Social Learning in a Multi-Actor Innovation Context

Pieter J. Beers[a], Jifke Sol[b] and Arjen Wals[c]

[a]*Education and Competence Studies, Wageningen University, Wageningen, The Netherlands, pj.beers@wur.nl*
[b]*Education and Competence Studies, Wageningen University, Wageningen, The Netherlands, jifke.sol@xs4all.nl*
[c]*Education and Competence Studies, Wageningen University, Wageningen, The Netherlands, arjen.wals@wur.nl*

Abstract: *Social learning is the process in which actors share and confront their knowledge and perspectives to produce innovative solutions. We introduce a new research framework for social learning, to be able to derive ways to facilitate social learning. We report on an explorative interview study to substantiate the framework. One interesting conclusion was that hidden agenda's were shown to undermine trust, which in turn undermined the social learning process. This explains the importance of openness for social learning. Our results show substantiate the research framework, and show that it can be used to derive methods to facilitate social learning.*

Keywords: *Social learning, sustainability, multi-actor innovation, trust, framing, commitment*

Introduction

Multi-actor collaboration is increasingly used to meet the challenges of sustainability issues in Dutch agriculture. Whereas formerly, innovation was mainly oriented at specialisation (doing things better), and did not require far-reaching integration of knowledge and perspectives, modern-day sustainability challenges demand an integration of different perspectives to develop innovative solutions and new ways of doing things (doing better things; Veldkamp, Van Altvorst, Eweg, Jacobsen, Van Kleef, Van Latesteijn, et al. 2009). In multi-actor innovation, entrepreneurs, policy makers, researchers, and members from NGO's collaborate to share their knowledge and perspectives. Multi-actor innovation teams therefore have the potential to develop the innovations necessary for sustainable development. The process that leads to these innovations in is called social learning (Pahl-Wostl, 2006).

In social learning the collaborating parties share and confront their different knowledge to produce innovative solutions. The heterogeneity of the collaboration parties offers the key for combining existing knowledge in novel ways. It also allows the combination of knowledge from different value systems, and can create a shared awareness of the various interests involved. However, the same heterogeneity often leads to conflict, and sometimes to a stalemate in the collaboration process. Value differences and conflicting interests can come to hold the social learning process hostage. Even though dissonance and, indeed, some conflict, are necessary prerequisites for learning and innovation, they often become obstacles in multi-stakeholder settings because actors perceive a strong need to protect their interests and values, and to keep their knowledge and insights to themselves to maintain a "competitive edge".

Good facilitation can make the difference between failure and success for a multi-actor innovation process. The facilitator can guide the team towards a situation of constructive conflict, that is, when important differences are shared, fundamental conflicts are taken into account, and when diversity is used for the benefit of the team's goals. However, theories of social learning have put scarce emphasis on the role of mutual conflict in social learning, and on how to use it for the benefit of a team.

In this paper, we introduce a new research framework for social learning that we use to analyse the mutual relations between social learning and its context of multiple values and stakes, in order to derive some options for the facilitation of multi-actor collaboration. We are particularly interested in processes and competencies that can turn potentially destructive conflict and dissonance into constructive triggers for learning and innovation. We first touch upon our research context of multi-actor innovation for social learning. We then discuss two paradigms of social learning, after which we introduce the new research framework for social learning. We report the results of an analysis of 18 interviews with Dutch innovators in the agricultural sector, which concern trust and match-making in social learning. We discuss our results in the light of the new framework.

Multi-Actor Innovation

Mutli-actor innovation projects often are formed around complex societal problems, which require new knowledge and new practice for their resolution. Such complex problems have no existing solutions, and they often cross disciplinary and sectoral boundaries. Knowledge from different societal actors and sectors is needed to come to terms with their breadth, and to produce solutions fit complex problems in all their different facets.

Multi-actor innovation teams include actors from different societal sectors, such as education, government, research, trade, NGO's and primary production, and generally include researchers, entrepreneurs, educators, policy makers, and NGO representatives. Each is involved through their interests and goals, which in turn can lead them to commit further knowledge, creativity, resources and talents to the innovation project. As the team commences its social learning process, the team members share their knowledge to analyse the problem, and they pool their knowledge and resources to design and develop innovative solutions. The team diversity is an important factor for success, because it strengthens the analysis and broadens the solution scope.

Diversity can also be detrimental to the social learning process. Each of the team members have a specific set of values and interests related to the challenge at stake. As a consequence, the same solution can be salvation to one actor, and disaster to another. And beside their own interests, many multi-actor innovation team members do not contribute on an individual basis. They often represent a constituency in one way or another. He or she has to guard both his/her own interests, and the interests of their constituency. Due to the many different values and interests involved, collaborating in a multi-actor innovation team can be a risk as well as an opportunity.

To what extent is a participant constrained by his/her organisational/institutional background? Which interests are open for discussion? These questions lead the team members to behave strategically at least to some extent. Some will have hidden agenda's, others are afraid that sharing certain information may hurt their interests. These strategic behaviours can severely limit the breadth and scope of the social learning process, which in turn is less able to benefit from the teams diversity. The complexity of multi-actor innovation projects is characterised by differences in goals and interests, and the interplay between the personal and organisational levels. The process of social learning is embedded in a web of power- and trust-relationships.

In the optimal case, a multi-actor innovation project becomes a community with a unique problem perspective, creating innovative solutions to shared problems. In the worst case, mutually exclusive perspectives divide the participants, who cease listening to each other (Van Eeten, 1999).

Theories on Social Learning

Theories on social learning can help us understand how multi-actor innovation teams work, and how their learning processes affect their performance. Furthermore, they can indicate starting points for facilitating the social learning process, so that the performance of those teams can be fostered. We now turn to two research traditions that address social learning processes.

Social Learning in the Tradition of Sustainability Science

The first tradition that identified social learning as a research theme originates in complex systems modelling communities. With the advent of system dynamics (Forrester, 1971, 1995) it became possible to mathematically simulate the (non-linear) behaviour of complex systems, and use these simulations to experiment with innovative solutions to sustainability issues. Probably the most well-known publication in this research tradition is "Limits to Growth" (Meadows, Meadows, Randers, & Behrens, 1972).

As the modellers attempted to model increasingly complex systems, they learned two important lessons. First, that the uncertainties involved greatly influenced the modelling results, which gave way to different interpretations of these models and their outcomes (Van Asselt, 2000). Second, that these different interpretations were fed by diversity: different values and interests, different world views and perspectives (Douglas & Wildavsky, 1982) led to different assumptions about systemic uncertainties. Those complex problems thus were subject to multiple interpretations from different perspectives, and to get a robust overview of the scope of the problems involved (Van Asselt, 2000), a social learning process was needed to engage this diversity (Pahl-Wostl, 2006).

Scholars in this tradition of sustainability sciences are very clear about the circumstances of the social learning process and its desired outcomes. First of all, they stress the importance of diversity (in knowledge, values, perspectives) at the beginning of a social learning process. Diversity is seen as a resource that enables the development of common frameworks of understanding, which in turn serve as a basis for joint action (Schusler, Decker, & Pfeffer 2003). During a social learning process, actors evolve in how they understand the challenge at hand. This evolution includes their values and the extent to which they agree with their collaboration partners. If successful, the actors involved partake in a process of sharing their own perspectives (or frames) on the problem at hand, they engage in a collaborative act of re-framing it, which in the end gives rise to a new, shared frame on the problem (Schön & Rein, 1994).

The most important product of social learning, in this view, would be the shared problem frame, because that is the integration of multiple perspectives that enables joint action to stand up to the challenges involved. These can be seen as the *problem-solving activities* in a social learning process. Additionally, social learning involves *relational activities* (Bouwen & Taillieu, 2004), which concern how actors overcome their cultural differences and mutual distrust. If successful, these relational activities produce a shared sense of problem ownership, which contributes to taking shared responsibilities, and fosters self-governing capacities (Bouwen & Taillieu, 2004). In other words, they produce a social capital, or a form of mutual trust, that fosters the actors' commitment to dealing with the problem.

In sum, in this view, social learning is a process of iterative problem-solving activities and relational activities that produce a new shared problem frame that serves as a joint basis for action, and the mutual trust needed for the actors involved to commit to dealing with the problem. However, the process of social learning itself is not well understood (Bouwen & Taillieu, 2004). What types of relational activities exist? What types of problem-solving activities exist? And how can we foster their occurrence? Furthermore, the role of mutual conflict and distrust appears to be underestimated in this tradition of social learning (Leeuwis, 2000). It appears that the scholars in this tradition must have been very successful in facilitating social learning multi-actor innovation, because the activity of facilitation itself rarely is the subject of scientific scrutiny.

Social Learning in the Learning Sciences

As social learning essentially is a learning process, we next turn to some theories from the tradition of the educational or learning sciences. Scholars in this tradition do not speak of social learning, but of collaborative learning. Interestingly, there appears to exist little interaction between this scientific tradition and the one discussed in the previous section.

Scholars in the learning sciences have concentrated on understanding learning processes in individuals and in groups. At first, they concentrated on how an individual can process

information, and how this information processing leads to the acquisition of new knowledge. Scientific models of human memory (Miller, 1956; Sweller, Van Merriënboer, & Paas, 1998) were used to increase the effectiveness of instruction and student performance (Van Merriënboer & Sweller, 2005). These studies relied on well-known learning subjects and a thorough learning task analysis to produce successful instruction. However, they were not well-adapted to more complex learning matter, let alone learning about real-world sustainability issues, which are very unstructured, subject to multiple perspectives, and exhibit non-linear behaviour (Rittel & Webber, 1973).

Observations like these spurred various lines of research on learning in groups (collaborative learning, or, as we would have it, social learning). It became clear the more complex a certain subject matter, the more learning became a question of sense-making or negotiation of meaning done in groups (Baker, Hansen, Joiner, & Traum, 1999; Dillenbourg, 1999). This is a process in which people iteratively voice their own understandings, interpret others' contributions, and negotiate a new, shared understanding of a learning task (problem). Furthermore, they started distinguishing between types of collaborative activities such as design (Buckingham Shum, MacLean, Bellotti, & Hammond, 1997) and argumentation (Conklin & Begeman, 1987; Suthers, 2001).

The systematic analysis of collaborative learning process then led to the design of support tools for their facilitation. For instance, the process of argumentation could be augmented by assisting people in how to argue a position, and how to defend against counter-arguments (Suthers, 2001). And collaborative sense-making was shown to benefit from making mutual misunderstandings explicit as soon as they arrived (Beers, Boshuizen, Kirschner, & Gijselaers, 2006). Analyses of these processes yielded ways to facilitate them. Now researchers focussed their instructional efforts on facilitating interpersonal communication instead of information processing.

Finally, the tradition of collaborative learning found its way to the professional work-floor (Brown & Duguid, 1991; Lave & Wenger, 1991). The latest insights in the learning sciences are that learning about real-life, complex problems takes place in groups and communities. These have members with diverse backgrounds and specific backgrounds, but together can produce new knowledge. In that sense the collaborative learning theories have converged with the social learning tradition that originated in sustainability sciences, with respect to the problem-solving activities. Furthermore, the view of how learning takes place and the analyses of collaborative learning processes appears to offer much firmer ground for the facilitation of social learning. However, scholars in the learning sciences have studied few learning environments in which multiple interests and values produced continuous threats to ongoing learning processes. It would seem that the usefulness of present-day insights about collaborative learning only have limited value for the facilitation of multi-actor innovation processes, because these insights do not address the risk of value-conflicts and conflicting interests.

Neither tradition addresses the intricacies of social learning in multi-actor innovation teams in full, but both can offer valuable insights for social learning in multi-actor innovation processes. Social learning theories from the sustainability science tradition identify a shared frame as the most important process outcome, and also take into account the role of diversity within the multi-actor context (multiple values and interests; different perspectives) Furthermore, these theories identify social capital, or mutual trust, as a second social learning outcome. Finally, these theories indicate that social learning is an action-oriented process; the shared frame serves as a basis for joint action, and mutual trust helps actors to commit in both word and deed to the innovation project.

An important lesson from the learning sciences tradition is that the analysis of the communication process and other interpersonal processes can serve as a basis for the design of support tools. This coincides with our own research goal of finding ways to facilitate learning. We aim to combine these insights in a new research framework for social learning multi-actor innovation projects.

Social Learning in Multi-Actor Innovation Projects

Our research framework posits that social learning is a dynamic process, in which three different social learning outcomes are continuously produced. In turn, these outcomes influence the way the learning process takes place. Our fresearch framework is new. Its goal is to offer a better analysis of social learning by integrating insights from the sustainability science and learning sciences traditions of social learning. In that respect, it serves as a bridge between two fields that currently see very little interaction.

We first discuss the social learning outcomes, then we describe our vision of what the social learning process is, and after that we give some examples of the reciprocal relation between the social learning outcomes and the social learning process.

Our theoretical perspective on social learning involves three main outcomes: shared frame, mutual trust, and commitment (see Figure 1). We want to stress that these are not outcomes in the sense of final products, but that they are produced as a consequence of the evolving learning process. One might say that they are the emergent properties of the learning process.

The first outcome is a shared frame. Participants in multi-actor innovation processes embark on a process of reflection on their knowledge and values. If this is successful, and original perspectives (*frames*) shift, or become substituted by new points of view, we call this process *reframing* (Schön & Rein, 1994). Reframing lies at the heart of social learning.

A safe environment (Edmondson, 1999), in which people can *trust* each other, is an important learning context. Mutual trust, the second social learning outcome, develops faster when participants invest in the projects and in each other, when they show their willingness to share knowledge and information, and when they prove to their project partners that they dare to take risks for the project. Trust often is higher in groups which share some history of positive mutual experiences; it gives group dynamics some resistance to problems.

Commitment is the third social learning outcome, and refers to how, and the extent to which participants and their organisational backgrounds are involved in the goals of the project. Commitment can concern passion, motivation, but also resources like time and money. Commitment originates from strong interests and values with regard to the problem at hand and the goals of the innovation project, and results in high willingness to contribute, both in thought and in action.
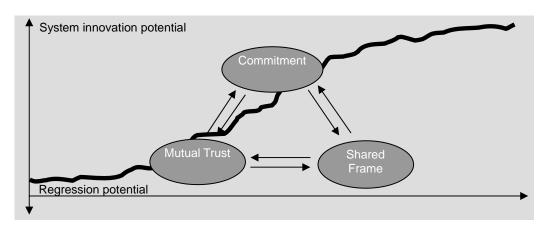

Figure 1. Social learning is the dynamic interplay of shared frame, mutual trust and commitment.

The social learning process is a continuous iteration of communicative actions by the project partners. Such actions can include contributing new knowledge, questioning each other's claims, making deals and keeping deals, etcetera. The importance of this notion is that it takes the actions of the project partners as the basic building blocks of the social learning process. In this view, the analysis of social learning should focus on the actions of the project partners, and the facilitation of social learning should focus in influencing those actions.

Finally, a dynamic interplay exists between the social learning process and the social learning outcomes. For instance, once a certain measure of mutual trust has been built, it will become less threatening to open up formerly hidden agenda's, and to contribute more vital information. This in turn may stimulate reframing activities (adding knowledge, changing supporting claims, etcetera) that lead to more shared frame. And as the shared frame evolves, the basis for joint action is broadened, which increases the possible scope for increasing one's commitment.

These are just a few examples of how, in this framework, the social learning process is hypothesised to interact with the social learning outcomes. In the remainder of this paper, we analyse the views on social learning of 18 innovators in Dutch agriculture. The goal of the analysis is to explore the framework, to test whether this view of social learning can be substantiated with empirical data, and to test whether it can be used to derive facilitation for social learning processes.

Method

We report on interviews with 18 Dutch innovators who all had experiences with multi-actor innovation processes. The interview focussed on knowledge and processes in multi-actor collaboration, with an emphasis on obstacles to knowledge sharing. We analysed the factors, considerations and actions that constitute the *process* of social learning, and its *outcomes* in terms of learning result (shared frame) and social capital (trust). We present results from the two most striking themes that surfaced in the analysis:

- Match making between actors
- Trust-building and commitment

All interviews were summarised by the interviewer, and the summaries were then sent to the interviewees to confirm that the summary was a good representation of the interview. The interviewees confirmed all summaries. The summaries were then qualitatively analysed.

Interview analysis was aimed at identifying the factors and processes that influenced actions with knowledge and on knowledge, and their mutual (causal) relations. This is in line with the process view expressed in our framework. An "open coding" procedure (Strauss, 1987) was used to identify interview summary excerpts that concerned those factors and processes. Each new factor or process that we identified was added to the analysis.

One analyst first analysed seven interview summaries completely. The resulting preliminary analysis was then applied to the other interview summaries by three new analysts, to identify new codes and to check the preliminary analysis. They confirmed the preliminary analysis and added a few more factors.

The analysis produced several main themes in social learning:

- Matchmaking; how actor find and select each other for multi-actor innovation.
- Trust; how expectations, goals and interests, and actual behaviour influence mutual trust.
- Visibility; the extent to which actor characteristics were accessible to (potential) partners.
- Team; aspects of team constitution in terms of individual, personal qualities.
- System state; general statements about agricultural innovation and the state it is in.

The identified excerpts were then used to derive some prescriptive conclusions for facilitation of multi-actor innovation processes.

We limit the discussion of results to the main themes of matchmaking and trust. The other themes in the analysis did not deepen our insights with regard to the research questions.

Results

Matchmaking

Matchmaking concerns how actors select each other as partners in a multi-actor innovation project. The associated challenge is to select those actors with the resources needed for the project, and who can be trusted not to turn into a threat to the goals and interests of the project. Our data suggests that a shared problem or a shared challenge are the most important criteria for the selection of collaboration partners. Additionally, the analysis yielded the following actor characteristics that influence whether an actor is a potential collaboration partner:

- Knowledge; Can the potential partner contribute knowledge that is vital to the project's performance?

- Interests; To what extent do the potential partner's interests coincide with the project's interests? Does the potential partner have conflicting interests?

- Goals and ambitions; To what extent do the potential partner's goals and ambitions coincide with the goals and ambitions of the existing partners?

- Resources (financial, time, network); Can the potential partner contribute resources that are vital to the project's performance?

These characteristics are not static, but they change over time. Take, for instance, shared problems and challenges. By engaging other actors, one may be able to increase their awareness of certain problems, and by sharing one's own goals and ambitions, one may be able to inspire other actors. One can point out how the innovation project may serve the interests of a potential partners. One can try to develop a persuasive vision that mobilises potential partners to join the innovation project.

In sum, our data suggest that matchmaking is an iterative, dynamic process in which various actors try to engage and influence each other, taking into account each other's knowledge, interests, goals and ambitions, an resources. Shared problems and challenges appear to be the most important criteria for joining a multi-actor innovation project.

Trust

From the data, the importance of trust showed especially from the role of "neutral" actors, that is, actors who do not have a direct interest in the goals of the innovation project. They are not under suspicion of having a hidden agenda, and therefore are easier to trust. The fewer interests an actor has, the easier it is to trust him. A prominent example from our data was apparent when students were involved in multi-actor innovation. Students have relatively high level of neutrality, because their presence is mostly temporary, and their only immediate interest is passing a course. They do not have interests vested in the innovation project itself. As a consequence, students gain access to multi-actor innovation projects fairly easily, and can come to act as a messenger of knowledge and ideas.

Trust becomes more of an issue as the activities of the innovation project can possibly affect the interest of one of the partners. Our data suggest that such tensions appear especially when the interests of a partner's constituency diverge from the project's interests. It can be difficult for the constituency to judge whether the project can turn into a threat, especially when the other partners represent yet other constituencies whose interests are not known. According to the interviews, uncertainties with regard to the various interests at stake can lead to more strategic use of resources, such as not sharing certain information, or keeping a hidden agenda.

Our data suggest that a partner's trustworthiness increases with his commitment to the project. Such commitment can take the form of a financial contribution, freeing labour force to work on the project, or public statements of adhesion to the project's goals and ambitions. Engaging in collaboration also means that the partners influence one's own goals and interests. The stronger everyone is committed to the project, the higher everyone's interest in the success of the projects. According to the interviews, such known shared interests

increase mutual trust. Thus, getting everyone to commit can ultimately foster the emergence of mutual trust.

The above shows that matters of trust concern one's expectations of whether others will hurt or benefit one's interest. Giving each other insight in one's agenda, being open about one's goals and interests, can help to overcome issues of trust.

Discussion

In this paper, we have argued that current theories on social learning leave something to be desired for the analysis of social learning in mutli-actor innovation projects and its facilitation. We have built on existing research traditions of social learning to develop a new research framework for social learning. We interviewed 18 innovators in Dutch agriculture to flesh out our framework, and to test whether it can be used to develop facilitation for social learning in multi-actor innovation.

From our explorative study, we reported some insights about matchmaking and trust in multi-actor innovation. The challenge of matchmaking is to select collaboration partners who can contribute important resources for innovation, and who can be trusted not to impinge on the interests of others. A shared challenge appeared to be the strongest selection criterion, because it implies a shared interest in meeting that challenge. In other words, a shared challenge contributes to mutual feelings of trust.

Trust was shown to be strongly related to interests. As actors increase their commitment to the collaboration (in terms of time, money, knowledge, and other resources), their interest in its outcomes become higher. As a consequence, actors' interests become increasingly vulnerable to the actions of their collaboration partners. Our data show that trust and commitment have to grow hand-in-hand as they are interdependent.

Most importantly, hidden agenda's were shown to undermine trust—the more covert another's interests are, the more difficult it is to assess whether he/she will later impinge on one's own interests. This explains the importance of openness for social learning.

These insights all exemplify that the social learning process, as a continuous iteration of actions, indeed is related the outcomes of that same process, in terms of commitment, shared frame, and mutual trust.

Furthermore, the analysis offers some insights in how to foster trust, and how to mitigate mutual distrust. Take, again, the example of how keeping a hidden agenda can undermine trust, and how providing openness can potentially benefit mutual trust. This example shows the advantage of focussing on actions; actions represent a level of analysis that coincides with what can be influenced by a facilitator.

This paper has pointed out the places in which existing theories of social learning can be improved to better fit the research context of the multi-actor innovation project. The exploratory study we reported here has shown that the main goals of our research framework are warranted: it can be substantiated with empirical data, and it can be used to derive facilitation for social learning processes. In future research, we aim to further substantiate the research framework and to systematically derive tools to support multi-actor innovation.

Acknowledgments

References

Baker, M. J., Hansen, T., Joiner, R., & Traum, D. (1999). The role of grounding in collaborative learning tasks. In P. Dillenbourg (Ed.), *Collaborative learning: Cognitive and computational approaches* (pp. 31-63). Amsterdam, The Netherlands: Pergamon / Elsevier Science.

Beers, P. J., Boshuizen, H. P. A., Kirschner, P. A., & Gijselaers, W. (2006). Common ground, complex problems and decision making. *Group Decision and Negotiation, 15*, 529-556.

Bouwen, R., & Taillieu, T. (2004). Multi-party collaboration as social learning for interdependence: Developing relational knowing for sustainable natural resource management. *Journal of Community & Applied Social Psychology, 14*, 137-153.

Brown, J. S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified theory of working, learning, and innovation. *Organization Science, 2*(1), 40-57.

Buckingham Shum, S. J., MacLean, A., Bellotti, V. M. E., & Hammond, N. V. (1997). Graphical argumentation and design cognition. *Human-Computer Interaction, 12*, 267-300.

Conklin, J., & Begeman, M. L. (1987, November). *gIBIS: A hypertext tool for team design deliberation.* Paper presented at the Hypertext'87, Chapel Hill, US.

Dillenbourg, P. (1999). What do you mean by 'collaborative learning'? In P. Dillenbourg (Ed.), *Collaborative learning: Cognitive and computational approaches* (pp. 1-19). Oxford, UK: Elsevier.

Douglas, M., & Wildavsky, A. B. (1982). *Risk and culture: An essay on the selection of technical and environmental dangers.* Berkeley, USA: University of California Press.

Edmondson, A. (1999). Psychological safety and learning behavior in work teams. *Administrative Science Quarterly, 44*, 350-383.

Forrester, J. W. (1971). Counterintuitive behavior of social systems. *Technology Review, 73*(3), 52-68.

Forrester, J. W. (1995). The beginning of system dynamics. *The McKinsey Quarterly, 1995*(4), 4-16.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral practice.* New York: Cambridge University Press.

Leeuwis, C. (2000). Reconceptualizing participation for sustainable rural development: Towards a negotiation approach. *Development and Change, 31*, 931-959.

Meadows, D. H., Meadows, D. L., Randers, J., & Behrens, W. W. (1972). *The limits to growth.*

Miller, G. A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological Review, 63*, 81-97.

Pahl-Wostl, C. (2006). The importance of social learning in restoring the multifunctionality of rivers and floodplains. *Ecology & Society, 11*(1), art.10.

Rittel, H. W. H., & Webber, M. M. (1973). Dilemmas in a general theory of planning. *Policy Sciences, 4*, 155-169.

Schön, D. A., & Rein, M. (1994). *Frame reflection. Toward the resolution of intractable policy controversies.* New York, NY: BasicBooks.

Schusler, T. M., Decker, D. J., & Pfeffer, M. J. (2003). Social learning for collaborative natural resource management. *Society & Natural Resources, 16*(4), 309-326.

Strauss, A. L. (1987). *Qualitative analysis for social scientists.* Cambridge, UK: Cambridge University Press.

Suthers, D. D. (2001). Towards a systematic study of representational guidance for collaborative learning discourse, *Journal of Universal Computer Science* (Vol. 7, pp. 254-277).

Sweller, J., Van Merriënboer, J. J. G., & Paas, F. G. W. C. (1998). Cognitive architecture and instructional design. *Educational Psychology Review, 10*(3), 251-295.

Van Asselt, M. B. A. (2000). *Perspectives on uncertainty and risk*. Dordrecht: Kluwer.

Van Eeten, M. (1999). *Dialogues of the deaf: Defining new agendas for environmental deadlocks*. Delft, The Netherlands: Eburon.

Van Merriënboer, J. J. G., & Sweller, J. (2005). Cognitive load theory and complex learning: Recent developments and future directions. *Educational Psychology Review, 17*(2), 147-177.