Challenges and Opportunities of Online Advisory Services for Dairy Goat Farmers in Northern Norway

Anders I. Mørch, Ingvill Thomassen, André V. Hvidsten

Department of Education, University of Oslo, Norway

Abstract: We present a case study of an online advisory service provided by a national dairy cooperative in Norway and identify opportunities and challenges in using a synchronous collaboration tool to support the service. The study involves a farmer and an advisor, geographically separated by several hours of driving, who aimed to simulate face-to-face dialogue in an online setting. We used a qualitative approach with participatory observation and semi-structured interviews for data collection. A theoretical framework from a sociocultural perspective informed our analysis, with a focus on communication, adaptation and mediation. Our findings address strengths and weaknesses of the collaboration tool: two modes of advising, challenges of adaptation in online learning, and the role of video. We suggest three directions for further work in online advisory services: the recruitment of young farmers, integrated services and automated analysis.

Key words: Case study, collaboration technology, empirical analysis, online advising, sociocultural perspective.

Introduction

This case study is part of the Competent Farmer project coordinated by the Norwegian Center for Rural Research. The advisory services offered by TINE, a national dairy cooperative in Norway, are the object of our study. The University of Oslo had the main responsibility of collecting and evaluating the data and carrying out the analysis. TINE offers advisory services within areas such as feed, microeconomics, milk quality, management, health, livestock welfare and machinery.

The topic for the advisory session was microeconomics within the context of a small dairy goat-herding community located along a fjord ringed by mountains in northern Norway (Figure 1). One farm in this community had to be relocated because the area had been classified as an avalanche risk area. A goat shed with 120 goats, 3–5 cows and a farmhouse had to be moved to a new location two miles away. The farmer contacted TINE's advisory services for help writing a loan application to finance the relocation.

Figure 1: Left: Dairy goat-herding community in rural Northern Norway in dark season, right: goat shed with 120 animals.

The goal of this case study was to contribute knowledge of alternative means to face-to-face (f2f) advice given the distance between many farmers and the nearest dairy cooperative. An online advisory meeting was carried out with the collaboration software IBM Sametime. Sametime offers real-time communication functionality via screen sharing, video conferencing and text-chat. The screen-sharing feature was the only feature used in our study

where a conventional phone line was used for communication. This set-up allowed the advisor to share and discuss documents and spreadsheets containing a financial plan for the whole-farm's budget (Figure 2).

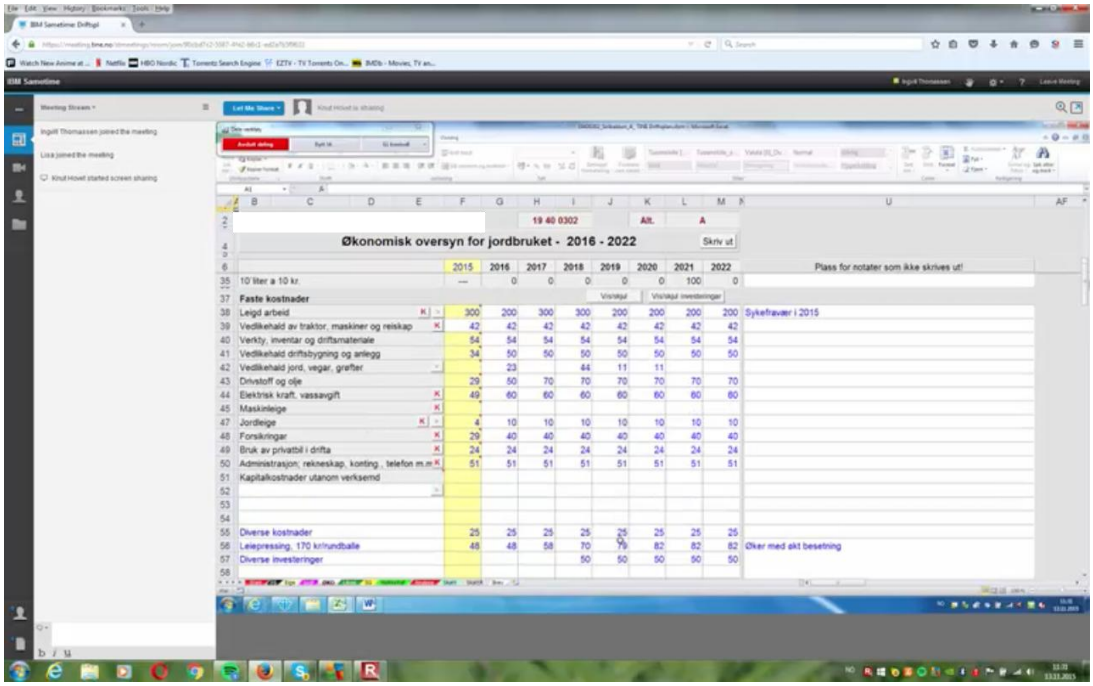

Figure 2: Sametime user interface in file sharing mode as seen by farmer. Names are anonymised.

We used a qualitative approach for data collection and analysis and focused on those aspects of the online advisory process that we believed to be critical for online advisory services to succeed as an alternative to f2f advising in some situations: communication, adaptation and mediation, which are key concepts taken from a sociocultural perspective on learning.

We asked the following research question: How does the collaboration software (Sametime) function as a mediating pedagogical tool in an online advisory session between a farmer and an advisor? In order to answer this general question, we formulated two specific questions to elaborate on in this paper: (1) How do the advisor and farmer communicate and adapt to each other in an online advisory setting? (2) How does the Sametime technology support advisory services in terms of communication, adaptation and mediation, and what obstacles can hinder one or more of these processes?

The rest of the paper is organised as follows. First, we summarize related work and present the conceptual framework for our analytic efforts and the methods used to gather data and answer the research questions. Then, we present a set of representative data excerpts chosen to answer the research questions. We then analyse the data and report our findings in terms of the technology's strengths and weaknesses in supporting online advice giving and advice seeking. Lastly, we provide some recommendations for further work.

Related Work

Materia and colleagues (2015) have studied how the use of information and communication technology (ICT) in communities of practice in the Italian Agriculture Knowledge System (AKS) can support knowledge sharing between researchers and advisory services and lead to better implementation of research results. The collaborators were organised into a community of practice to support learning and knowledge co-construction. These communities can be either non-virtual (f2f) or virtual (ICT-supported). The study showed that ICT tools should

not be the sole platform for knowledge sharing as they can produce passive users. Instead, ICT tools should complement f2f interactions in the form of follow-up meetings.

The EU SCAR (2013) committee provides a survey of experiences from different European countries and regions that is useful for promoting ICT in learning and innovation processes in agriculture. The authors claimed that a combination of f2f meetings and social media within existing networks would strengthen the networks and create new opportunities for interaction and recruitment. The survey did not find any 'killer app' for innovation processes in agriculture, i.e. a favourite social networking site or collaboration (groupware) tool considered indispensable or superior to rival products. Wikipedia and Yammer are mentioned as examples of crowdsourcing software with which a large group of users can share experiences and contribute knowledge in innovation processes depending on the complexity of the joint task (EU SCAR 2013, 95). For these online meeting arenas to work well, physical meetings are needed for discussing complex issues or problems requiring direct observation.

By using a web camera, farmers and advisors can see each other's gestures and facial expressions, which can facilitate heightened perspective-taking and serve as an aid for explaining ideas more effectively (Olson and Olson 2000). The quality and reliability of the technology should be considered when using collaboration tools to support distance advisory services. Poor sound quality and time-lagged video have been shown to cause problems for both students and instructors in courses where videoconference tools are used for distance education courses (Belanger and Jordan 2000). Being able to see and hear each other at the same time as well as the means to modify what has been said are factors that can contribute to creating, maintaining and expanding common ground (Clark and Brennan 1991) and intersubjectivity (Rommetveit 1979).

Chowdhury and Odame (2013) conducted a comprehensive literature review and content analysis of 50 online communities to determine how social media platforms were used as channels for innovation among multiple stakeholders within the Canadian agri-food and rural sectors. The findings from this study indicate that social media such as Twitter and Facebook are important means of communication and information sharing in the farming community. Among the various stakeholders, farmers and producers are the predominant users of social networking sites, which they consider to be part of an interactive communication strategy. On the other hand, the authors found that government agencies use these platforms mainly for information dissemination (Chowdhury and Odame 2013). The authors identified challenges associated with poor Internet access in rural areas, the effective use of social media, and comprehension of users' security, privacy and proprietary rights (Chowdhury and Odame 2013).

Kelly, Bennet and Starasts (2017) conducted two case studies to explore pedagogical and economic motivations for adopting computer-mediated learning networks in agricultural extension and education. The case studies were carried out in two different communities of farmers in India (asynchronous voice communication in a small network) and Australia (synchronous and asynchronous communication via Twitter in a large network). In both cases, farmers could communicate via the extension services and researchers. The two learning networks were designed with different aims based on the local needs of the farmers and their relative level of digital literacy. The authors argued that there are pedagogical and economic benefits of using such learning networks and proposed a pedagogical framework rooted in constructivist learning theory to connect economic benefits by distributing extension services across f2f and computer-mediated learning networks. In both networks, the participants contributed by information sharing, asking questions and engaging in discussions. The authors suggested that for this to succeed over time, computer-mediated networks must be sustained

through facilitation and by focusing on their aims and key roles (Kelly, Bennet and Starasts 2017).

Theoretical Framework

We used a conceptual framework for our analysis based on key concepts in computer-supported collaborative learning (CSCL) and sociocultural learning theory, namely communication, collaboration, information sharing, mediation, joint action, intersubjectivity and shared artifacts.

Intersubjectivity is a term used to conceptualise the psychological relationship between people during conversations, e.g., for building shared understanding (Fugelli, Lahn and Mørch 2013; Rommetveit 1979). Intersubjectivity is a key concept for understanding microprocesses in communication, adaptation and mediating shared artifacts in CSCL and related work (Ludvigsen and Mørch 2010; Mørch 2013), i.e., farmers need to understand the meaning of the advisor's 'academic' language, while the advisor needs to see the root problem in order to provide advice from the farmer's perspective.

Intersubjectivity is at stake when communicating individuals must share information in order to be understood and contribute to the conversation. This is a prerequisite for collaborative learning, including learning in small groups, as we have here. By adopting a sociocultural approach to learning, learning takes place on two levels: first, as a social process between people; second, as an internal learning process within individuals (Vygotsky 1978).

The task of sociocultural analysis is to understand how cognition is related to and mediated by culture-specific artifacts and institutional and historical contexts (Wertsch 2007). Computers serve as cultural artifacts in this respect. A key concept in Vygotsky's theory is the zone of proximal development (ZPD). ZPD refers to the region of 'potential development' in a person where learning takes place, between new knowledge represented by goals, tools, artifacts and more knowledgeable persons and the person's current knowledge and experiences. Mediation and adaptation with the help of shared artifacts and more knowledgeable persons play an important role in extending one's knowledge in the ZPD during collaborative learning. When collaborative learning is supported by technology, it is referred to as CSCL (Ludvigsen and Mørch 2010).

When analysing a collaborative learning process from a sociocultural point of view, e.g., as mediated by technological artifacts, we need to consider both verbal and non-verbal activity and the cultural context wherein the interaction occurs (Ludvigsen and Mørch 2010; Säljö 1999; Wertsch 2007). One method for capturing a rich set of information for sociocultural analysis is interaction analysis (Jordan and Henderson 1995).

Research Methods

We used a case study as part of our qualitative approach. A case study (Yin 2003) is characterised by the involvement of a few informants who are studied in their natural surroundings. The research design of a case study is often used to describe a limited object of study through which the informants' meanings, understandings, attitudes and behaviours (verbal behaviour, body language and actions) are foregrounded. In this case study, the focus was on how collaboration software as a mediating artifact functions as a pedagogical aid to support communication, adaptation and the mediation of shared artifacts between a farmer and an advisor. We wanted to determine what worked, what was under par, and what could be done to improve the online advisory experience.

We used video to record the data (spoken utterances, actions on shared artifacts and interviews) (Derry et al. 2010). In order to manage the data, each session and interview were

stored in a separate file and the interactions were transcribed in their entirety using linguistic conventions via interaction analysis, which is a type of discourse analysis involving artifact mediation (Jordan and Henderson 1995).

Four researchers were involved in the coding process. Our conceptual framework from sociocultural learning theory (communication, adaptation, mediation) informed the initial naming of coding categories. Next, we grouped the data into more refined categories using an iterative, thematic coding technique (Given 2008). The categories were then extended and adjusted as new instances of data were identified. The following categories were established: (1) communication process, (2) online advising: what works, what does not work, (3) Sametime, and (3) alternative tools. Illustrative examples of each category are reproduced in Section 5 (Excerpts 1–7).

Data Collection and Participants

We collected data first from Troms county (northern Norway) and then from South-Trøndelag (middle Norway). Troms is the focus of our analysis because the main goal was to study online advising. The South-Trøndelag data were used to study innovation on a farm level, and Sametime was used in the advisory session. Therefore, the data from South-Trøndelag served as a secondary source and helped to substantiate some of our findings regarding the use of Sametime.

Four researchers collaborated to create the interview guide, which consisted of 30 questions. The interviews were carried out separately with the two informants, whereas observations took place in Sametime and involved the informants and two researchers. The online sessions were observed at a distance and video-recorded with screen-capture software by two of the authors. During the Sametime meeting, the advisor took the farmer through a whole-farm budget via the Sametime tool.

A researcher in TINE put the authors in contact with the informants. We consider our access to the data an instance of purposeful informant sampling. Purposeful sampling is a common qualitative research technique whose aim is to identify and gather as much rich data as possible about a phenomenon, i.e., choosing well-informed individuals who represent different viewpoints.

The advisor has a university degree (BS) from the Norwegian University of Life Sciences and worked as a substitute farmer for six months. He has 27 years of experience as a dairy farm advisor. The farmers in Troms are married and have run the farm since 2009. They have no formal agricultural education.

Data Analysis

We present seven data extracts from the Troms interviews (one with the advisor and the other with the farmer). The supplementary observation data will be used to contextualise the interview data. The two interviews were based on both informants' experiences using Sametime to review the whole-farm budget for a bank loan application to finance the farm's relocation. This section is organized according the research questions, which informed the initial empirical categories: communication, adaptation and mediation.

How do the Farmer and Advisor Communicate and Adapt to Each Other in the Advisory Setting?

According to the advisor, a typical advisory process starts with a three-hour f2f meeting whereby the advisor obtains an overview of the situation by seeing and talking with the farmer. The advisor knows what questions to ask, such as the size of the farm and pasture, its

cost to run, how to meet a larger milk quota, and how to expand the size of the livestock. A Sametime meeting then occurs, whereby the advisor presents the results of the three-hour meeting.

Excerpt 1

[00:23:44.05] Interviewer: In the beginning of a meeting with the advisor, will the first part of the meeting be to create a common understanding before the advisor gets into the subject matter, or do you start more directly on the subject matter ((more theoretical)) talk—with the risk of talking past each other?

[00:23:56.10] Farmer: Yes, it is a concern, you need to have good chemistry so that you can learn to know the advisor through social communication, but I believe it is very important if you do not speak the same language, and in particular if you are an inexperienced farmer, then it is important to start from scratch; that is, to start from the beginning with the subject matter content ((academic talk)).

The farmer and advisor have established a good and cooperative communication channel. The excerpt shows that a typical meeting has two complementary parts: informal talk and academic (subject-specific) talk. Informal talk creates a context for academic talk; however, the farmer maintained the importance of quickly turning to the subject matter to avoid the risk of 'coffee talk', i.e., social talk with no intended outcome. Yet, communication only reaches the right level once the communicators have achieved a sufficient, common understanding of the topic, which the farmer believed should happen through the gradual formalisation of subject-specific talk.

The advisor claimed that online advising without a home visit is difficult, perhaps impossible, as Excerpt 2 shows:

Excerpt 2

[00:25:58.24] Advisor: Regarding the farm visit, I think it is much more about discussing matters back and forth to find out what they ((farmers)) really want and things like that.

[00:26:12.18] Interviewer: … and you get contextual information, information about the situation at hand, and you get information when you are on the farm and walk through the barn, looking at the animals and asking how the animals are doing, etc. You get a feel for the totality of the situations there and then?

[00:26:24.15] Advisor: Definitely, and I imagine it is easier for the farmer to talk to someone they have met before, but it is also clear to me that ((information technology)) is here to stay. I can give you an example. I am off for Tana in April to do 3-4 visits ((driving distance from Tromsø to Tana is almost 10 hours)). I will only arrange one f2f meeting with these farmers. I do not come back to Tana for a second visit.

Home visits give the advisor a contextual understanding of farmers' challenges and opportunities as well as an approximate understanding of their proficiency in handling them. This becomes the benchmark for the distance advisory meeting that follows. During this meeting, the advisor makes no effort to adapt to the farmers' proficiency level, as online sessions are mostly one-way communications consisting of a step-by-step review of the whole-farm budget, which is made possible due to prior f2f meetings.

The main finding here is that the advisory meeting has two parts: informal (to provide context) and more formal (to complete the job). Thus, the conventional (f2f, farm) meeting is divided into two parts that correspond well with the difference between f2f and online meetings, where the latter is better suited for goal-oriented activity. No sharp distinctions exist between

them; rather, a gradual formalisation occurs in the conventional meetings, whereas a sharper distinction appears when combining f2f and online meetings. This finding may provide new ways of organising such meetings in the future.

In the comprehensive EU SCAR (2013) studies, it was found that a combination of f2f meetings and social media would strengthen existing networks and create new opportunities for interaction, while physical meetings should be used for discussing complex issues or problems requiring direct observation. Materia and colleagues (2015) suggested that ICT tools should be combined with f2f meetings because relying solely on ICT for knowledge sharing can produce passive users. The researchers also found that ICT tools can be used for follow-up meetings to complement physical interactions (Materia, Giarè and Klerkx 2015). Our findings are in line with these results.

Running a dairy farm is knowledge-intensive work, with different farmers possessing different types of knowledge about specific areas. This can make it challenging for farmers to obtain advice and for advisors to give effective advice, as the farmer indicates in the following excerpt:

Excerpt 3

[00:05:57.09] Farmer: As an example, if the (.2) bacteria count in the milk suddenly rises, or (.4) yes (.) then ((laughs)).

[00:06:16.05] Interviewer: Could it be that the feed could cause problems for the animals or do you mainly identify if there are problems by looking at the animals and analysing the milk's bacteria level?

[00:06:26.05] Farmer: Yes it could be … what we usually do if we detect high values of milk bacteria is we go through the entire milk machinery, step by step, to find the cause of the problem.

The farmer needs help when irregular values are observed during milk production, such as bacteria counts outside the normal range. The farmer does not completely answer the interviewer's question in the second turn about possible causes for the high values. Knowing this would require trouble-shooting procedures, which the farmer does not know. The advisor could address the problem with a farm visit, during which he would take the opportunity to assess other possible causes of the problem, such as giving check-ups to the animals and comparing their feed.

Farmers gain new knowledge when advisors assist in problem solving related to milk machinery, feed, whole-farm budgets, etc. Advisors have the necessary, specialised knowledge and thus complement the farmers' practical knowledge. Farmers prefer to see illustrations or visualisations of the theoretical knowledge and have access to shared documents, both of which are supported in Sametime by the screen-sharing feature. There is untapped potential in online advisory services for adaptive learning and for improving current advisory methods beyond f2f approaches by drawing on the new technology's strengths (Hollan and Stornetta 1992). Adaptive learning means that the knowledge provided by the advisor is within the farmer's ZPD in which deep learning occurs (Vygotsky 1978). This constitutes a challenge for collaboration software that caters only to communication and coordination. Current work with data analytics aims to integrate automated analysis tools with collaboration software, which, in our case, could mean integrating farmers' milk production data with the online advisory loop via statistical analysis and prediction methods.

How does the Sametime Technology Support Advisory Services in Terms of Communication, Adaptation and Mediation, and What Obstacles can Hinder one or more of these Processes?

Sametime supports synchronous communication between two or more users, which, in many respects, can simulate f2f communication via tools such as high-resolution web cameras. Both the farmer and advisor explained that distance advisory services provide the means to convey facial expressions and gestures (body language), as Excerpt 4 shows:

Excerpt 4

[00:17:23.21] Interviewer: Would you also have liked to see the other person you are communicating with to have better means to repair misunderstandings?

[00:17:32.13] Farmer: Yes, it would generate better contact, but on the other hand … it was not necessary in our situation ((referring to their recent Sametime meeting)) because we were going through a well-defined task ((items for a whole-farm budget and loan application)); however, if we were discussing complex issues, it would have helped to see each other by using video.

The advisor's computer is not used for video streaming but rather for sharing his desktop with the farmer during the entire online meeting. This allows the advisor to focus the meeting by communicating through a shared artifact – in this case, a spreadsheet with an overview of the proposed whole-farm budget – but results in a one-way communication. The farmer explained that the built-in web cameras would be useful for discussions, but were not necessary in this meeting because they had already discussed the financial plan during the f2f meeting. Thus, the cameras were not used.

Another reason for the computer set-up was the advisor's negative experiences using web cameras, as stated in Excerpt 5:

Excerpt 5

[00:45:56.24] Interviewer 2: Are you familiar with Skype or similar communication tools?

[00:46:01.01] Advisor: Yes, I know it, and I like it as much as I like Facebook. In here ((referring to their office)) we have a dedicated videoconference room, which was a big thing a few years ago. I thought it was a crappy idea at the time, and in a similar vein I do not like Skype. I don't like to see people on bad ((time-lagged)) video cameras. I do not see any positive thing in that.

The advisor's previous experience with web camera technology had been negative due to poor video quality. On the other hand, the advisor was eager to find solutions that might increase farmers' request for advisory services. The advisor thus suggested a combination of one physical and two online meetings, with the second online meeting taking place 1-2 days after the first (as described above) to allow time for decision-making regarding the plan presented in the initial session. In this respect, the advisor adapted to the farmer's need for better video communication support.

Finding the right balance between informal and formal meetings supported by collaboration software is a challenge. To approximate f2f situations where discussions work well, contextual information and body language from the f2f setting should be replicated in the online setting. This is a debated issue in the distance education literature; with proponents arguing that video helps facilitate the explanation of ideas in distance communication (Olson and Olson 2000). Poor sound quality and time-lagged video transmissions, however, have

been shown to cause problems for both students and instructors in distance education courses using videoconference tools (Belanger and Jordan 2000).

Whereas the farmer responded positively to the use of Sametime, she had suggestions for how it could be improved in comparison with other tools and social media. Skype and Facebook were mentioned several times in our interviews, as expressed in the following way:

Excerpt 6

[00:16:20.22] Interviewer: Do you know of other software tools that could have worked in this situation ((referring to the recent Sametime meeting))? Tools you are familiar with from other walks of life (home or work), such as Skype and Facebook?

[00:16:36.08] Farmer: Yes, I have used other collaboration tools through my other job ((in the municipality)).

Guidance from the TINE advisors is not the only source of information used by the farmer. Other sources include meeting with neighbouring farmers, reading farming magazines, and using social media. We focus on the third source here, as our research is centred on technological mediation.

The farmer was especially fond of Skype because the webcam was easy to use. She also liked Facebook, finding it useful for cooperative problem solving via Facebook groups. A Facebook group is an asynchronous communication tool, allowing members to post messages and comment on posts. In Norway, there is one large, open Facebook group called 'Venner av norsk landbruk' (Friends of Norwegian agriculture) with over 44,000 members; a smaller, closed group called 'Melkegeit i focus' (Dairy goats in focus) has approximately 400 members and serves as the main forum for goat farmers in northern Norway. The farmer is a member of this group.

From a comprehensive online communities study in Canada, Chowdhury and Odame (2013) reported that social media such as Twitter and Facebook act as important means for communication and information sharing in farming communities. Furthermore, Kelly, Bennet and Starasts (2017) conducted case studies of computer-mediated learning networks in India and Australia and found that these voluntary networks need facilitation to be sustained over time. The authors argued that sustaining such networks produces benefits for both farmers and advisors (pedagogical and economic benefits), finding that participants in both networks contributed by sharing information, asking questions and engaging in discussions; this success was attributed to various forms of facilitation. This indicates an area for further research, as we did not observe many discussions in the online meeting, but we did find some in the Facebook group.

Finally, we asked the farmer a series of follow-up questions regarding the applicability of these tools (Skype and Facebook) for online advisory services:

Excerpt 7

[00:16:47.13] Interviewer: Could these tools ((Skype, Facebook)) be used for online advice giving?

[00:16:52.25] Farmer: Yes … If it was another type of session, then additional ((video streaming)) tools would improve the communication. But it would not improve the session we just had with a document, during which we went through it from beginning to end!

[00:17:07.21] Interviewer: So the tool to be used depends on the type of information to be communicated?

[00:17:09.06] Farmer: Yes.

The farmer stated that these tools (Facebook, Skype) work well when the main task is discussion. The purpose of the Sametime meeting was to walk through the whole-farm budget, and Sametime worked well towards this end thanks to its screen-sharing feature. Both informants agreed that document sharing is the preferred way to review a budget, as it is information-rich and requires the assessment of a set of items on a form with frequent references. In spite of this, they each independently claimed that a webcam could contribute by providing a richer channel of communication that would in turn decrease misunderstandings.

The role of mediating artifacts is central in the sociocultural analysis of human learning. Artifacts complement verbal conversation in communication. As we have seen here, this is also the case for online communication. The data show that the shared artifact (the advisor's shared applications) provided constraints on the conversation that followed. According to the farmer (Excerpt 7), this did not hamper communication; on the contrary, she considered it to be the preferred approach for the type of information being shared. We believe online advisory dialogues could be improved in a more collaborative direction by supporting joint actions on shared artifacts whereby both advisors and farmers can manipulate the documents. Therefore, in addition to being able to see and hear each other at the same time as an important factor in contributing to the creation of common ground (Clark and Brennan 1991) and expanding intersubjectivity (Rommetveit 1979), the means to modify what is said as well as the shared artifact itself should be given priority for improved technological support in online advisory services.

Summary of Findings

Overall Findings

- *Two modes of advisory communication* between the farmer and advisor: informal/social and formal/subject-specific, which corresponds in our case to physical and online meetings, respectively;
- *Adaptation during the advisory setting* allows the farmer to acquire new knowledge and the advisor to assess the farmer's level of knowledge of the topic to be addressed in the meeting;
- *The difficulty in supporting adaptation* in an online setting is connected to intersubjectivity, i.e., there are fewer cues for building understanding and mutual knowledge, for repairing misunderstandings, for anticipating what to do next, and for the advisor to evaluate the farmer's prior knowledge of the topic to be addressed;
- *The use of video* for replicating f2f communication is useful in some situations (e.g., in discussions) but can be a hindrance in others (e.g., situations requiring actions on artifacts).

We summarise our findings about the collaboration technology in terms of its strengths and weaknesses in supporting online advisory services based on the data from our case study.

Strengths of the Technology

- *Advisory services across time/place*: The technology can serve as a tool for improved distance communication between farmers and advisors that saves time and costs when the technology is freely available; collaboration technology goes beyond traditional phone lines by providing a richer channel of communication, including conversations and file sharing for working on shared objects;

- *Complementary physical/online meetings*: Online advising by Sametime has a different function than f2f advising on the farm. The initial f2f meeting is the time during which shared understanding is established. The technology did not support the creation of a shared context, but it was effective for reviewing the details of the financial plan after the initial meeting. Thus, the two meetings complemented each other;
- *Increase the frequency of advisory meetings:* Sametime seems to be well suited for scheduling follow-up advisory meetings. Both the advisor and TINE have expressed interest in exploring ways to lower the threshold for farmers to contact their advisors for more frequent meetings. Collaboration technology and social media offer plenty of opportunities.

Weaknesses of the Technology

- *Inefficient use of technology and lack of training*: The advisor used only a small subset of the tools available in the Sametime software; a regular phone line was used simultaneously, despite the video-conferencing features of Sametime. This resulted in a higher threshold for initiating the meeting that would have been eliminated with simpler technology; online tutorials and better pre-meeting preparations could address this problem.
- *Joint action on shared objects*: It would be advantageous if both communicating parties could access the shared artifact referred to during the meeting in a reciprocal manner (e.g., Google Docs). With Sametime (and Skype), only the person who shares his or her desktop has the means to invoke actions on the shared applications by mouse and keyboard operations.

Conclusions and Directions for Further Work

The general research question we asked was: How does the collaboration software (Sametime) function as a mediating pedagogical tool in an online advisory session between a farmer and an advisor? By using qualitative methods, semi-structured interviews with an advisor and a farmer on their premises (a town office and a dairy goat farm in a rural area in northern Norway) and participant observation of an online meeting in Sametime, we determined strengths and weaknesses of the technology as well as some unique opportunities offered by online collaboration. One weakness of our study is attributable to data collection limitations: one case study, few informants, and the corresponding generalisation problems. Therefore, our findings should be considered tentative at this stage, as well as situation-specific, and should not be generalised to other settings except to those situations where our findings corroborate previous research. Further work is needed to address the unique opportunities offered by online collaboration, including:

- *Recruiting new (young) farmers*: Our data indicate that Sametime can generate more meetings between farmers and advisors and possibly encourage other farmers to use the advisory services (especially young farmers). Our informants claimed a good return on their money insofar as the advisor did not have to travel to meet them, saving three hours of travel time in each direction); however, the software requires farmers to be capable of and interested in using computer technology for distance meetings. This aligns with the EU SCAR (2013) survey, which found that a combination of f2f meetings and social media within existing networks creates new opportunities for recruiting new actors;
- *Integrate different technologies:* Farmers make use of alternative communicative means when seeking information about everyday problems, but these means are not well integrated. For example, social media like Facebook groups could be integrated with the collaboration software used by advisors, allowing advisors to give guidance and topical critiques in advisory sessions that are proposed in social media discussion groups. This

aligns with the findings of Kelly, Bennet and Starasts (2017), who reported that such networks must be sustained if they are to continue to be used as a resource for farmers and, indirectly, advisors;

- *Automated analysis to improve advisory services (data analytics)*: Better use of the farm data collected by TINE for advisory purposes is recommended. An overview of data based on analytics could help farmers make adjustments to irregularities in machine readings and other farm practices more quickly. This information can be made available in different formats for users (the user interface can, for instance, be different for farmers and advisors). Ethical concerns connected to privacy and the scope of distributing this information to third parties (e.g., neighbouring farmers, feed suppliers, service providers, etc.) need to be taken into consideration.

Acknowledgements

The research presented is part of "Competent farmer: Improving farmers' competence by more efficient interaction between farmer, advisory services and research," which is jointly funded by Norwegian Research Funding for Agriculture and Food Industry; county governors in Møre and Romsdal, South-Trøndelag and North-Trøndelag; cooperatives TINE, Nortura, and Felleskjøpet Agri; the Norwegian Agricultural Extension Service; the Mid-Norway Board of Cooperation in Agriculture. Views expressed in this article are those of the authors only.

References

Belanger, F., and D. Jordan. 2000. "Evaluation and Implementation of Distance Learning: Technologies, Tools and Techniques." Tech. report, Virginia Polytechnic Institute and State University and Booz Allen & Hamilton, Inc., USA

Chowdhury, A., and H. H. Odame. 2014. "Social Media for Enhancing Innovation in Agri-food and Rural Development: Current Dynamics in Ontario, Canada." *Journal of Rural and Community Development* 8(2): 97-119.

Clark, H., and S. Brennan. 1991. "Grounding in Communication." In *Perspectives on Socially Shared Cognition*, edited by L. B. Resnick, R. M. Levine and S. D. Teasley, 127-149. Washington, DC: American Psychological Association.

Derry, S. J., R. D. Pea, B. Barron, R. A. Engle, F. Erickson, R. Goldman, and M. G. Sherin. 2010. "Conducting Video Research in the Learning Sciences: Guidance on Selection, Analysis, Technology, and Ethics." *The Journal of the Learning Sciences* 19(1): 3-53.

EU SCAR. 2013. "Agricultural Knowledge and Innovation Systems Towards 2020: An Orientation Paper on Linking Innovation and Research." Brussels: European Commission.

Fugelli, P., Lahn, L. C., and Mørch, A. I. 2013. "Shared Prolepsis and Intersubjectivity in Open Source Development: Expansive Grounding in Distributed Work." In *Proceedings of the 2013 Conference on Computer Supported Cooperative Work*, 129-144. New York: ACM.

Given, L. M., ed. 2008. *The SAGE Encyclopedia of Qualitative Research Methods*. London: Sage Publications.

Hollan, J., and Stornetta, S. 1992. "Beyond Being There." In *Proceedings CHI'92*, 119-125. New York: ACM.

Jordan, B., and A. Henderson. 1995. "Interaction Analysis: Foundation and Practice." *The Journal of the Learning Sciences* 4: 39-103.

Kelly, N., J.M. Bennet, and A. Starasts. 2017. “Networked Learning for Agricultural Extension: A Framework for Analysis and Two Cases.” *The Journal of Agricultural Education and Extension* 23(3): 1-16.

Ludvigsen, S., and Mørch, A. I. 2010. “Computer-Supported Collaborative Learning: Basic Concepts, Multiple Perspectives, and Emerging Trends.” In *The International Encyclopedia of Education, Volume 5*, edited by B. McGaw, P. Peterson and E. Baker, 290-296. Oxford: Elsevier.

Materia, V. C., F. Giarè, and L. Klerkx. 2015. “Increasing Knowledge Flows between the Agricultural Research and Advisory System in Italy: Combining Virtual and Non-virtual Interaction in Communities of Practice.” *The Journal of Agricultural Education and Extension* 21(3): 203-218.

Mørch, A. I. 2013. “Information Seeking and Collaborative Knowledge Creation: Exploring Collaborative Learning in Customer Service Work and Software Product Development.” In *Computer Supported Collaborative Learning at Work*, edited by S. P. Goggins, I. Jahnke and V. Wulf, 293-313. New York: Springer.

Olson, G. M., and J. S. Olson. 2000. “Distance Matters.” *Human-Computer Interaction* 15(2): 139-178.

Rommetveit, R. 1979. “On The Architecture of Intersubjectivity.” In *Studies of Language, Thought and Verbal Communication*, edited by R. Rommetveit and R. M. Blakar, 147-161. New York: Academic Press.

Säljö, R. 1999. “Learning as the use of Tools: A Sociocultural Perspective on the Human-Technology Link.” In *Learning with Computers*, edited by K. Littleton and P. Light, 144-161. New York: Routledge.

Vygotsky, L. 1978. *Mind in Society*. Cambridge, MA: Harvard University Press.

Wertsch, J. V. 2007. “Mediation.” In *The Cambridge Companion to Vygotsky*, edited by H. Daniels, M. Cole and J. V. Wertsch, 178-192. New York: Cambridge University Press.

Yin, R. K. 2003. *Case Study Research*. London: Sage Publications.