. An LMS should provide tools that scaffold and support reflection on the learning process. e.g. journal keeping, probing questions to reflect on, etc. – Requires prompt feedback. Integrate feedback within the grade book. An LMS can use Intelligent Agents to provide feedback to student work and help the teacher monitor student progress.

Source	Vries de, S. et al. (2000). Online Knowledge Communities. *WebNet 2000 World Conference on the WWW and Internet* (pp. 124-129). San Antonio.
Description	Four guidelines for online knowledge communities (oke).
Guidelines (complete)	Four main guidelines: 1. The oke has to be functional: the oke has to include all the functionalities members need and has to support the user while being member of the community 2. The oke has to be usable: the member have to be able to perform easily with expected results. 3. The oke has to be sociable: the members have to be able to be a communicative person in a comfortable environment. 4. The oke has to be valuable: members have to feel that the membership of an oke is usefull.

Source	Weert van, T. (2001). Ontwerphandboek Taakgericht Teamleren met ICT-ondersteuning. Hogeschool van Utrecht/Universiteit Utrecht.
Description	28 success factors for ICT-supported, task- and team-based learning.
Guidelines (summary)	1. De veranderingsstrategie – Succesfactor 1.1. Leer ontwikkelen door doen – Succesfactor 1.1a Maak ontwikkelen van nieuw onderwijs tot competentie-ontwikkelen van de staf – Succesfactor 1.1b Ontwikkel gefaseerd, met opklimmend ambitieniveau – Succesfactor 1.2 Organiseer succes – Succesfactor 1.2a Verzeker de motivatie als sleutel tot succes – Succesfactor 1.2b Organiseer plannen maken en verantwoording – Succesfactor 1.3 Bouw op een goede basis – Succesfactor 1.3a Er is operationeel ICT-beleid – Succesfactor 1.3b De competentiebasis is voldoende – Succesfactor 1.4 Succes behoeft aandacht en ondersteuning – Succesfactor 1.4a Regel ondersteuning en beheer – Succesfactor 1.4b Organiseer kennisontwikkeling en -deling – Succesfactor 1.5 Maak ruimte voor investeringen en exploitatie – Succesfactor 1.6 Neem verantwoordelijkheid en lever kwaliteit 2. Het opleidingsmodel – Succesfactor 2.1 Het opleidingsmodel wordt voldoende breed gedragen en 'leeft' – Succesfactor 2.2 Het opleidingmodel legt operationele verbinding met de professionele praktijk – Succesfactor 2.3 Ontwikkel onderwijs waarin de student functioneert in de rol van junior-professional – Succesfactor 2.4 Ontwikkel onderwijs waarin realistische problemen uit het beroepsgebied met ICT worden opgelost. – Succesfactor 2.5 Ontwikkel onderwijs waarin studenten zich op realistische wijze verantwoorden – Succesfactor 2.6 Ontwikkel onderwijs waarin studenten op realistische wijze een studieloopbaan doorlopen, inclusief reflectie op die loopbaan 3. Het ontwerpproces – Succesfactor 3.1 De organisatorische omgeving is duidelijk en er zijn kaders gesteld voor de ontwerpopdracht – Succesfactor 3.2a Het proces van aanbesteding, uitvoering en oplevering van ontwerpopdrachten is transparant en past bij de zwaarte van de opdracht – Succesfactor 3.2b Opleidingsmanager en ontwerpteam nemen hun verantwoordelijkheden in het ontwerpproces – Succesfactor 3.3 Voer de taak 'ontwerpen' uit in teamverband met ICT-ondersteuning 4. Het ontwerpresultaat – Succesfactor 4a Er zijn concrete kwaliteitscriteria voor de ontwikkelopdracht vastgesteld – Succesfactor 4b De door het ontwerpteam opgeleverde ontwikkelopdracht voldoet aan de gestelde kwaliteitscriteria 5. Beheer en onderhoud – Succesfactor 5.1 Ontwerpresultaten worden beheerd om later van te leren – Succesfactor 5.2 Er vindt periodiek onderhoud van de opleiding plaats

Source	Winfield, W., Mealy, M., & Scheibel, P. (1998). Design Considerations for Enhancing Confidence and Participation in Web Based Courses. The University of Wisconsin Learning Innovation Center.
Description	6 guidelines for Web Based Courses, incorporating collaborative discussions and interactive experiences for the learner.
Guidelines (summary)	– Build up user confidence with technology – Build in the instructors presence and personality – Provide a clear set of learning activities – Build on personal and professional experience of participants – Relate content to real situation using case studies and simulation – Build in collaboration and facilitated team projects

Source	Young, L. (2003). Bridging Theory and Practice: Developing Guidelines to Facilitate the Design of Computer-based Learning Environments. *Canadian Journal of Learning and Technology, 29*(3).
Description	'Design principles for computer-based learning environments; loosely based upon the twelve socio-cognitive and technological determinants developed by Scardamalia' [Scardamalia, M. (2002). Collective cognitive responsibility for the advancement of knowledge. In B. Smith (Ed.), *Liberal education in a knowledge society* (pp. 67-98). Chicago: Open Court].
Guidelines (summary)	1. Create Environments that Include Social Negotiation and Cognitive Responsibility 2. Provide Authentic Experiences and Contexts 3. Allow for the Development of Pervasive Knowledge