

Collaboration Is Smart: Smart Learning Communities

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Abstract. Technological advances in the last decades have significantly influenced education. Smart Learning Environments (SLEs) could be one solution to meet the needs of the 21st century. In particular, we argue that smart collaboration is one fundamental need. This paper deals with the question what ‘smart’ is and why a SLE’s design has to consider collaboration. Drawing on various theories, we argue that the community aspect plays a vital role in successful learning and problem solving. This paper outlines the benefits for the community and all parties involved (defined as a win-for-all or winⁿ-solution), as well as drivers that might influence collaboration. Design principles for SLEs, Smart Learning Communities (SLCs) and finally the conclusion close the paper.

Keywords: smart learning environment, smart learning communities, collaboration, social learning, win for all, design principles.

1 Introduction

In the last decades, we have been faced with tremendous technological advancements that have impacted greatly on the way people engage, interact and communicate with each other [1]. These developments in particular also affect teaching and learning as well as learning environments. Previous research studies [see references 1–5] in the context of smart learning environments (SLEs) have focused mainly on the technical development of SLEs. Additionally, only sporadic theoretical approaches to learning theory have been taken up by research studies. Certainly, learning theories do not provide a simple recipe for designing SLEs. Learning processes still happen in the brains of the learners, quite independently from technical supporting tools. Therefore, a profound and comprehensive consideration of the basics of learning processes is essential. This paper makes a contribution to this issue, with a particular focus on collaboration. However it is worth noting that the scope of this paper is limited, and therefore does not allow for an extensive picture. The following research questions are discussed:

- What does ‘smart’ mean in the context of (collaborative) learning environments and what does it mean for different individuals or groups?
- Why is it smart to collaborate and how can it be fostered through a SLE?

2 The Concept of ‘Smart’ Learning Environments

A consequence of all the technological changes in the last few years is that learning environments are increasingly being called ‘smart’ (even blackboards are called ‘smart’). But what are actually “smart learning environments”? “Ubiquitous smart learning environments are always connected with WiFi, 3G and 4G and provide a learners’ paradise where they can learn anywhere and anytime whatever they want to learn on the Net.” [6]. Further, SLEs encourage multi-content on multi-devices [3]. Environments that are aware “of user behaviour in the learning process can be very helpful in providing the right content at the right time. The learning services that include the concept of such awareness and the capability of handling multi-media resources efficiently can be termed smart learning systems.” [7] The definitions of ‘smart’ [e. g. 8] are manifold and do not provide a clear pathway that allows for a common understanding or an unambiguous definition.

We can cement our understanding of ‘smart’ learning environments as follows: “**Social**” (communication and interaction/connecting with others), “**Motivating**” (mutual benefits/reciprocity and enjoyment), “**Autonomous**” (self-paced and self-directed), “**Reputation**” (social appreciation, trust and competence) and “**Technology**” (getting the maximum out of technology).

2.1 Smart – But for Whom?

Next, we would like to start by asking: smart for whom? For engineers, who develop SLEs and are eager to show what is possible from a technical point of view? For lecturers, who would like to decrease their (classroom) teaching time? For the individual learner, who wants to learn more comfortably with reduced effort? For the community of learners, who wish to get connected and share experiences and knowledge? Or for the society, that aims to have a strong and capable (but maybe not too critical) workforce? Our answer is simple: *Although the individual learner and the learning community should remain the focal point of interest, a SLE should be ‘smart’ for each stakeholder.* It should use up-to-date technology in a thorough didactical and pedagogical way. It should smartly support individual learning processes and enhance collaborative learning and learning groups. And (perhaps this is wishful thinking) SLEs should support societies to develop the necessary skills and knowledge to ensure sustainable solutions that show respect for all living beings and the environment. Although this is an extremely broad and comprehensive requirement that SLEs should fulfil, we have to keep in mind that if we want to build truly ‘smart’ solutions, we cannot neglect the fact that our world is one gigantic system.

2.2 ‘Smart’ in (Learning) Theory

When we focus on the individual learner, some fundamentals of SLEs have been well known for decades, but very often ignored. Certainly, the complexity of human cognition and learning is rather high and until now there has been no single theory, which is able to cope with this complexity.

Bransford et al. [9] suggests four interconnected perspectives for implementing proper learning environments that seem particularly important: Firstly, there is the

learner-centred component, which pays careful attention to the knowledge, skills, attitudes, and beliefs that learners bring to the educational setting. Secondly, the *knowledge-centred* component, reflecting the need to help students become knowledgeable, by learning in ways that lead to understanding and the ability to subsequently transfer this knowledge. The third component is *assessment-centred*, offering opportunities for feedback and revision aligned to the users' learning goals; and finally the *community-centred component*, which *embraces all the other components*.

In addition to Bransford et al. [9], the community and social learning aspect is an important part of other theories. Self-determination theory (SDT) by Edward Deci and Richard Ryan, e.g. [10, 11], addresses extrinsic forces and intrinsic motives and needs, as well as their interplay. One of its components – in addition to autonomy and competence – is ‘*relatedness*’; which is about *interacting and connecting with others*: “Conditions supporting the individual’s experience of *autonomy, competence, and relatedness* are argued to foster the most volitional and high quality forms of motivation and engagement for activities, including enhanced performance, persistence, and creativity.” [11]

Another useful theory in the context of SLEs is social learning theory. “The social learning theory explains human behaviour in terms of a continuous reciprocal interaction between cognitive, behavioural and environmental determinants” [12]. For SLEs, we argue that the environmental dimension is reflected in the community as well as on the technology as such.

2.3 Why Is It Smart to Collaborate?

It is of utmost importance for the well-being of the individual to have successful social interactions and to cooperate with others. The human brain is much more a social organ than a reasoning tool [13]. Hormones like dopamine and oxytocin are released through successful cooperation, which is also the basis for learning processes [14]. Further, our minds are susceptible to systematic errors [15], which can be counterbalanced by the group. Almost all learning, in particular the development of higher cognitive functions [16] or the acquisition of fundamentally (ontogenetically) new knowledge [17], is related to other people and embedded in social interaction. One more advantage of the group is heterogeneity. Plurality and the diversity of opinions are necessary to find workable solutions, for fundamental learning and for creativity. Knowledge sharing and knowledge creation are highly subject to social phenomena [18], which are inevitable for the exchange of *tacit knowledge or tacit knowing* [19, 20]. In contrast to codified or *explicit* knowledge, which is quite similar to information and thus can be formalized and stored in technical systems (e. g. SLEs), implicit or tacit knowing only exists in the brains of human beings. Usually people are not aware of it [21, 22], until it is requested, for example in a collaborative learning setting like a SLC.

Consequently, a SLE should provide explicit knowledge, and should use technology to support learning processes, for example through multi-media, simulations or serious games. However, when it comes to the acquisition of tacit knowledge, communities are necessary for exchange and interaction as tacit knowledge cannot be stored in any technical system. Hence, we propose that SLEs have to integrate both kinds of knowledge (see Fig.1). However, since tacit knowledge is achieved through exchange and interaction, communities have to be an

integral part of SLEs. Nonetheless, tacit knowledge can also be acquired through exercises and adequate technical support can encourage users to practice, i.e. e.g. real-world simulation or serious game-based learning.

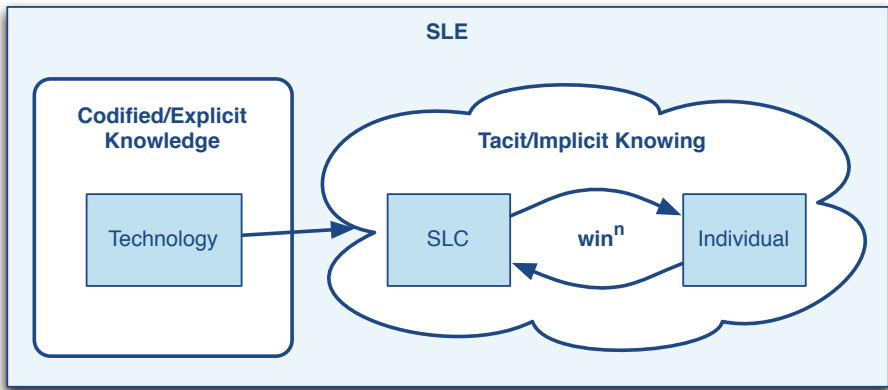


Fig. 1. Components of a SLE, integrating SLCs

When individuals share their valuable tacit knowledge with the SLC, which offers its growing knowledge-base to its members, a new virtuous circle and a win-for-all solution comes about (see Fig. 1).

Thus, interactivity is highly important for learners [23]. Even though interaction is not enough for online learning to be successful, it is considered as central to an educational experience [24], and facilitating interaction is key within a learning community [25]. Further, collaboration of competent individuals in a group or a team is necessary as today's problems are getting increasingly complex and therefore a single individual cannot deal with them alone anymore. A SLE focusing solely on the individual learner misses one important current demand – 'smart' in the 21st century means to collaborate successfully and sustainably. However, to a large extent there is a lack of knowledge on how we can collaborate successfully. Technology should be able to provide support in furthering this collaboration.

2.4 Why Do We Need SLEs?

One can argue, that humankind has been learning since the very beginning of time without SLEs. Why is it now necessary to invent something new? The answer is quite simple: A fundamental tenet of modern learning theory is that different kinds of learning goals require different approaches to instruction; new goals for education require changes in learning opportunities [9]. The complex problems we are facing today require changes in the way we educate people. One of these changes is the necessity to support groups and teams to learn successfully together, exchanging valuable tacit knowledge. A SLE should support collaboration processes and help people to overcome the potential obstacles to effective group processes and group dynamics when working together. If they manage to do so, SLEs could be one solution in meeting the demands of the 21st century.

3 Generating Benefits through the Community

A solution that is ‘smart’ for each stakeholder, as was claimed in point 2.1, needs to address the needs and wishes of each stakeholder and harmonize these different interests. Beyond that, a smart solution will meet needs of stakeholders they themselves were not aware of before. However, no matter how it is technically implemented, benefits for all stakeholders cannot be guaranteed, particularly not on a long-term basis in our rapidly changing world. Thus, we suggest a SLE, which enables a ‘win for all’-solution [26, 27] within and through the community. Strictly speaking, such a SLE would be smart in the sense that it provides not only a SLE for individuals, but a framework that supports and fosters human interaction, information and knowledge sharing, cooperation and collaboration in order to realize a ‘living’ and emergent system. This can only come into being through ‘smart’ individuals working together in a ‘smart’ way. The mutual benefit generated through this community will be central to its vitality and success. Unfortunately, many learning environments are still not able to support or manage community building and knowledge sharing.

To make this social change happen, a shift in thinking will be necessary, which can be described as a *win-for-all, or winⁿ-solution*: A winⁿ-constellation means that each participant in this constellation (more precisely: all n participants) can only see him-/herself as a winner if all other participants win too and hence all participants themselves feel as winners [26]. Each individual using the SLE should feel responsible for his or her own learning process and progress, and, in addition, s/he has to support other students to reach their learning aims. A solution, where only one individual wins could be called win¹.

4 Drivers and Design-Principles for SLEs

Drawing on the theoretical concept of winⁿ, we argue that the main driver for collaboration and SLEs is *usefulness and benefit*. People make use of tools that they regard as beneficial. Hence, the benefit for the individual is increased through a living community. Additionally, there has to be a benefit for this community (i.e., winⁿ). As a consequence, technical environments that do not benefit anyone or only selected users (in case the community is crucial for the overall success), should not be implemented at all. The initial point in designing a SLE is to ask for the benefits to each stakeholder, what new benefits would appear and for whom. Certainly, selected stakeholders should be incorporated into this process. The next challenging task is to harmonize the variety of interests of the various stakeholders. This is not easy, but necessary for a ‘smart’ solution. Where the condition for the main driver - that is providing a ‘benefit’ - is fulfilled, additional drivers can be striking.

A major benefit is the existing virtuous circle between the SLC and the individuals involved, as shown in Fig. 1. Taking a closer look on this circle it can be separated in two parts: the *central learning processes* and the *influencing processes* (see Fig. 2). Please note that Fig. 2 is work in progress and constitutes a first approach to tackle these highly complex and interwoven issues.

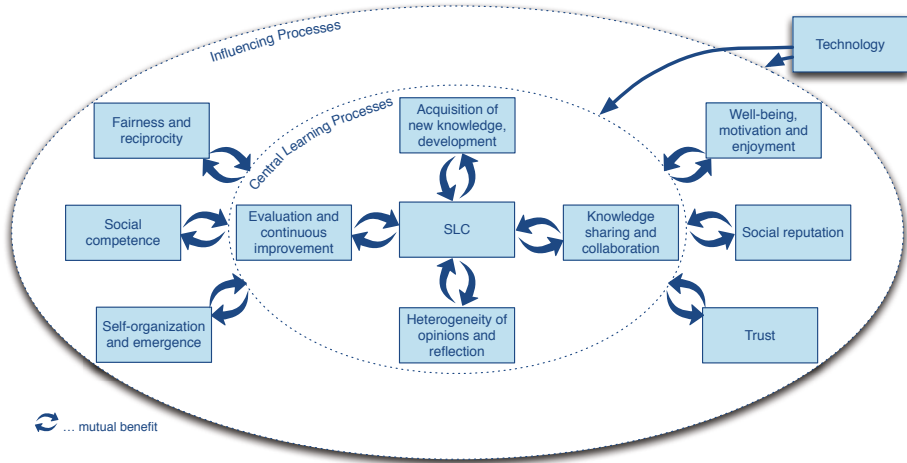


Fig. 2. Central and influencing processes of SLCs

Central learning processes deal with various smaller virtuous circles, impacting the win-for-all solution of a SLC (mutual benefits). As already mentioned, the individual needs the community to *acquire new knowledge* and thus to *further develop*. This in turn benefits the community, needing highly qualified members. Since experts are becoming increasingly specialized, *collaboration* and exchange of tacit knowledge are necessary to solve complex problems. Consequently, the quality of the community is augmented with successful *knowledge sharing*. Through the *heterogeneity of opinions* and various perspectives in the community, creativity and *reflection* are fostered, and one’s own blind spots and mistakes are eliminated, again benefiting the individual and the community. Thus, there is an on-going *evaluation and continuous improvement* of individual and community knowledge, as well as knowledge areas.

The influencing processes include various virtuous circles as well: The *well-being* of individuals (as mentioned in 2.3), which is subject to the involvement of the community, has a positive impact on the community itself, fostering *motivation and enjoyment* to engage in the community. SLEs should be intrinsically motivating as well as motivating through collaboration. According to motivation theory people seek optimal stimulation and have a basic need for competence [28]. Consequently, through successful engagement, *social reputation* increases, nurturing individuals’ motivation as well as trust in the community as a whole. Reputation is the outcome of what members promise and fulfil, hence, it reveals the participants’ honesty and their concern about others and their needs [29]. The social appreciation of the community has shown to be an essential factor for individuals to contribute in knowledge sharing and supporting others to develop skills [30]. As several previous studies pinpoint (for example [31, 32]), *trust* is a vital component for knowledge sharing, as “knowledge sharing can be a demanding and uncertain process” [33] and learners have to feel “safe” to interact and share” [34]. This environment of trust enables the community to establish shared goals and values [27, 35], which have a positive impact on motivation. Hence, it could be argued that on the basis of trust, untypical solutions are

found, as learners are more willing to engage in risky behaviour, supporting creativity as well as further developments. *Fairness and reciprocity* are critical and crucial motivating factors for human encounters. They are significant for the exchange of knowledge that is initiated by pro-social and altruistic behaviours [30, 36]. Reciprocity is defined as “voluntarily repaying a trusting move at a later point in time, although defaulting on such repayment is in the short-term self-interest of the reciprocator.” [37]. We argue that reciprocity is necessary for the *mutual benefit* of collaboration in SLEs. The next circle is concerned with *social competence* of individuals. Participating within the community fosters social competences, which in turn leads to more successful interactions in the SLC. Having reached a critical amount of interactions, another important influencing factor can occur to the benefit for all: Social *self-organization*, which will keep the SLC alive and capable of acting, even with modified environmental conditions, and which is related to social *emergence*, which means that the SLC is more than the sum of its parts, namely the individuals involved. Surely, another influencing factor of a SLC is *technology*. Technology could lead to a virtuous circle by improving learning and sharing processes, which in turn improves technology; but this is not the norm.

Consequently, SLEs should provide an appropriate service and challenge the individual learner but at the same time offer interconnectedness with the learning community. The design of the SLE has to make this obvious and guarantee that the community fulfils each other’s benefits. When designing an SLE, one should be aware, that there are mainly three different types of learning needs: Learning of single individuals (in interaction with technology); learning of well established work groups (task-oriented); and sharing between individuals, being loosely interconnected in a SLE (knowledge-oriented).

One requirement for both social-types of SLEs to be recognized as a comfortable and trustworthy environment is to be personalized and transparent. An example of a very simple way to do this is to set up a profile including picture(s) and some background information about the person. In order to foster learning processes, mutual support and collaboration, we propose that the SLE should request learners to define their tasks or learning goals and share them with the community. Additionally, learners should reveal topics on which they would like to receive support from the community but also issues where they are able to help other members. It would also be supporting that the SLE provides learners a scheduling function where they can post when they will have time and how much time they have to support others, since time is always short but required for the learning process. Learners should also report continuously to which degree they have already achieved their learning goals and whose support was helpful as well as what is still missing and where they would need (further) assistance. This process provides self-monitoring as well as self-reflection by the learners, which is essential for successful and sustainable learning and the improvement of self-education. Further, the design of a SLE should take into account the possibility that learners can give each other praise. This could be for example a medal being added to the profile-picture. This is one of the few exceptions where reward systems do not harm learning processes by destroying intrinsic motives. Ultimately, the architecture should initiate peer-discussion by suggesting peers with

whom a discussion might be fruitful – this could be because of (dis-)similarities of knowledge, experience or interests. Finally, SLEs should foster different media qualities, the preparation of students for ‘flipped classrooms’ [23] and open spaces, crossing the borders of the Internet, because learning doesn’t only happen in front of screens.

5 Conclusion

In this paper, we propose that ‘smart’ in the 21st century has to be associated with collaboration and sustainability. We draw on the concept of winⁿ, implying that *all* participants and stakeholders of a SLE should benefit mutually. Consequently, if the system does not provide sound benefits for its stakeholders, it should not be constructed. This might sound trivial, however, in practice a lot of systems were built lacking perceived usefulness. Needless to say, this is also an economic goal: although ‘use’ is quite a problematic word in the context of education, even inert knowledge, which is not used at any time, might be worthless for the individual, the team, the company or the society. Thus, the transfer of acquired experiences and knowledge in the SLE, i.e. the ability to extend what has been learned from one context to new contexts [38][39] and particularly to real world problems is an essential requirement for a SLE. The community can also support this transfer by defining various examples or scenarios on how to apply learned content in practice. Furthermore, the framework sets out some potential drivers for collaboration and design principles for SLEs, or SLCs. Certainly, there are many more relevant theories concerning smart learning and collaborative learning: social constructivist theory, social presence, social interdependence, situated learning, self-directed learning and self-regulation theory [34]. Additionally, (empirical) research in this case is needed, as this paper only offers an initial theoretical analysis of potential determinants and processes of SLEs and SLCs. The technological advances enabled us to connect globally with each other, providing us with an immense potential for synergetic, sustainable, creative or shorter: smart solutions. We have to take this opportunity.

References

1. Hirsch, B., Ng, J.W.P.: Education Beyond the Cloud: Anytime-anywhere learning in a smart campus environment. In: 6th International Conference on Internet Technology and Secured Transactions, Abu Dhabi, United Arab Emirates, December 11-14, pp. 11–14 (2011)
2. Burghardt, C., Reisse, C., Heider, T., Giersich, M., Kirste, T.: Implementing Scenarios in a Smart Learning Environment. In: 2008 Sixth Annual IEEE International Conference on Pervasive Computing and Communications (PerCom), pp. 377–382 (2008)
3. Kim, S., Yoon, Y.I.: A Model of Smart Learning System Based on Elastic Computing. In: Ninth International Conference on Software Engineering Research, Management and Applications, pp. 184–185. IEEE (2011)
4. Miyata, N., Morikawa, H., Ishida, T.: Open Smart Classroom: Extensible and Scalable Learning System in Smart Space Using Web Service Technology. IEEE Transactions on Knowledge and Data Engineering 21, 814–828 (2009)

5. Scott, K., Benlamri, R.: Context-Aware Services for Smart Learning Spaces. *IEEE Transactions on Learning Technologies* 3, 214–227 (2010)
6. Lee, J.R., Jung, Y.J., Park, S.R., Yu, J., Jin, D., Cho, K.: A Ubiquitous Smart Learning Platform for the 21st Smart Learners in an Advanced Science and Engineering Education. In: 15th International Conference on Network-Based Information Systems, pp. 733–738. IEEE (2012)
7. Kim, S., Song, S.-M., Yoon, Y.-I.: Smart learning services based on smart cloud computing. *Sensors* 11, 7835–7850 (2011)
8. Kim, T., Cho, J.Y., Lee, B.G.: Evolution to Smart Learning in Public Education A Case Study of Korean Public Education. In: Ley, T., Ruohonen, M., Laanpere, M., Tatnall, A. (eds.) *OST 2012. IFIP AICT*, vol. 395, pp. 170–178. Springer, Heidelberg (2013)
9. Bransford, J.D., Brown, A.L., Cocking, R.R.: *How People Learn: Brain, Mind, Experience, and School*. National Academy Press (2000)
10. Deci, E.L., Vansteenkiste, M.: Self-Determination Theory and basic need satisfaction: Understanding human development in positive psychology. *Ricerche di Psicologia* 27, 23–40 (2004)
11. N.A.: Self-Determination Theory. About the theory, <http://www.selfdeterminationtheory.org/theory>
12. Tu, C.-H.: On-line learning migration: from social learning theory to social presence theory in a CMC environment. *Journal of Network and Computer Applications* 23, 27–37 (2000)
13. Hüther, G.: *Bedienungsanleitung für ein menschliches Gehirn*. Vandenhoeck & Ruprecht GmbH & CoKG, Göttingen (2010)
14. Bauer, J.: *Prinzip Menschlichkeit*. Springer, Heidelberg (2008)
15. Kahneman, D.: *Thinking, Fast and Slow*. Farrar, Straus and Giroux, New York (2012)
16. Vygotsky, L.S.: *Mind in Society*. Harvard University Press, Cambridge (1978)
17. Miller, M.: *Kollektive Lernprozesse*. Suhrkamp, Frankfurt (1986)
18. Duguid, P.: The art of knowing: social and tacit dimensions of knowledge and the limits of the community of practice. *The Information Society* 21, 109–118 (2005)
19. Polanyi, M.: *The Tacit Dimension*. Peter Smith, Gloucester (1966)
20. Polanyi, M.: *Knowing and being*. Routledge & Kegan, London (1969)
21. Anderson, J.R.: *Kognitive Psychologie*. Springer, Heidelberg (1980)
22. Day, R.E.: Clearing up “Implicit Knowledge”: Implications for Knowledge Management, Information Science, Psychology, and Social Epistemology. *Journal of the American Society for Information Science and Technology* 56, 630–635 (2005)
23. Khan, S.: *Die Khan Academy. Die Revolution für die Schule von morgen*. Riemann, München (2013)
24. Garrison, D.R., Cleveland-Innes, M.: Facilitating cognitive presence in online learning: Interaction is not enough. *American Journal of Distance Education* 19, 133–148 (2005)
25. Hill, J.R.: *Learning Communities. Theoretical Foundations for Making Connections. Theoretical Foundations of Learning Environments*, pp. 268–285. Routledge, N.Y. & London (2012)
26. Frankl, G.: *win-n. win-win-Konstellationen im Wissensmanagement* (2010)
27. Frankl, G.: Common Benefits and Goal Cooperativeness as Driving Forces for Knowledge Management. In: *Proceedings of the 13th European Conference on Knowledge Management, Academic Conferences International (ACI)*, Reading, pp. 341–349 (2012)
28. Eccles, J.S., Wigfield, A.: Motivational Beliefs, Values, and Goals. *Annual Review Psychology* 53, 109–132 (2002)

29. Casaló, L.V., Cisneros, J., Flavián, C., Guinalú, M.: Determinants of success in open source software networks. *Industrial Management & Data Systems* 109, 532–549 (2009)
30. Wasko, M.M., Faraj, S.: It is what one does: Why people participate and help others in electronic communities of practice. *Journal of Strategic Information Systems* 9, 155–173 (2000)
31. Hsu, M.-H., Ju, T.L., Yen, C.-H., Chang, C.-M.: Knowledge sharing behavior in virtual communities: The relationship between trust, self-efficacy, and outcome expectations. *International Journal of Human-Computer Studies* 65, 153–169 (2007)
32. Mooradian, T., Renzl, B., Matzler, K.: Who Trusts? Personality, Trust and Knowledge Sharing. *Management Learning* 37, 523–540 (2006)
33. Mooradian, T., Renzl, B., Matzler, K.: Who Trusts? Personality, Trust and Knowledge Sharing. *Management Learning* 37, 523–540 (2006)
34. Hill, J.R.: Learning Communities. *Theoretical Foundations for Making Connections. Theoretical Foundations of Learning Environments*, pp. 268–285. Routledge, N.Y (2012)
35. Guldberg, K., Pilkington, R.: A community of practice approach to the development of non-traditional learners through networked learning. *Journal of Computer Assisted Learning* 22, 159–171 (2006)
36. Wasko, M.M., Faraj, S.: Why should I share? Examining social capital and knowledge contribution in electronic networks of practice. *MIS Quarterly* 29, 35–57 (2005)
37. Gunnthorsdottir, A., McCabe, K., Smith, V.: Using the Machiavellianism instrument to predict trustworthiness in a bargaining game. *Journal of Economic Psychology* 23, 49–66 (2002)
38. Thorndike, E.L., Woodworth, R.S.: The influence of improvement in one mental function upon the efficiency of other functions. *Psychological Review* 8, 247–261 (1901)
39. Byrnes, J.P.: *Cognitive Development and Learning in Instructional Contexts*. Allyn and Bacon, Boston (1996)