

Toward an integrative perspective on learning in innovation initiatives: The case of the Dutch greenhouse sector

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Abstract: It is widely acknowledged that innovation goes hand in hand with learning. However, theories in the realm of sustainability sciences mostly concentrate on diversity and learning outcomes, whereas theories from the educational sciences mostly focus on learning as interaction. In this contribution, we aim to benefit from an integration of these perspectives in order to better understand how different interaction patterns contribute to learning. We studied an initiative of greenhouse growers that moved towards more client-oriented business models by innovating their value chains, while at the same time increasing their societal acceptability (societally responsible innovation). As action researchers we collected extensive transcripts of meetings, interviews, and various other documents. Transcripts were segmented into qualitatively different interaction episodes. Next, we used an open coding strategy to identify different patterns of interaction. Then we coded which episodes resulted in a learning outcome. Preliminary analysis suggests that seemingly "negative" attack-and-defend patterns of interaction certainly can result in substantial results, while seemingly "positive" synthetic interaction patterns, where participants strive to build on each other, can result in rather bland interaction without substantial outcomes.

Keywords: Innovation, greenhouse growers, social learning, negotiation of meaning

Introduction

The more complex our innovation challenges, the more important the associated learning processes. Sustainability issues, complex as they are, arguably constitute the highest such innovation challenge. However, our understanding of the associated learning processes is still maturing. Various scientific disciplines have contributed to our understanding of learning in general, but they widely differ in how they conceptually approach learning and the extent to which they apply to the specific context of sustainability issues. Especially research on social learning in the context of natural resource management involves societal contexts with rather high complexity (e.g., Pahl-Wostl, 2006; Ison & Watson, 2007; Rodela, 2011). But even this line of research often does not take into account learning across networks, beyond the group level (Cundill, 2010; Reed et al., 2010).

Traditionally, educational science can be seen as the main discipline concerned with learning. Theories in the realm of sustainability sciences mostly concentrate on learning in terms of diversity learning outcomes, whereas theories from the educational sciences mostly focus on learning as an individual or interactive process. In a social context, this usually concerns learning in collaborating teams, where communicative interaction between learners constitutes the learning process of interest (e.g., Beers et al., 2006). Strangely, these fields of learning hardly interact, barring a rare exception (Scholz et al., In Press).

Apparently, we only have a limited understanding of the role of learning in the context of complex societal issues, despite its importance for innovation. A better understanding of those learning processes may improve our ability to deal with sustainability issues. In this contribution, we aim to benefit from an integration of interactive and outcome perspectives on learning. Our aim is

to improve our understanding of learning in the context of sustainability issues and to develop an analytical framework to study such learning.

We combine existing theories to develop a new theoretical framework about learning in the context of systems innovation. This framework is then applied to a case of system innovation by private partners in the Dutch greenhouse sector. Learning is analysed with specific focus on coordination activities and the crossing of sub-network boundaries. The main research questions:

1. Can we operationalise learning in the context of sustainability issues both in terms of process and outcomes?
2. How are qualitatively different interactive processes related to learning outcomes?

Learning in the context of Natural Resources Management

The learning sciences are an interdisciplinary field with many different applications. Several recent studies explore learning in sustainability transitions in more detail (e.g., Regeer et al., 2011, for learning as a capability of an innovation experiment; or Beers et al., In Press, relating images and discourses to learning processes for innovation) but they are rather scarce.

Social learning occurs when a heterogeneous set of actors shares their knowledge in an interactive process to produce new knowledge and trust that, in turn, serve as the basis for joint action (Pahl-Wostl, 2006). Social learning theory treats actor diversity (in terms of knowledge, values, interests, goals) as an important prerequisite for the ability to deal with complex issues (Ison & Watson, 2007; Wals, 2007). Most authors distinguish conceptual from relational outcomes of social learning. Others add that actions, for instance in the sense of ongoing experimentation, also should be treated as outcomes of the social learning process (Sol et al., 2013).

Reed et al. (2010) have criticized social learning research for staying within the limits of a single group, at a single moment in time (e.g., a workshop or conference). In that guise, “social” learning is hardly distinguishable from other social approaches to learning. Since then, some efforts have improved on the conceptual basis of social learning (e.g., Cundill, 2010; Rodela, 2011; Scholz et al., In Press), but these approaches do not *operationalise* social learning as social interaction.

Interactive or discursive approaches to learning

Traditionally, education scientists have predominantly focussed on learning as a process. Collaborative learning then is seen as a type of interactive communication, in other words, learning as a discursive process. For instance, learning as *negotiation of meaning* is not so often used in the case of sustainability issues (see Beers et al., 2006 for an exception). Educational scientists usually concentrate their research on experimental or classroom contexts, without conceptual treatment of the diversity that exists within and across societal networks.

Various recent contributions outline *discursive* approaches to learning based on *interactional framing* (Dewulf & Bouwen, 2012; Lems et al., 2013). These differ from most educational approaches in the sense that they presuppose strategic behaviour, which, in turn, entails that people have different interests and goals. The analysis is conducted at the sentence level. This approach yields an exceedingly fine-grained analysis of communication. However, it is also exceedingly demanding, methodologically, when applied to a larger case study spanning several three-hour meetings over a year.

In sum, existing approaches to learning rarely integrate learning in terms of outcomes and process, and both approaches also have their separate shortcomings. Therefore, we aim to develop a more integrated approach.

Towards a more integrative approach

We see learning in the context of sustainability issues as an interactive contingent process with several outcomes as emergent properties (cf. Leeuwis & Aarts, 2011; Sol et al., 2013). Furthermore, we limit our view of learning to those processes that transcend local group or network boundaries (cf. Reed et al., 2010). To that end, we explicitly distinguish learning processes within a group / local networks and learning processes in wider networks (between multiple networks). We define social learning as the process in which “people align, share and discuss their ideas together, with the outcome that they develop new shared mental models, form new relationships, and develop the capacity to take collective action and manage their environment” (Beers et al., In Press).

We see social learning, in essence, as an interactive process (cf. Leeuwis & Aarts, 2011; Sol et al., 2013), as a discursive activity in which participants have an exchange of meanings to reach specific goals (cf. Dewulf & Bouwen, 2012). Furthermore, we assume that several outcomes emerge from this interaction. First, these outcomes can concern the conceptual content of the interaction, that is, interacting participants exchange and produce new knowledge, change their views, and produce new visions while pursuing their goals (Wals, 2007).

A second type of outcome concerns action. Scholars from very different research traditions agree that (social learning-like) interaction processes are often embedded in a real-world context that requires or invites action. Wals (2007) and Pahl-Wostl (2006) hold that social learning, if successful, can result in joint action. For analytical reasons, we here distinguish between discourse-as-interaction, and its discursive results, such as agreements, decisions, and other forms of action.

A third type of outcome is relational in nature. Over the course of on-going interactions, mutual trust can grow or break down. Through interaction, social relations and networks are shaped and changed—the relational outcomes of learning (Pahl-Wostl, 2006). Discursively, this can happen when external stakeholders are discussed and put in a certain light that changes his/her relational status.

In practice this often takes the form of an ongoing chain of events, meetings, phone calls, etcetera. Each such interactive situation offers a *discursive space* (Leeuwis & Aarts, 2011) that can re-establish, reinforce and/or change conceptual outcomes, relational outcomes and action, and over the course of its existence, one innovation initiative will see a host of consecutive discursive spaces across a wide network of insiders and outsiders.

Research design

We followed an innovation initiative of Dutch greenhouse growers for ten months. Using a participant observation approach, we collected data while at the same time offering support to the initiative by reflecting on both ongoing interactive processes and the initiative as a whole from a transition science perspective.

Case

STAP is an innovation initiative of greenhouse growers. STAP is a Dutch abbreviation for Foundation for Strengthening the Sales and Marketing Position of Greenhouse Vegetable Producers in the Netherlands (in Dutch: STichting versterking Afzetpositie Producenten van glasgroenten in Nederland). STAP was founded around August-September 2011 and can be seen as a network of greenhouse growers, researchers, educational institutes and intermediaries. At the beginning of our study, STAP consisted of an executive board and a larger general board, both consisting mainly of greenhouse growers. Furthermore, STAP was setting up a platform of universities, educational organisations and intermediaries which got established as the chain knowledge platform during our studies.

Data

We attended meetings of the general board and of the chain knowledge platform and had email communications with active members of the executive board. We collected extensive notes on six meetings as well as complete transcripts for another three. We collected notes during seven incidental phone calls. We also conducted five interviews with greenhouse growers, three of which were fully transcribed, and we collected six documents written by the initiative. Finally, we had access to numerous other documents that were distributed in preparation for the meetings.

Analytical Framework

Data analysis concentrated on three main aspects: the type of interaction in meetings, the learning content (conceptual, relational, actions) of the interaction during meetings, and the learning outcomes, in terms of their impact in the innovation initiative.

Interaction type

Meetings were used as the prime source of data about the discursive interaction. We used an open coding approach (Strauss, 1987) to analyse the interaction, with the aim to *distinguish different types of interaction*. Each meeting was segmented into different interaction episodes. Interaction episodes were identified as dealing with one conversation topic, not unlike how participants in a professional meeting treat one issue on their agenda. When a clear change in interaction type would occur in the midst of one agenda issue, we would code two segments with different codes for interaction. Furthermore, some parts of the conversation more drifted than that they were on-topic. Such drifting parts of the meeting were also treated as one interactive episode.

Learning outcomes

Learning outcomes were coded per episode. An episode was only coded as having resulted in learning if 1) it contained conceptual content, relational content and actions, 2) clear conceptual relations existed between these content types, and 3) at least one action discussed concerned a *decision*, meaning that an intention existed to carry out that action. We first identified those episodes in which a decision was taken, those being the segments with the highest probability of having a learning outcome. Next, we coded the learning content of each of these episodes, distinguishing three main content categories—conceptual content, relational content, and actions. This procedure led to the identification of 14 episodes with a learning outcome.

Action content was coded for any statement that included an actual decision or an opportunity for action. In that sense, action content does not necessarily entail a concrete decision. In our coding, we distinguished between action content as *options for action* and action content as *decisions*. A decision includes an explicit or entailed commitment to a future (material) action by one or more participants in the meeting. Furthermore, a proposal for action is sometimes put on the agenda, while during the meeting it becomes clear that the proposal has insufficient backing. Such content was coded action, even though the proposal, as is, was not accepted.

Conceptual content was coded for any statement describing the initiative, its context, its problem orientation, etcetera, such as “There is a difference between producing for bulk or producing for Japan: Japan has much higher quality standards.” Conceptual content, as we coded it, included the current state of affairs in the initiative, problems and challenges confronting the initiative, and goals, visions, strategies and ways of working toward change. Other examples of conceptual content include illustrative stories about cases. Sometimes, conceptual content really concerns discussion about the meaning of a concept, e.g., “What do we mean by communication?”

Relational content was coded for data fragments about actors. Usually, this concerned actors outside the initiative, and their relations with (the goals of) the initiative. Relational utterances concern actors and their 1) activities and development, 2) constituency, 3) disposition towards (the

goals of) the initiative (roughly: insiders vs. outsiders), 4 importance for the initiative, and 5 the desired position towards the initiative. Furthermore, aspects such as culture and practice of other actors were coded relational content, such as when someone remarked that we should speak the language of growers. Participants could be member to multiple groups and they also could change groups over time (cf. Akkerman et al., 2008).

Results

Interaction types

The meeting data gave rise to the identification of six qualitatively different types of interaction: antithetic interaction, synthetic interaction, informing, word of power, agenda wars and conflict

In *antithetic interaction*, a proposal or similar contribution is introduced and discussed, upon which it is, in the end, accepted or rejected (“it was only an idea...”). The interaction pattern involves “proponents”, who introduce and defend the proposal, and “opponents”, who point out shortcomings, concerns, and hesitations, sometimes including outright attacks. The proponents try to address these concerns by refuting them or by amending the proposal. The basic rule seems that the proposal will be rejected, unless all concerns have been addressed. Some antithetic episodes seemed a bit like a game—the more opposition one offers, the higher one’s status. Participants seem as if competing for who’s the most critical opponent.

Synthetic interaction is like antithetic interaction in the sense that it often concerns a conversation about a proposal. However, instead of attacking the proposal, participants instead use their knowledge to build upon and improve the proposal in question, to make it more acceptable. It appears to be a mode of interaction in which participants have the opportunity to make the proposal conform better to their own views. The basic rule, in this pattern, appears that the proposal will be accepted, unless the interaction yields some severe concerns. In the end, this category became quite big because many episodes not antithetic or informative ended up being coded synthetic. As a consequence, the synthetic interactions differed in terms of how constructive they actually were.

The *informing interaction* pattern typically concerns one participant sharing information with the other participants. A typical example would be a round of news and messages in a meeting—every member may share some messages that he/she thinks are informative to the others, but usually without the aim of starting a discussion or choosing a course of action (“The students have started their project with the small-scale greenhouse growers.”) The main difference between this pattern, on the one hand, and antithetic and synthetic interaction on the other, is whether or not participants use their own knowledge to give a reaction. In informing interaction, participants may ask some questions for clarification, but they do not use their knowledge to attack or build upon the information shared. Incidentally, many participants appeared to be able to give criticisms by asking questions. Such questions might come across as informative, but they actually belong to synthetic or antithetic interaction, and not to informing.

The *word of power* pattern involves one participant using his/her position to overrule deliberations of the group as a whole. In the case of “word of power”, one person with sufficient power takes a decision, seemingly regardless of the meeting’s proceedings up until then. It is like informing in the sense that the other participants’ knowledge appears not to inform the resulting decision. However, in the “word-of-power” pattern we still have heard others’ knowledge and insights.

Agenda wars are interaction episodes in which one or more people actively try to steer the conversation to a topic not explicitly on the agenda, but without explicitly mentioning this. This code

was often used for episodes in which the topic appeared to drift between two or even three topics. Apparently, sometimes participants tried to raise a topic without appearing to do so. If successful, it would mean that they need not explain their reasons why. In comparison with the previous interaction types, only agenda wars witnesses multiple drifting conversation topics.

Table 1: Interaction type frequencies and learning outcomes

Interaction type	Frequency	With learning outcome ¹
Antithetic interaction	8	5
Synthetic interaction	33	8
Informing	27	3
Word of power	5	2
Agenda wars	7	0
Conflict	7	0

¹: Total number of interactions with learning outcome exceeds total learning results, because some episodes exhibited characteristics of multiple (consecutive) interaction types.

Conflict was coded for episodes in which one participant voiced their unhappiness about another's actions, views, or positions. Examples include a participant complaining that a meeting had been too "political". In some cases, conflicts were resolved, for instance when one participant reassured another that he was fully committed to the initiative, after his position had caused some doubts, but this did not always happen.

Learning Outcomes

We identified 14 episodes with an interweaving of content, relations and actions. So, one meeting can be expected to include one or two learning outcomes, sometimes as much as four. In the most typical case, it appeared in such an episode as if 1) the content spoke of a certain view or analysis; 2) the actions mentioned would potentially improve upon the current situation; and 3) the actors mentioned would be the logical targets of the actions. Such a learning outcome can be described as "positive" because the topic involved has been accepted as a proposal for action. In other cases, however, the interweaving appeared to be a reaction to perceived (as by the participants) inconsistencies within the content and between content and relations. This type of learning outcome can be seen as "negative", since the proposal discussed ends up being rejected.

The various patterns and the learning outcomes

Table 1 shows the various interaction types and their frequencies. Synthetic interaction and informing are the most predominant interaction types. Four patterns appeared associated to concrete learning outcomes: 1) synthetic interaction; 2) antithetic interaction; 3) word-of-power; and 4) informing. Antithetic episodes interestingly number only a small proportion of total episodes while ranking second among all episodes with learning outcomes, and even sharing the first rank among episodes with immediate impact, together with synthetic interaction.

The synthetic and antithetic patterns are most intense in terms of exchange of ideas. In these patterns, many, if not all, participants share their own views, either to criticise (antithetic) or build upon (synthetic) each other. In contrast, the informing and word-of-power interaction types do not include an exchange of ideas. Rather, they involve one member informing the others, or deciding for the others, while the other's opinions are either not voiced (informing) or not taken into account in the result (word-of-power). In that sense, the learning outcomes in these episodes, and even their impact, might not be as shared among all members as would the case for the synthetic and antithetic episodes, which by definition involve multiple opinions being heard.

Discussion

1. Can we operationalise learning as both interaction and outcomes, and if so, how?
2. Which interaction types are most prone to result in learning?

This study shows that learning can indeed be empirically operationalised in terms of both interaction and outcomes. We established several qualitatively different interaction patterns in meetings by identifying and characterising interactive episodes in meetings. Furthermore, we found a way to code the learning outcomes for these episodes in a way that reflected concepts, relations, and actions. Finally, the results suggest that the various interaction types have specific roles in the learning process within an innovation initiative.

The antithetic interaction pattern appeared to result in learning most often, followed by the synthetic interaction pattern. This was to be expected—these two patterns can be seen as both particularly on-topic and as rich in exchange of knowledge and participation from multiple perspectives. It was surprising that antithetic episodes most often resulted in learning, by a wide margin. This result is possibly reflective of our operationalisation of learning, in the sense that it should include actions. Those actions, then, require the commitment of various members involved. We hypothesise that the requirement of commitment to learning outcomes causes the participants to be especially critical, because they want to make sure that they commit themselves to the “right” actions. An antithetic interaction type better fits this critical attitude. Furthermore, this suggests that antithetic interaction can help to establish everyone’s commitment to a specific view or course of action.

Antithetic interaction should not be taken as the “best” interaction, rather, it most often combines concepts, relations and actions in a way that leads to impact. Other patterns might have different functions. For instance, the synthetic interaction pattern appears more explorative with concepts and associated actions being pondered, and in which it is still “accepted” to ask for clarification. Future research is needed to come to a more complete understanding of the relation between learning as interaction and learning as outcomes.

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