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Redes de aprendizaje, aprendizaje en red

Learning Networks, Networked Learning

ABSTRACT

Learning Networks are on-line social networks through which users share knowledge with each other and jointly develop new knowledge. This way, Learning Networks may enrich the experience of formal, school-based learning and form a viable setting for professional development. Although networked learning enjoys an increasing interest, many questions remain on how exactly learning in such networked contexts can contribute to successful education and training. Put differently, how should networked learning be designed best to facilitate education and training? Taking this as its point of departure, the chapter addresses such issues as the dynamic evolution of Learning Networks, trust formation and profiling in Learning Networks, and peer-support among Learning Network participants. This discussion will be interspersed with implementation guidelines for Learning Networks and with a discussion of the more extended case of a Learning Network for Higher Education. Taking into consideration research currently carried out at our own centre and elsewhere, the chapter will close off with a look into the future of Learning Networks.

RESUMEN

Las redes de aprendizaje (Learning Networks) son redes sociales en línea mediante las cuales los participantes comparten información y colaboran para crear conocimiento. De esta manera, estas redes enriquecen la experiencia de aprendizaje en cualquier contexto de aprendizaje, ya sea de educación formal (en escuelas o universidades) o educación no-formal (formación profesional). Aunque el concepto de aprendizaje en red suscita el interés de diferentes actores del ámbito educativo, aún existen muchos interrogantes sobre cómo debe diseñarse el aprendizaje en red para facilitar adecuadamente la educación y la formación. El artículo toma este interrogante como punto de partida, y posteriormente aborda cuestiones como la dinámica de la evolución de las redes de aprendizaje, la importancia de fomentar la confianza entre los participantes y el papel central que desempeña el perfil de usuario en la construcción de la confianza, así como el apoyo entre compañeros. Además, se elabora el proceso de diseño de una red de aprendizaje, y se describe un ejemplo en el contexto universitario. Basándonos en la investigación que actualmente se lleva a cabo en nuestro propio centro y en otros lugares, el capítulo concluye con una visión del futuro de las redes de aprendizaje.

KEYWORDS / PALABRAS CLAVE

Learning networks, design, education, training, informal learning, lifelong learning.
Redes de aprendizaje, diseño, educación, formación, educación informal, educación a lo largo de la vida.

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1. Introduction

The knowledge society is characterised by the acceleration of knowledge production and the advent of knowledge-based communities (David & Foray, 2003; Sloep & Jochems, 2007). A central idea is that, ultimately, knowledge-intensive services and products will generate more economic value than do trade or the industrial production of bulk goods. However, knowledge intensive products and services demand highly-skilled people for their delivery. Also, the transition to a knowledge society is causing industrialized nations to experience fundamental changes in economic, political, cultural and social order. Consequently, citizens are experiencing various social and psychological effects (Sloep & al., 2011; Van Merriënboer & Brand-Gruwel, 2005). Other compounding factors include Europe's ageing population; new competences required for new ways of working and employability; relentless information overload; and the trend towards political and economic globalization. For Europe to retain global competitiveness it should speedily embrace multidisciplinary approaches and be flexible in deploying these (European Commission DG Research, 2009). Consequently, Europe cannot afford to stop educating its youth once they reach adulthood. It must invest in learning throughout people's lifespan, encouraging an ongoing exchange of knowledge across a diverse range of disciplines and levels of expertise. In other words, Europe must invest in lifelong competence development, from cradle to grave, i.e. in the initial education of learning children and adolescents as well as in the post-initial education of working professionals. If for economic reasons alone, we should invest more effort in the former but for the very same reason, we should pay even more attention to the latter (OECD, 2010).

We have a coherent system for initial education, but not for post-initial education. The imperatives of the impending knowledge society demand we develop such a system for the latter too. However, it would be a grave mistake to assume that our system for initial education fits the post-initial education's bill. The way we have organised initial education in our societies makes it ill-suited for the education of adult professionals. Curricula, classrooms and office hours do not sit well with the flexibilities of content, didactics and logistics adult learners require in order to acquire the exact competences they need, at their point of need and at their preferred pace, place and time. Indeed, many argue that our system for initial education badly needs reform as well (Robinson, 2001). We will not go into these arguments any further, but surmise that

education in general and post-initial education in particular would profit from an approach that supports lifelong competence development and is flexible in several important ways.

Recently, several approaches have been developed that address these requirements. In our view they show much potential, even though they have not yet achieved the level of maturity of higher education institutions. Prominent amongst them is the idea of learning (building and exchanging knowledge) in technology-enhanced, networked settings (Dron & Anderson, 2009; Haythornthwaite, 2002; Jones, 2008; McConnell, 2005; Siemens, 2004). Our attempt at developing such networks goes under the name of Learning Networks (Koper & Sloep, 2002; Sloep, 2009a).

2. Learning Networks

Learning Networks are online learning environments that help participants to develop their competences by sharing information and collaborating. In this way, Learning Networks by their design aim at enriching the learning experience in non-formal educational contexts (professional education); with slight adaptations, they are useful in the context of formal education (school or universities) as well. In their efforts to acquire competences, the inhabitants of a Learning Network could for instance (Koper, 2009):

- Exchange experiences and knowledge with others.
- Work collaboratively on projects (e.g. innovation, research, assignments).
- Set up working groups, communities, discussions, conferences.
- Offer and receive support to/from others in the Learning Network (e.g., questions, remarks, etc.).
- Assess themselves and others, find learning resources, create and elaborate their competence profiles.

A Learning Network as a social network is comprised of people who share roughly similar interests; any Learning Network supports resources that the participants may use for their specific purposes (see the above list) and a variety of services that supports them doing so. The main actors of the Learning Network thus are its participants. They can be anybody and will play a variety of different roles: e.g. learner, teacher, coach, mentor, interested bystander, support seeker, etc. Resources consist of files or links that might help participants to do what they deem necessary in order to develop their competences. Resources include, for instance, entire courses, single learning

objects, any kind of online documents, videos, blogs, wikis, etc. They are in part imported into the network, in part created by the participants themselves. Supporting services are software tools that increase a Learning Network's viability by facilitating the transactions of network members (Sloep, 2009a). These transactions permit participants to collaborate, to explore and to exploit the Learning Network. In terms of the above list, supporting services help participants to exchange knowledge, to work collaboratively and set up tools for that, to provide support and receive it, to assess themselves or others, to find learning resources, to work on their competence profiles, etc. Supporting services thus always concern a participant's (a) learning needs, (b) competences or (c) collective behaviour.

Such services could offer advice on the basis of the network members' collective behaviour (Drachler, 2009). So if most people studied course Y after course X, a pertinent service could recommend a learner to do similarly. Or, if most people found document Y useful with respect to a particular issue X, a pertinent service could recommend participants dealing with issue X to consult document Y. These kinds of recommender system are useful in that they capture the collective wisdom of the Learning Network 'crowd'. They can be made more sophisticated by taking into account participant profile data, so that recommendations become more personalised. The strength of such recommendations is that they can be given without any human intervention, once the recommender system has been set up, it just continues to generate recommendations.

Alternatively, support services could consist of advice provided by fellow learners (peers), hand-picked through data-mining, via team and group formation or matching technologies (Kalz, 2009; Van Rosmalen, Sloep, Kester & al., 2008). Unlike recommender systems, they have the potential to strengthen the social cohesion of the network as they require human intervention. Thus, when peers tutor each other, reciprocal learning occurs: peers learn by discussion and explanation. Reciprocal learning occurs in small groups of about 4 to 5 people, called ad-hoc

transient communities (Sloep, 2009b); ad hoc, because they are topic bound, transient, because their activity wanes once the problem has been solved. In the context of these ad-hoc transient communities, weak network links are transformed into strong community links. Initial research findings suggest that ad-hoc transient communities provide a mechanism for community growth within networks (Fetter, Berlanga & Sloep, 2008). This mechanism of community growth is important for fostering the emergence of social learning in Learning Networks (Chapman & Ramondt, 2005). The social learning which occurs

Ever more it becomes evident that Higher Education Institutions should focus on managing the increasingly permeable boundaries among universities, and between universities and the world outside them (Benkler, 2009). In Higher Education contexts, Learning Networks could be an excellent means to ensure that faculties and students have the largest possible capacity to act freely, to innovate within the confines of the University, and to liaise with external parties.

within these Learning Networks is also important for the individual in their professional life: emerging learning communities will, over time, acquire the characteristics of communities of practice (Brown & Duguid, 2000; Wenger & Snyder, 2002).

The social character of a Learning Network, furthermore, fosters the social capital of the participants (Fetter, Berlanga & Sloep, 2010), promotes networking learning and has the potential of minimizing the isolation that participants (due to geographical, social or cultural reasons) might have.

3. Learning Network: design, implementation and impact

The design of a Learning Network is context-dependent, each one of them has its unique characteristics; there are no predefined designs or recipes. Designing a Learning Network is a matter of co-creation, an interactive process that considers the participa-

tion and feedback of all stakeholders, such as the networks' patrons, its future participants, and possible other agents. One should decide to work with a user-centred approach, such as participatory design, which has the benefit of addressing not only tool use, but the learning environment in its entirety (Spinuzzi, 2005). Whatever the methodology used, it should include an analysis of the objectives of the Learning Network, the needs of the stakeholders, and an assessment of the technology already available.

After an initial design has been sketched, it then is evaluated and subsequently improved. The focus

Network will be maintained and controlled by an institution, as is the case in formal education or a company-based network. Another dimension pertains to the importance of knowing the initial position of the Learning Network, whether participants already know each other from face-to-face contacts, or whether they are expected to make first-time contacts through the Learning Network. Finally, the design of the Learning Network should consider if the access of the Learning Network will be open or restricted.

The analysis of participants should determine the type (prototype or persona) of users that will join the Learning Network, the benefits they expect to obtain from the Learning Network, their experience in online learning contexts, and their digital competences.

The analysis of resources delineates what knowledge, information and learning plans/paths a Learning Network will contain and how participants are expected to contribute to the well-being of the Learning Network; for instance, whether they are expected to create new resources individually or collaboratively.

Based on these considerations, the next step is to describe typical usage scenarios or use cases.

These should describe the problems or issues participants have as well as the proposed solution: how the Learning Network will work. By means of these use cases, an initial design model is proposed. It details the communication and collaboration functionalities the network will have and the services it will contain. Additionally, interaction strategies needed to stimulate interaction and collaboration between participants will be elaborated. These strategies could comprise resources, methods, activities or functionalities.

The initial design is verified and validated with a group of stakeholders, to obtain feedback and suggestions for improvement. Afterwards, the Learning Network is launched, which includes training and dissemination activities. Training should target key stakeholders, to motivate them and set in motion the creation of relevant resources. Also, online or face-to-face sessions are needed to spread the word on the availability of the Learning Network and on its functional-

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should be on solving the stakeholders' challenges by proposing solutions that will impact practice and provide an added value. One should avoid purely technological-driven approaches as these only address some of the stakeholders' problems.

Broadly speaking, the analysis of the objectives of the Learning Network should consider the type of participants and resources that will be interacting in the Learning Network. It should also take into account a variety of dimensions that may impact the Learning Network, such as the nature of knowledge the Network is expected to manage (in terms of complexity and actuality), or the organization of the learning process (formal, informal, non-formal). These two dimensions will influence the control participants will have in the Learning Network. Control could percolate from the bottom-up, as in approaches in which participants are expected to maintain the Learning Network themselves; or it could seep from the top-down, as in approaches in which the Learning

ties, but also to acquire new participants, and to fine-tune the network. When the Learning Network is running, monitor and evaluation activities should be conducted. They should include an assessment of the pertinence of the proposed solution, the competences acquired by the participants, an analysis of the social interaction (e.g., centralization versus distribution, number of contacts per participants, etc.), the number of active participants, the number of resources accessed, the impact of the services provided by the Network, and so on.

4. Learning Networks and Higher Education

Ever more it becomes evident that Higher Education Institutions should focus on managing the increasingly permeable boundaries among universities, and between universities and the world outside them (Benkler, 2009). In Higher Education contexts, Learning Networks could be an excellent means to ensure that faculties and students have the largest possible capacity to act freely, to innovate within the confines of the University, and to liaise with external parties.

For instance, let us take the example of a Learning Network for some Higher Education Institution whose objective it is to provide university stakeholders with opportunities to collaborate interactively with peers and tutors on specific issues.

This Learning Network might contain: 1) a profile service (Berlanga, Bitter, Brouns, Sloep & Fetter, 2010); 2) functionality for collaboration and sharing of resources between participants; 3) navigation services that will allow participants to search and receive recommendations for contacts and resources; and 4) supporting services to help participants to acquire answers for their problems/questions.

A profile service allows participants in the Learning Network to create and manage their own presence in the community, by means of a profile and contacts, as well as to manage their contributions for the community, by means of creating communities and learning actions (Berlanga, Rusman, Bitter-Rijpkema & Sloep, 2009). Profiling in Learning Networks enables understanding of the participant's context (Preece, 2000), gives security to build up trust between peers (Rusman, Van Bruggen, Sloep & Valcke, 2010), and provides safety within the conventions and boundaries of the community.

Functionality for collaboration and sharing includes creation of communities (which contain communication services such as email, chat or forum), and facilities to create and share resources as, for instance, bookmarking, rating, annotations, recommendations or

tagging (Berlanga, Rusman, Bitter-Rijpkema & Sloep, 2009).

Stakeholders, therefore, are given the option of creating online learning communities within the Learning Network, in the form of online learning (sub) communities for formal or informal learning purposes. For teachers, this could mean that through them, they now can act on their common interest in new teaching methods. In this community they could have a navigation service that will allow them to personalize, share and find out information and relevant resources. ReMashed (Drachler & al., 2009) is such a service. This service analyzes collaborative behaviour (using a technique called collaborative filtering) to recommend learning resources from emerging information of a Learning Network. Participants should specify the Web 2.0 services they use (e.g., del.icio.us, blog feeds, Twitter, YouTube), the subjects they are interested in, and their knowledge of these subjects. Based on these criteria, participants receive recommendations for relevant resources. Participants can also rate the recommendations they are receiving, and the service takes these preferences into account to fine-tune the recommendations.

This Learning Network could also broker learning offers available through the universities. Stakeholders (current and potential students, but also teachers and staff) could then search, find and compare learning opportunities that fit their interests or needs. To this end, learning opportunities should conform to a uniform computer interpretable language, as the Learning Path Specification (Janssen, Berlanga, Vogten & Koper, 2008) so a navigational support service could recommend relevant learning paths, considering learners' needs and preferences regarding competence level, delivery mode, time, and so on.

Finally, in this Learning Network stakeholders could use supporting services to be guided to solve their problems or questions. For instance, the Learning Network could contain a PhD community on research methods; in it researchers and PhD candidates could use a peer-support service to help each other (Van Rosmalen, Sloep, Brouns & al., 2008). Using such a peer-support service, a researcher posts a question, and the service finds out one or a few participants, depending on how the service is set up, who are best suited, in terms of their knowledge and availability, to help the question asking person to solve his or her problem. The service sets up a private working space (e.g. wiki) so participants can work together on solving the posted questions. Once the question is solved the working space is disbanded.

5. Future of Learning Networks

In the previous paragraphs we have attempted to sketch a picture of how Learning Networks operate, defined as online learning environments that help their users to develop their competences by sharing information and collaborating. First, we have acknowledged that the advent of the knowledge society is an important, though not the exclusive driving force behind them. Educational reform is another one. Then we have discussed how such networks are useful in contexts of formal, institutional learning and non-formal, workplace learning. We have established that next to participants, they contain resources and services. The services unlock the resources, but also foster the emergence of multiple, topic-bound communities through forging smart ties between network participants. We have urged the use of user-centred design approaches when creating concrete Learning Network instances, taking stakeholder objectives, participant characteristics, and locally available technologies into account. Finally, we discussed an example case of wanting to design a Learning Network in Higher Education.

What we hope to have conveyed is the understanding that:

- Educating people for the knowledge society requires an approach different than what we are accustomed to, certainly in post-initial, professional education, but likely also for initial, mandatory education.
- A Learning Networks approach provides a possible solution to this demand.

We would like to wrap up our discussion by listing a few opportunities for research on Learning Networks. In due time, the research outcomes should both deepen and widen the possible uses of Learning Networks as a promising learning environment for the future.

First and quite generally, Learning Networks heavily rely on online collaboration; they thrive in the environment the modern Internet provides: Web 2.0 (Berlanga, García Peñalvo & Sloep, 2010). However, the social web, as it is often called, is evolving rapidly. Natural language processing is becoming more powerful, whether it employs inferencing techniques based on ontologies and RDF or statistical techniques such as latent semantic indexing. Recommender systems are becoming ever more powerful, also because data sets become available on which they feed (Manouselis, Drachsler, Verbert & Santos, 2010). Open standards for online networking such as Open Social emerge and become implemented. This list may be extended almost indefinitely. So the precise elaboration of

Learning Network instantiations may change rapidly, some technology being state of the art a few months ago now being replaced by today's, more powerful technology; or, some service being costly or even impossible a few months ago, becoming affordable and available today. Research that monitors technological development therefore pays off.

Second, much has been said about the way in which a Learning Network should be stocked with resources and services in order for it to function as a collaborative environment for learning and knowledge exchange. What has received little attention so far is how people actually learn in such contexts, what kinds of resources, services and interactions between people are needed to optimise learning and knowledge exchange in such environments.

This question borders on the kinds of questions addressed by the field of CSCL, computer supported collaborative learning, but is different in that Learning Networks do not presuppose the omnipresence of teachers and staff as CSCL seems to do. It is pertinent as, obviously, learning and knowledge sharing do not come about automatically (Kirschner, Sweller & Clark, 2006). So, if teachers do not assume their traditional role of organisers of the learning process, who or what does? The problem, of course, is that too much organisation up front hampers flexibility. But too little is likely to lower learning efficiency. So the problem is one of finding an optimum and determining how this can be achieved efficiently. Only research can provide such answers.

Third and focussing on Learning Networks for non-formal learning, research is needed at the organisation and business model level. Allowing for the obvious variety between different nations, normal learning has its organisational structures in place. They come in the form of schools, faculties, classes, levels (primary, secondary), orientations (vocational, academic), teachers or lecturers, teaching assistants, support staff, etc. Also the way initial education is paid has been sorted out, again allowing for some variation. Basically, governments are the largest funders, with some room for private initiatives (Guthrie, Griffiths & Maron, 2008). Non-formal education is an entirely different matter. Without even attempting to elaborate the possibilities that there are, let alone go into their various details, it should be clear that the range of possibilities is vast (Kollock & Russell Brazier, 2006).

At the least innovative extreme, a Learning Network could be fully internal to a single, large organisation that wants to organise its knowledge management and professional development along novel lines.

In this case, it is this organisation that imposes the structure and foots the bill. At the other most challenging extreme a Learning Network could be like a commons, owned by nobody really, but constituting the shared interest of many interested parties, even single individuals. Structure emerges and many costs could be deferred to the use of open source, software, by open content as in, say, Wikipedia and, more specifically, open educational resources. However, some costs, if only those of the server space and data traffic somehow need to be paid for. These could be covered by allowing the posting of advertisements or by selling users' profiling data. Clearly, privacy is a concern here that needs to be addressed (Gallant, Boone & Heap, 2007). In between these extremes a whole range of possible organisational and financial configurations lives. If Learning Network-based learning is to be a viable option, research needs to chart out these configurations and assess them for their viability.

Fourth, as the organisational model just discussed makes clear, Learning Networks for non-formal learning in particular naturally link with open content. However, for a learning environment that feeds on Web 2.0 developments, open standards and open source software applications are no less important. Open standards allow any one instance of a Learning Network easily to track and adapt to novel developments, such as for example to the advent of the Open Social specification for profiling data. Open source software developments allow for the easy expansion or rejuvenation of Learning Network services. Obviously, also Learning Networks for formal learning stand to profit from openness of software, standards and content. In terms of research efforts, Learning Networks research should not merely inventory from what kinds of openness Learning Networks profit, it should also actively contribute to relevant standards and tools.

Fifth and final, there is one member of the open family that has not been mentioned yet: open innovation (e.g. Von Hippel, 2005). It is a relatively new development that originally only included the advice for corporations not necessarily to develop all their

intellectual property in house but, if more profitable, go out and simply buy it. Of recent, the notion has been extended to include collaborative innovation across companies in the precompetitive phases of the innovation process. Adopting a Learning Networks' approach would extend the playing field for open innovation even further (Sloep, 2009c), and that applies as well for Higher Education. After all, a Learning Network fosters the knowledge exchange that is a prerequisite of innovation. Also, it sports the kind of tools that facilitate collaboration. However, these are only the basics. For a Learning Network fully to support distributed (as in online), collaborative inno-

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vation, more is needed. For one, the Network participants should have a stock of creativity techniques at their disposal. Also, the Network should possess a collective memory that stores and retrieves, if one so wishes, the results of collaborative innovation sessions (Dolog, Lin, Grube & Schmid, 2009). Also, a service that handpicks networks participants best suited for a particular innovative job, should be available (Sie, Bitter-Rijkema & Sloep, 2009). Innovation, parenthetically, should be conceived broadly, to include bold attempts at designing the next generation smart phones and more modest attempts to design a new environmental science curriculum that better suits societal needs. Although some work has been done in this area, a vast number of questions, fundamental and practical, need to be resolved.

In conclusion, Learning Networks are a promising means to innovate education, formal and non-formal alike, but also a fertile ground for exciting research.

References

- BENKLER, Y. (2009). The Tower and the Cloud: Higher Education in the Age of Cloud Computing. In KATZ, R. (Ed.). *The University in the Networked Economy and Society: Challenges and Opportunities*. *Educause*; 51-61.
- BERLANGA, A.; RUSMAN, E.; BITTER-RIJPKEMA, M. & SLOEP, P. (2009). Guidelines to foster Interaction in On-line Communities for Learning Networks. In KOPER, R. (Ed.). *Learning Network Services for Professional Development*. Berlin: Springer Verlag; 27-42.
- BERLANGA, A.J.; BITTER, M.; BROUNS, F.; SLOEP, P.B. & FETTER, S. (2010). Personal Profiles: Enhancing Social Interaction in Learning Networks. *Int. Journal of Web Based Communities*, 7, 1; 66-82.
- BERLANGA, A.J.; GARCÍA PEÑALVO, F. & SLOEP, P.B. (2010). Towards eLearning 2.0 University. *Guest Editorial, special issue*, 8, 3; 199-201.
- BROWN, J.S.; & DUGUID, P. (2000). *The Social Life of Information*. Boston: Harvard Business School University Press.
- CHAPMAN, C. & RAMONDT, L. (2005). Strong Community, Deep Learning: Exploring the Link. *Innovations in Education and Teaching International*; 42, 3; 217-230.
- DAVID, P.A. & FORAY, D. (2003). Economic Fundamentals of the Knowledge Society. *Policy Futures in Education—An e-Journal*, 1, 1.
- DOLOG, P.; LIN, Y.; GRUBE, P. & SCHMID, K. (2009). Creativity Support at the Workplace. In HAMBACH, S.; MARTENS, A.; URBAN, B.; & TAVANGARIAN, D. (Ed.). *Proceedings of the 2nd International eLBA Science Conference (eLBA 2009)*. Rostock, Warnemünde (Alemania): Fraunhofer IGD, Institutsteil Rostock de la Universidad de Rostock.
- DRACHSLER, H. (2009). *Navigation Support for Learners in Informal Learning Networks*. *SIKS Dissertation Series 2009-37*. Heerlen (Países Bajos): Open Universiteit Nederland.
- DRACHSLER, H.; PECCEU, D.; ARTS, T.; HUTTEN, E.; RUTLEDGE, L.; VAN ROSMALEN, P. & AL. (2009). ReMashed - Recommendations for Mash-up Personal Learning Environments. In CRESS, U.; DIMITROVA, D.; SPECHT, M. (Eds.). *Learning in the Synergy of Multiple Disciplines. 4th European Conference on Technology Enhanced Learning. EC-TEL 2009*, 5794. Nice (France): September/October 2009. Proceedings. Berlín: Heidelberg, Springer.
- DRON, J. & ANDERSON, T. (2009). *How the Crowd Can Teach. Handbook of Research on Social Software and Developing Community Ontologies*. IGI Global.
- EUROPEAN COMMISSION (2009). *The European Research Area Partnership; 2008 Initiatives*. Bruselas: Dirección General de Investigación, Oficina de Publicaciones de la Comunidad Europea; 1-92.
- FETTER, S.; BERLANGA, A.J.; SLOEP, P. (2010). Fostering Social Capital in a Learning Network: Laying the Groundwork for a Peer-Support Service. *International Journal of Learning Technology*, 5, 3; 388-400.
- FETTER, S.; BERLANGA, A.J. & SLOEP, P.B. (2008). *Strengthening the Community in Order to Enhance Learning*. *Doctoral Consortium at the IADIS International Conference on Web Based Communities*. Amsterdam.
- GALLANT, L.M.; BOONE, G.M. & HEAP, A. (2007). Five Heuristics for Designing and Evaluating Web-based Communities. *First Monday*, 12, 3.
- GUTHRIE, K.; GRIFFITHS, R. & MARON, N. (2008). *Sustainability and Revenue Models for On-line Academic Resources - An Ithaka Report*; 1-66.
- HAYTHORNTHWAITE, C. (2002). Building Social Networks via Computer Networks: Creating and Sustaining Distributed Learning Communities. In RENNINGER, K. & SHUMAR, W. (Ed.). *Building Virtual Communities: Learning and Change in Cyberspace*. New York: Cambridge University Press.
- JANSSEN, J.; BERLANGA, A.; VOGTEN, H. & KOPER, R. (2008). Towards a Learning Path Specification. *Int. J. Cont. Engineering Education and Lifelong Learning (IJCEEL)*, 18, 1; 77-97.
- JONES, C. (2008). Networked Learning: Weak links and Boundaries. *Journal of Computer Assisted Learning*, 24, 2; 87-89.
- KALZ, M. (2009). *Placement Support For Learners in Learning Networks*. *SIKS Dissertation Series 2009-36*. Heerlen: Open Universiteit Nederland.
- KIRSCHNER, P.; SWELLER, J. & CLARK, R.E. (2006). Why Minimal Guidance during Instruction does not Work: An Analysis of the Failure of Constructivist, Discovery, Problem-based, Experiential, and Inquiry-based Learning. *Educational Psychologist*, 41, 2; 75-86.
- KOLLOCK, P. & RUSSELL BRAZIEL, E. (2006). How Not to Build an On-line Market: The Sociology of Market Microstructure. In THYE, S.R. & LAWLER, E.J. (Eds.). *Advances in Group Processes: Social Psychology of the Workplace*. New York: Elsevier Science.
- KOPER, R. (Ed.). (2009). *Learning Network Services for Professional Development*. Berlin: Heidelberg: Springer.
- KOPER, R. & SLOEP, P.B. (2002). *Learning Networks Connecting People, Organizations, Autonomous Agents and Learning Resources to Establish the Emergence of Effective Lifelong Learning*. *RTD Programma into Learning Technologies 2003-08. More is Different...* (<http://hdl.handle.net/1820/65>) (22-032011).
- MANOUSELIS, N.; DRACHSLER, H.; VERBERT, K. & SANTOS, O.C. (2010). *Procedia Computer Science*, 1, 2. Barcelona: I Workshop on Recommender Systems for Technology Enhanced Learning (RecSysTEL 2010).
- MCCONNELL, D. (2005). Examining the Dynamics of Networked E-learning Groups and Communities. *Studies in Higher Education*, 30, 1; 25-42.
- OCDE (2010). *The High Cost of Low Educational Performance, the Long-run Economic Impact of Improving PISA Outcomes*. OECD Publishing.
- PREECE, J. (2000). *On-line Communities: Designing Usability, Supporting Sociability*. New York: John Wiley & Sons.
- ROBINSON, K. (2001). *Out of Our Minds: Learning to Be Creative*. Bloomington (USA): Capstone.
- RUSMAN, E.; VAN BRUGGEN, J.; SLOEP, P. & VALCKE, M. (2010). The Mind's Eye on Personal Profiles: How to Inform Initial Trustworthiness Assessments in Virtual Project Teams. In KOLFSCHOTEN, G.; HERRMANN, T. & LUKOSCH, S. (Eds.). *Lecture Notes in Computer Science*; vol. 6257. *Collaboration and Technology. Proceedings of the 16th International Conference CRIWG 2010*. Heidelberg: Springer; 297-304.
- SIE, R.L.; BITTER-RIJPKEMA, M. & SLOEP, P.B. (2009). The Influence of Coalition Formation on Idea Selection in Dispersed Teams: a Game Theoretic Approach. In CRESS, U.; DIMITROVA, D. & SPECHT, M. (Eds.). *Learning in the Synergy of Multiple Disciplines. 4th European Conference on Technology Enhanced Learning. EC-TEL 2009*, 5794. Nice, France, September/October 2009. Proceedings. Berlín; Heidelberg: Springer; 732-737.
- SIEMENS, G. (2004). *Connectivism: a Learning Theory for the Digital Age*. (www.elearnspace.org/Articles/connectivism.htm) (22-03-2011).
- SLOEP, P. (2009a). Section 1: Social Interaction in Learning Networks. In KOPER, E.J. (Ed.). *Learning Network Services for Professional Development*. Berlín; Heidelberg: Springer; 13-16.
- SLOEP, P.B. (2009b). Fostering Sociability in Learning Networks through ad-hoc Transient Communities. In PURVIS, I.M. & SAVARIMUTHU, B.T. (Ed.). *Computer-Mediated Social Net-*

- working. *Proceedings of the 1 International Conference, ICCMSN 08*. Dunedin, New Zealand, June 2008: Springer; 62-75.
- SLOEP, P.B. (2009c). Innovation as a Distributed, Collaborative Process of Knowledge Generation: Open, Networked Innovation. In HORNUNG-PRÄHAUSER, V. & LUCKMANN, M. (Eds.). *Kreativität und Innovationskompetenz im digitalen Netz - Creativity and Innovation Competencies in the Web, Sammlung von ausgewählten Fach- und Praxisbeiträgen der 5. EduMedia Fachtagung 2009*, Mai. Salzburg: Salzburg Research Forschungsgesellschaft m.b.H.; 33-38.
- SLOEP, P.B.; BOON, J.; CORNU, B.; KLEBL, M.; LEFRÈRE, P.; NAEVE, A. & AL. (2011). A European Research Agenda for Lifelong Learning. *International Journal of Technology Enhanced Learning*.
- SLOEP, P.B. & JOCHEMS, W. (2007). De E-lerende Burger. In: HAAN, J. DE & STEYAERT, J. (Ed.). *Jaarboek ICT en samenleving 2007. Eindelijk digitaal*. Amsterdam: Boom; 171-187.
- SPINUZZI, C. (2005). The Methodology of Participatory Design. *Technical Communication*, 52, 2; 163-174.
- VAN MERRIËNBOER, J. & BRAND-GRUWEL, S. (2005). The Pedagogical Use of Information and Communication Technology in Education: A Dutch Perspective. *Computers in Human Behavior*, 21; 407-415.
- VAN ROSMALEN, P.; SLOEP, P.; KESTER, L.; BROUNS, F.; DE CROOCK, M.; PANNEKEET, K. & AL. (2008). A Learner Support Model Based on Peer Tutor Selection. *Journal of Computer Assisted Learning*, 24, 1; 74-86.
- VON HIPPEL, E. (2005). *Democratizing Innovation*. Cambridge (USA): MIT Press.
- WENGER, E.C. & SNYDER, W.M. (2002). *Cultivating Communities of Practice: A Guide to Managing Knowledge*. Boston: Harvard Business School University Press.