Using video diaries in studies concerning scientific literacy

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Abstract

In this article the possibilities to use video diaries as data collection tool in studies about scientific literacy are discussed. The starting point is a need for students to develop scientific knowledge which they can use as citizens in different situations. I argue that with this definition the students' scientific literacy (SL) must be investigated outside school in everyday life. It is also argued that studies investigating SL in an out-of-the-school context cannot be performed in the same way as studies in a school context, since situations outside school often are more complex. The use of video diaries is reviewed and then described as a research tool in investigating individuals´ scientific literacy. The methodology of investigating scientific literacy outside school is problematised, for instance which type of data that that can be collected. It is also emphasised that this way of data collecting differs from researcher controlled video filming. The control is in the hands of the video-diary maker, even if the instructions from the researcher affect how the participation from the video diarist will be expressed. This perspective will lead to use of theoretical frameworks that are built on views where the social world is seen as constructed and dependent on context. Discourse psychology analysis (Potter and Wetherell 1987) is presented as a suitable framework. This is in line with Sadler (2009) who emphasizes the importance of that students get the ability to learn science in a community where they can be central participants and express their identities.

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Key words: Video diary, scientific literacy, methodology, discourse analysis, identity

Introduction

The aim with this article is to outline the possibilities of using video diaries as a data collection tool and thereby opening up an opportunity for individuals to demonstrate scientific literacy in an everyday context. Video diaries and scientific literacy are presented mainly from a methodological perspective. The use of video diaries when documenting and analysing individuals' everyday life has been proposed as appropriate by several researchers from different fields (e.g. Buchwald, Schantz-Laursen & Delmar, 2009; Holliday, 2004). In most video diary studies, the participants are provided with a video camera and are supposed to document their life during a certain period of time. The instructions from the researcher can vary depending on the research purpose. The video material is then analysed by the researcher. This article focuses on the following points concerning video diary studies and scientific literacy: the demands for a new methodology in investigating scientific literacy,

earlier video diary studies in different fields, the type of data that can be collected, ethical aspects, and how video diaries can be analysed with respect to scientific literacy and identity.

Background

Academics and politicians have emphasised the importance of encouraging scientific literacy for a number of years. Many studies have demonstrated (for reviews, see Laugksch (2000) and Roberts (2007)) that the level of scientific literacy among students does not satisfactorily meet the demands of academics or organisations such as the Organisation for Economic Co-operation and Development (OECD, 2003; 2007). One conclusion is that individuals are not always able to use science content knowledge in an 'appropriate way'. Driver et al. (1996) describe scientific literacy as knowledge about science and its concepts, processes which involve science, and situations or context. Several researchers, such as Driver et al. (1996), van Eijck and Roth (2010), Roberts (2007), and Waldrip, Prain and Carolan (2010), emphasise that the focus should be on the *use of* knowledge, not just on its reproduction. Similarly, the OECD defines scientific literacy as "the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity" (2003, p.133). From this perspective, science knowledge can be seen as a useful tool in one's everyday life. In the same way, Ryder (2001) emphasises *functional* scientific literacy, and Roberts calls for scientific literacy Vision 2: A vision about scientific literacy which "derives its meaning from the character of situations with a scientific component, situations that students are likely to encounter as citizens" (2007, p.730). Both the OECD's definition and Roberts' vision of scientific literacy stress the use of scientific knowledge when making decisions and acting in daily situations outside the school environment. According to Roth and Lee (2004), the knowledge and skills learned in science education are often presented as necessary in order to be able to handle a future, adult life. However, Roth and Lee question whether science education really offers the possibility of becoming a participant in society; instead of concurring that science education is necessary in preparing for an adult life, they emphasise the importance of 'rethinking scientific literacy,' and see scientific literacy as participating in society.

Despite this emphasis on using scientific knowledge in different situations, the majority of research and evaluations of scientific literacy have been made using methods such as questionnaires, interviews, and observations in a school context (Roberts, 2007) and (Soobard & Rannikmäe, 2011). Lau (2009) and van Eijck and Roth (2010) question this scientific literacy research and call for other types of studies on scientific literacy where the problems are more complex.

Moreover, van Eijck and Roth (2010) and Roth and Lee 2004 state that research that investigates scientific literacy in everyday life should also use research methods close to the participants' everyday life. In this article I argue for one such possibility: that video diaries, as modern video cameras are easy for the informants to handle and use, can catch many daily situations when they occur. This research method meets the request to collect data close to the situations and actors, both in time and in space.

The demands of a new methodology in research about scientific literacy have sought to examine knowledge that would be useful in everyday life, however, the research has mainly been carried out in different school situations (Roberts, 2007). There are exceptions to this, where an everyday perspective outside school has been given more emphasis. Ryder (2001) reviewed studies on using science knowledge in different situations where scientific

knowledge is appropriate. He reviewed 31 published case studies where individuals not professionally involved with science interacted with scientific knowledge or science professionals. Thereafter, Ryder reported that much of the science knowledge relevant to individuals in the case studies was knowledge *about* science: knowledge about the use of scientific knowledge rather than scientific knowledge itself. Further, Ryder suggests that this knowledge is possible for individuals to acquire if the situation demands it, for instance, if facing a severe disease or when buying a drug.

The development of a research tool that is used close to the participants meets the call from Gee (1999) and van Eijck and Roth (2010) to investigate scientific literacy outside school. Gee (1999) and Aikenhead (2006) both emphasise that scientific knowledge learned in school cannot easily be transferred to other, more complex situations outside school. Science seldom appears in its pure forms in society; instead, it is mixed with other forms of knowledge or values. Individuals have to deconstruct their science knowledge and then construct it in a new way, one that is dependent on the context and other available information. Van Eijck and Roth assert, "there is not so much understanding of ways in which we actually can describe scientific literacy 'in the wild' in terms of knowing and current review studies are remarkably limited in this respect" (2010, p.186). 'In the wild', here, refers to everyday contexts outside school. However, studies investigating science literacy in an out-of-the-school context cannot be performed in the same way as studies conducted within in-the-school context, since situations outside school often are more complex.

Videotaping as a tool in science education research

In recent years, the possibility of using the video camera as a tool in educational research has become more apparent. A video camera gives the opportunity not only to make field notes or audio tape different situations but also to document what the students are doing during their talk. Further, the use of videotaping can easily collect a great amount of data in a short period of time.

However, the use of the video camera as a research tool for data collection in educational research has, thus far, been applied mainly in the science classroom. On the whole, the videotaping has been controlled by the researcher. On some occasions, the situations have been constructed by the researcher, while at other times the video camera has recorded ordinary lessons. Still, the researcher had some control over the settings and the filming; for example, it is the researcher who decides when to start and stop filming, and how the movie clips are to be edited. In the future, these types of studies can also contribute to research about science education, but there are some limitations in what those studies can examine; for example, they are not able to capture decision-making at the very moment decisions are made in everyday life (Lundström, 2011; Pink, 2001). Observation studies investigating scientific literacy that are conducted in school which investigate scientific literacy are normally presented as cases from everyday life (e.g., Kolstø, 2006) but which may be regarded as school tasks. However, there are exceptions to this, where video cameras have been used outside the classroom; for example, Roth and Lee (2004) followed students' engagement in environmental problems and water supply issues in their neighborhood. They demonstrated how engagement in and activities related to a scientific issue can be documented during work. Nevertheless, even though the task demonstrated engagement from the students, the main context was still a compulsory school task.

Instead of discussing videotaping in the classroom, this article demonstrates that there are alternatives to this way of using the video camera for research. It can be used closer to

everyday life, where the informants are regarded as participants *controlling* more of the videotaping and situating it in another non-institutional context; thus, it will produce another type of data when compared to classroom studies. The next section will briefly consider some studies from different research fields where the informants made video diaries that allowed them to be more involved in the research.

Earlier video diary studies in different fields

Some research fields have used the video camera to a large extent in a non-traditional manner, meaning that the researcher does not operate the cameras (e.g. Buckingham, 2009). There are studies - mainly about media (Voithofer, 2005), health (Buchwald et al., 2009), consumer research (Brown, 2010) and sexuality (Holliday, 2000; 2004) – in which the informant manages the video camera. Buckingham (2009) mentions areas, such as health care, social policy and childhood, where participatory methods have been particularly apparent. Brown (2010) describes these fields of research as concerning vulnerable groups, such as medical patients, school children or disabled patients. By that means, there are clear democratic aspects of video diaries that may raise thoughts about investigating scientific literacy in a similar manner, as scientific literacy has democratic aspects, for instance, the possibility to be involved in different types of decision-making where science may be one part of the reasoning. The aim in studies on vulnerable groups has been to give informants the opportunity to raise their voices, thereby improving our understanding of their arguments and, thus, improving the treatment or policies relating to them. The forms are diverging, but the overall purpose of this research is to allow the informants to participate in the collecting/making and, on occasion, in the analysis of the material. These different studies and the conclusions drawn from these video diary studies will be discussed further in the article, where the possibility of using video diaries for investigating scientific literacy is considered.

Video diaries in education

There have been studies in educational research where the informants have had the possibility to be participants in and producers of the research process, as they can be in video diaries (e.g., Noyes, 2004; Quadri & Bullen, 2007). A review of the use of video diaries in educational research is regarded as an appropriate way to focus on how students talk about themselves and how making video diaries can contribute to educational research. The articles that are briefly reviewed will be used later, together with the video diary studies from other previously mentioned fields, as starting points for the discussion regarding the possibilities and obstacles in demonstrating scientific literacy through video diaries.

Noyes (2004) used a video diary room in which it was possible for the pupils to be on their own and to comment on anything they wanted. The video camera was installed in a video diary room which was located close to the classroom. The purpose of the study was to gain a better understanding of the children's experiences of school, their attitudes to education and learning dispositions, their personal beliefs, their friends, their home life, and so on. The study focused on the pupils' attitudes to mathematics. The pupils, 10-11 years old, were asked to comment on mathematics, lessons, difficulties in mathematics and the use of mathematics outside school; their video diaries complemented participant observations and interviews. Noyes' intention was to encourage the children to talk more freely about their unseen day-to-day experiences. However, the study was designed in a manner that the children did not have the opportunity to edit the material, even if they had the possibility to prepare themselves before entering the diary room beside the classroom. Noyes' study can, therefore, be regarded as highly controlled by the researcher in relation to the possibility of editing the clips. In another video diary study, Quadri and Bullen (2007) let five university students reflect and give feed-back on their education during one week at university. The students had few

restrictions on the content. They were equipped with camcorders and, at least twice daily, they commented on their education, on things such as their learning and teaching preferences, perspectives on using technology in learning, and how the learning environment was an aid to learning. The teachers were often mentioned in the video diaries, which somewhat focused on the students' expectations of help from the lecturers. The authors regard the data from video diaries as much more in-depth when compared to data from interviews. Quadri and Bullen regard this possibility for the students to give feedback as very suitable; the students review and report what they believe is of importance for their education and learning. The students were also allowed the possibility of editing the material during the week.

Video diary studies in the field of science education outside school

Video diary studies connected to school education but performed outside school have, thus far, not been conducted to any great extent. Cotton, Stokes and Cotton (2010) studied the use of the video camera as a video diary in an educational setting outside school. Roberts (2011) used video diaries to investigate undergraduate students' processes of transformative learning in sustainable development. Finally, in our own study, Lundström, Ekborg and Ideland (2012) investigated teenagers' decision-making and the use of different discourses regarding the new (swine) flu vaccination. The experiences from my own study will be discussed along with, but more deeply than, the other studies.

Cotton et al. (2010) used the video camera in field work where the students were told to document their experiences and discussions during excursions. During a field trip to South Africa, 12 students filmed their daily work for one week. Cotton et al. stress the engagement the students demonstrated during their work and mention how the video diary made it possible to catch their first-hand 'lived experience' of the field course and, thus, to gain a deeper insight into the students' experience. When used in this way, video diaries are a type of non-participant observer, in which the researcher discusses the settings with the participants but is not so involved in the videotaping. Cotton et al. (2010) contend that the video diaries meet some of the criticism aimed at the use of surveys and interviews as methods of investigating students' experiences and behaviours. Furthermore, they suggest that with video diaries memory limitations that may be apparent in interviews can be minimised. They describe such memory limitations both in students who do not remember details about experiences and in post-hoc rationalisation, where the participants provide rational explanations for their actions after the event.

In another video diary study performed in the field, Roberts (2011) let students document their learning about Uganda, the UK, their subjects (biology, community development, environmental management), their field class group, and themselves in a video diary during a field trip to Uganda. They were not explicitly requested to document their learning about sustainability. Nevertheless, Roberts stresses that much of the data was sustainability related and appropriate for analysis. Based on conversations from previous trips, Roberts assumed that issues related to sustainability would be present in the diaries. He contends that the video diaries captured the development of the students' sustainability-related learning to a higher degree than written, reflective accounts do. Even when the students reported that they did not learn anything, they demonstrated reflective capacities. The video diary data "concerned not only students' understanding of equity, environmental justice and their status as global citizens but also their ethics, values and social, cultural, economic and psychological and scientific understandings" (Roberts, 2011, p. 686).

Lundström's (2011) video diary study was performed during the outbreak of the 2009 influenza (swine flu) pandemic. The purpose of the study was to develop knowledge

regarding the connections between how teenagers talked about themselves and the decisions they made concerning the new influenza and the vaccination against it. The purpose was also to investigate whether the teenagers expressed school and science education as one available discourse or repertoire when they talked about the new influenza and vaccination. In this way, the ambition was to come closer to the informants' lives outside the school environment. These ambitions led to the decision to use video diaries as a tool to collect data and thereby study decision-making and scientific literacy as defined by the OECD (2003) in a context outside school, when making a decision that may affect individual health. The seven teenagers in the study were provided with a video camera and an mp3-player, and they were requested to document situations in which they considered science knowledge to be important in their daily lives outside school. Moreover, all the teenagers were asked to comment on their thoughts about the swine flu, for instance, on the thoughts affecting their decision regarding the offered vaccination. The teenagers composed their diaries over a period of one to three weeks; one to four weeks later, semi-structured interviews were conducted. During the interviews, some of the material was discussed with teenagers while watching a small part of their video diary. The video diaries were between 6 minutes and 3 hours. The results demonstrated the use of two main types of discourses/repertoires (Potter & Wetherell, 1987): experienced emphases and important actors. The former included the categories of risk, solidarity and knowledge. The latter included family and friends, media, school, and society. The school repertoire was seldom used by the students, indicating that school and science education seem not to be an interpretative repertoire available to them. Instead, the risk, solidarity, family and friends, and the media repertoires were available in their talk about the vaccination. The results from the study demonstrate the difficulties in using science knowledge in decision-making in everyday life (Lundström et al., 2012).

Video diary data

In this section, data from video diary studies and the possibilities and difficulties of working with this kind of data are discussed. Brown (2010) and Pink (2001) both argue that the diversity of the research field in which video diaries have been used can contribute to the understanding of how to conduct this type of research in other disciplines. Earlier studies where different types of diaries or images have been used (e.g. Goldman-Segall, 1998; Pink, 2001), as well as other video diary studies, may be useful guide. Pink calls for more video studies, but she contends that the instructions to the diarists about presenting their lives may be as similar in video diary studies as it is in ordinary diary studies.

The empowering parts: correct data versus the possibility to speak

One initial difficulty of using video diaries might be in truly succeeding in collecting data that can be used to answer the research questions of the project. When the data collection is left to a high degree in the diarist's hands, the fear of not collecting enough data or not enough 'correct' data arises. Brown (2010) managed this problem by encouraging the informants to make the video diaries on a regular basis, by keeping them on the topic and by contacting the informants every week. Holliday (2000; 2004) solved the same issue by directing some themes for the informants to discuss. However, there might be tensions between the researcher's wish to keep the informant on track, the wish to create possibilities for the informant to speak, and the fear that handing over the video camera will not automatically produce new, interesting, and independent data. Buckingham (2009) stresses the importance of understanding how research establishes positions from which it is possible for participants to speak. The possibility to speak and participate is often emphasised in diary studies and other forms of creative methods; Buckingham discusses different creative methods, such as video diaries and how the possibility for informants to express their views

more directly is empowering for the participants. He does not mean that the empowerment parts should be emphasised but that the collaborative production of a video diary gives the informants the possibility to create representations of their own experiences. These could, for instance, be connected to food or health. Moreover, the video diary, according to Buckingham, explores issues and areas of experience that might be difficult to access using words alone. Holliday's (2004) themes, Cotton et al.´s (2010) reported engagement and Buckingham´s (2009) not using words alone, support this article's suggestion of using video diaries to meet situations that "students are likely to encounter as citizens" (Roberts, 2007, p.730). The participants can choose situations on their own, and how and what they talk about can be analysed with regards to scientific literacy.

Buckingham contends that a video diary also, like other types of data, "creates positions from which it is possible for the participants to speak, to perform or to represent themselves" (2009, p. 648). Similarly, Holliday (2000) describes video diaries as more complete than other methods by making the construction and display of identity easier. The informants in a video diary will, according to Holliday, collect data or participate to a high degree, thereby increasing the likelihood of rich source material for the researcher. To summarise, the video diary researcher must be able to handle and balance these two, sometimes conflicting, desires: 'correct data' and the 'possibility to speak'.

The aim with our own video diary study, (Lundström et al., 2012) was to come close to the decision-making process of the participants, both in time and in space, and thereby follow some of their reasoning and their use of different discourses. In other words, if the students had the possibility to immediately document situations, the data may be different when compared to data collected after the event. However, a large difference in comparison to other methods is the aforementioned ownership of the data collection. The collaborative method achieved by means of a video diary collects data that is relevant for the participant. Consequently, we used the new influenza as one main theme. One important fact that occurred to us very early in this study using video diaries was the willingness of the informants to contribute material, which may not have occurred to the same extent if the informants were expected to write. Video diaries may be easier to make than written diaries; for some individuals, it is easier to talk than to write. Indeed, the teenagers seemed to be comfortable with the format. The skill of formulating themselves in writing may be an obstacle for some individuals, the video diary overcomes that obstacle. In this way, a clear possibility to speak could be seen in the video diaries. The video diaries in this way demonstrated scientific literacy in the form of *use of knowledge* (Driver et al, 1996; Waldrip et al., 2010), something also reported in Roberts' (2011) study.

The quality of video diary data

The quality of the data in a video diary when compared to other methods is frequently discussed by researchers who have used video diaries. According to Quadri and Bullen (2007), it would not have been possible for them to collect their data through surveys or interviews. Similarly, Noyes (2004) states that data from video diaries provides a fuller representation or description of social life, and Roberts (2011) emphasises the reflective capacities that were demonstrated in the video diary data. Video diaries enable the informants to make links to other aspects of their broader daily experiences. These links to broader daily experiences are important to regard from a quality aspect. The data is richer than conventional interview transcripts, which leads to a challenge: the possibilities of recording, analysis and interpretation are increased (Holliday, 2000; 2004; Noyes, 2004). However, the kind of data is different and gives difficulties when, for instance, analysing whether the participants use science in an 'appropriate way'. Science knowledge will not always appear explicitly in the

form of a knowledge expressed as scientific language; instead it appears mainly in the form of different actions or talk about actions. As an example we can look at an excerpt from Anders video diary about the swine flu vaccination:

- Anders: *It's not only to not get swine flu myself but also maybe to protect others. If I, don't know, would be hospitalised or something, and then accidently infect innocent people. But it's maybe mostly because I have cousins that are very young, so if I accidently see them and infect them …so it was mostly for the sake of others that I really chose to have the vaccination*

Anders diary excerpt, about the risk of getting infected, is not crowded with scientific concepts; instead his talk about why he chooses to be vaccinated contains evidence that Anders understands something about infections. Together with other parts of the diary and follow-up interview, Anders talk about the swine flu and the vaccination can be analysed.

There have been discussions as to whether or not the format of the video diary, addressing the camera alone and in private, in some way allows for a more truthful or confessional mode. Holiday (2004) asserts that this can be the case, for instance, when talking about sexual identity, while other researchers (e.g., Pink, 2007) reject this notion. Cotton et al. (2010) think that the video diaries captured more of the first-hand 'lived experience' when compared to the other forms of diaries (written and audio taping) that were made during their project. Students were not as self-conscious as they were in the audio diaries, which were also made during the video diary project throughout the geology studies. Cotton et al. also suggest that observational methods such as video diaries limit some of the risks of interviews, such as the informant only reporting aspects that fit in to the researcher's perspective or the informant providing rational explanations for his or her actions after the event. However, this suggestion is countered by the possibilities that the video diary method opens up; one of the most significant differences from other methods is the possibility of preparing and editing the material, something discussed by Brown (2010), Buchwald et al. (2009) and Holliday (2004). Holliday claims, "Video diaries afford participants the potential for a greater degree of reflection than other methods, through the processes of watching, recording, and editing their diaries before submission" (Holliday 2004, p. 1603). Buchwald et al. (2009) and Brown (2010) also emphasise the possibility for the informants to prepare themselves and to edit the diaries; editing may also be a way for the informant to choose not to participate in some parts. Thus, control is in some way in the hands of the one making the video diary. The editing possibilities are important when working with literacies and decision-making. The video diary provides the possibility to follow the reasoning and use of science over an extended period of time.

The importance of these editing possibilities is questioned by Quadri and Bullen (2007), who consider that the information will be more honest with fewer restrictions when compared to other forms of evaluation or feed-back. Cotton et al. (2010) also de-emphasise the editing possibilities, and they contend that video diaries have the advantage of enabling data to be collected on events occurring in real-time, in a natural situation, rather than through the more artificial context of an interview, focus group or questionnaire. Consequently, the data will be less influenced by the researcher's own agenda and will be (at least in the raw form) relatively free from bias. Consequently, the editing possibilities influence the data to be collected. Brown (2010) discovered that the presence of the camera could explain large differences in how personal the informants were about their consumption and about the rest of their lives. Holliday (2000) was also surprised by the frankness of the diarists' responses, which documented very personal routines and experiences. This frankness is difficult to explain, but Holliday argues for the participants' strong motivation to talk about and explain their lives to others. There is also some variation in the extent to which the diarist involves other people,

both between the diarists and between different themes by the same diarist (Holliday, 2000; 2004; Lundström et al., 2012). Some informants kept a diary of their own; some of them involved family and friends. In our study, there were also large differences in the openness of the teenagers; some of them talked only about the given subject, others imitated the format of video diaries that they might have seen on television or on the Internet to a higher degree. The latter group of teenagers was also prepared to describe their innermost thoughts and dreams with no obvious connections to science knowledge. There were also the same differences in what type of style they used in their diaries. Both formal and informal styles were used even though the formal style, in which the talk seemed rather edited or prepared, dominated. The teenagers in our study related how different actors or situations had influenced their decision to get vaccinated or not. To summarise, the data in video diaries will vary in several aspects. Some of these variables are length, thought receiver, frankness and the individuals involved or mentioned (Brown, 2010; Lundström et al., 2012; Quadri & Bullen, 2007).

Combination with other methods

Many researchers emphasise the importance of combining methods. Video studies may be combined with other forms of methods which intertwine and overlap or link conceptually as the research proceeds (Cotton et al., 2010; Pink, 2001). Holliday (2004) suggests that video diaries are mainly a one-way conversation, and she recommends follow-up interviews to achieve a two-way conversation regarding the issues discussed in the video diaries. Buchwald et al. (2009) and Quadri and Bullen (2007) also suggest that an interview after the making of a video diary gives the researcher the opportunity to understand more about the information provided by the informants. Similarly, Goldman-Segall (1998) also emphasises the possibility of combining different methods to gain insight into what to record in order to get a richer description of the topic or informant. These follow-up interviews can be made in different formats. In our study (Lundström et al, 2012), we used stimulated recall (Bloom, 1953): the interviews were introduced by watching a small part of the informant's video diary. This method is proposed by several researchers (Buchwald et al., 2009; Holliday, 2004; Quadri & Bullen, 2007; Cotton et al., 2010). However, the risk with stimulated recall is that it puts the informant in a position where he/she feels forced to act rationally and consistently. In his study, Noyes (2004) seems satisfied that none of his informants were interested in changing their story from the diary when they were interviewed. This consistency between video diary and interview was also common in our study. None of the informants regretted the decision they made concerning the swine flu vaccination when they were confronted with their video diary about the issue. However, this persistence of an opinion can be regarded differently than Noyes' interpretation. An interview puts the student on track again, but there is also a risk that the interview takes a direction where the interviewee interprets the situation as an interrogation in which it is important to maintain consistency with his/her original statements on an issue. In a perspective in which context is regarded as important for what repertoires are available, it should not be surprising if some participant's stories are different in an interview when compared to video diary entries. In our study, stimulated recall might have had the consequence that the teenager felt it important to stay with his/her original story. Another interpretation is that the teenagers had considered their decision deeply and became more certain about their decision.

Ethical aspects

The ethical aspects of participatory research in general, and video diaries in particular, are detailed by several researchers in the field (see Buchwald et al., 2009; Pink, 2001; Rees, 2009). The truthful, confessional mode reported by Holliday (2004) has consequences for the

type of material that can be collected and how it is handled; for example, Buchwald et al. (2009) suggest that being alone with the video camera might provoke uncontrollable emotions revealing one's innermost thoughts and feelings. According to Buchwald et al. (2009) and Noyes (2004), this can introduce issues such as the confidentiality of the informants. By asking the informant to document his/her daily life, the researcher also risks receiving material that can contain sensitive information about the informant. Careful consideration must be given to how such information is handled. This information can, for example, be about the informant's family situation, self-abuse or drug habits. The form of the video diary and informants seeing documentaries in video diary form may result in some informants exposing themselves to a great extent. The special situation of looking into an individual's life using the video diary format differs from an interview situation, where that type of information can be handled immediately. With a video diary, the researcher is more dependent on the informants' choices even when instructions on what topics to document have been given. If careful ethical considerations are not made, the participants and the public will lose their confidence in the research (Shamoo & Resnik, 2009); thus, the research should follow some ethical guidelines or rules in the same manner as all other research (Pink, 2001).

The video diary format has one other advantage when compared to other observation methods: the diary maker collects the data. She/he can often choose situations to record in and can even edit or delete the material afterwards if she/he is not satisfied with it – if the framework given by the researcher allow for this. From this, the video diary format is appropriate in ethical aspects even if it is close to the participant's life (Holliday, 2004; Lundström et al., 2012).

The truthful, confessional mode of video diary reported by Holliday (2004) also appeared in our study. The requested information was, in some cases, followed by information that was not obviously related to the given subject: the swine flu or situations where science knowledge is important. One of the video diaries contained material different to the others; despite the instruction of talking about science-related situations, including the vaccination decision, it contained a lot of material that had nothing to do with either school or science. Instead, the person talked a lot about her social life, friends and family. Some of the information, where she referred to problems in her life, was considered emotional. After consulting legal experts and supervisors, the interviewer decided to talk with the girl regarding these problems. At the end of the interview, the interviewer asked her about this part of the video diary and if she needed some help in managing the situation. Since she explained that it was not a problem and that she was not in need of any help, the interviewer decided not to further act on the matter.

The connection to personal health made our video diaries even more problematic and raised considerations regarding how to act ethically and what reactions this type of data collection provokes. One of the participants in the study had chosen very unique situations when she documented situations where science knowledge could be important. Her diary contained comments where blood, alcohol and tobacco dominated; the participant had chosen material that had connections to science, but she expressed herself in a manner that felt like a provocation against the adult world. One part of her diary told a story about a Saturday evening when she and her friends met; when the interviewer asked her about the incident, she explained that this was the first time she had smoked. This result highlights the importance of combining methods and shows that the truthful, confessional mode can be difficult to analyse. Further, it demonstrates the importance of an appropriate theoretical framework and how this choice of framework is decisive for the interpretations and conclusions that can be drawn.

Another ethical aspect of video diaries is who will be involved in the diaries; even if the participants or their parents had permitted the teenagers' participation, the video diary clips might include individuals who have not been asked about involvement. These individuals may be not only those directly filmed in the diaries but also people mentioned in the material. For instance, one of the teenagers wanted to record the vaccination, but he was not allowed to do so by the nurse, who explained this by stating that the participant had to be calm during the vaccination. This can also happen in interviews and observation studies, but the confessional mode the diary format encourages should be noted. To protect the identities of all individuals involved, confidentiality is important in the process of handling the data.

Analysing and theoretical framework

Pink (2001) states that video images are interpreted in different ways by different individuals at different times, making analysis difficult. Analysis involves examining how different producers and viewers of images give meaning to their content and form (Pink, 2001). She stresses that data should be analysed reflexively to examine how visual content is informed by the intentions of the individuals involved. Thus, it is important to analyse the data in a video diary from the participants' points of view. Moreover, the different editing possibilities have consequences for how the data should be interpreted and analysed.

Video diaries have been analysed in different ways. However, there is a general consensus that identity often is in focus in video diary analysis (Brown, 2010; Gibson, 2005; Holliday, 2004). Rees (2009) suggests that video diaries offer an exciting opportunity to explore the visual character of construction and the performance of identities through the "triadic interaction between participant, camcorder and researcher" (Rees, 2009, p. 5). Identity is not described in the same manner in all the above mentioned studies, but, in most cases it is regarded as discursive, dependent on the situation. This view of identity that is regarded as dependent on the situation is interesting when investigating scientific knowledge as context dependent and involved in complex situations (Aikenhead 2006; Gee, 1999). The different frameworks use identity as a key concept, and then often combine it with other theories; for example, Brown (2010) combined identity with critical theory and Gibson (2005) combined it with Bourdieu's theories. Gibson contends that the informants present themselves according not only to what is expected of them but also to how they want to be perceived in relation to those expectations.

Pink (2001; 2007) argues that visual representations are always constructed; therefore, they should not be seen as a means of objectively documenting reality. This perspective highlights theoretical frameworks that are built on views in which the social world is seen as constructed and dependent on context. A constructionist perspective (Potter, 1996) emphasises that the world is not categorised in a certain way that all are forced to accept but that descriptions of the world are human practices; the world is constituted as people talk it, write it or argue it. Language, together with actions and interactions, builds and rebuilds our world (Gee, 1999). Therefore, how we regard and construct the world will change, both for an individual and over time. One such perspective is discourse analysis, for example, discourse psychology (Potter & Wetherell, 1987; Wetherell & Potter, 1992). A discourse psychology analysis is close to the informant's everyday life and, therefore, gives us a suitable framework for developing knowledge about the video diarist's life. The application of discourse psychology analysis allows the opportunity to analyse the diarist's use of different discourses. Roth (2008) proposes discursive psychology as one appropriate framework in analysing scientific literacy because discourse psychology theorises the function of talk and of language itself. This focus on talk is publicly available and, therefore, "accountable, situated and

embodied*"* (Roth, 2008, p. 32). The term 'literacy' indicates the importance of being able to act in different situations. Both researchers, such as Driver et al. (1996); Jenkins (2006); Levinson (2010); Norris and Phillips (2003); Norris, Phillips and Korpan (2003); and van Eijck and Roth (2010), and organisations, such as the OECD (2007), highlight the importance of being able to use scientific knowledge not only in the science classroom but also in different situations in daily life. This emphasis on use in different situations in daily life aligns with Roth's description of talk and language; therefore, it can be considered appropriate when investigating scientific literacy. It demands a view of scientific knowledge as participating in society.

The proposed follow-up interviews (Buchwald et al., 2009; Holliday, 2004; Quadri & Bullen, 2007) allow for the possibility to check thoughts and interpretations of the video material with the informant. Cotton et al (2010) refer to stimulated recall (Bloom, 1953), which can be used to combine observations with interviews, for example, by using a transcript of a teaching session as a prompt or stimulus for discussion during an interview with students or by getting tutors to review a video of their lecture. Cotton et al. (2010) also emphasise the importance of data triangulation by combining methods. In this way, different statements in different situations, video diaries and interviews, can be analysed. They contend that the changes to normal behaviour that occur in a video diary can be analysed through respondent validation. Cotton et al.'s statement about 'normal' behavior demands a theoretical standpoint from which the way individuals talk about the world can be described in terms of true, normal, or long lasting and stable; however, theories of identity often describe identity as dependent on the situation and flexible (Gee, 1999; 2001; Potter & Wetherell, 1987). With a more flexible view of identity, it is not possible to detect 'normal' behaviour if normal behaviour is described in terms of a solid and inflexible identity; the individual might present herself/himself differently in different situations.

A primary question in the analysis is how the informant meets the researcher's expectations or what expectations the informant thinks the researcher has and how he/she is to meet them. Reflexivity is often emphasised in analyses of qualitative studies (Pink, 2001; Buckingham, 2009). Pink describes reflexivity as being important in different kinds of diary studies, such as in video diary studies. Buckingham (2009) also highlights the importance of reflexivity, which examines how to understand how research itself establishes positions from which it becomes possible for participants to speak. Pink suggests that a reflexive approach "recognizes the centrality of the subjectivity of the researcher to the production and representation of ethnographic knowledge" (Pink, 2001, p.19). She emphasises both that researchers must be self-conscious of how they represent themselves and that they "ought to consider how their identities are constructed and understood by the people with whom they work" (Pink, 2001, p. 20). The relationship between the subjectivities of researcher and informants will, according to Pink (2001), produce a negotiated version of reality. Consequently, research is trying to make research *with* people and not *on* people. She also claims that ethnographers are themselves subjective readers with certain aspirations; a reflexive approach to "classifying, analysing, and interpreting visual research materials recognizes both the contractedness of social science categories and the politics of researchers' personal and academic agendas" (Pink, 2001, p. 94). Video diaries are, in accounted studies, proposed as an appropriate method to investigate the different aspects both in individuals' everyday lives and in more formal situations, and, thus, the diarist's use of different discourses. The aforementioned stimulated recall situation gives an opportunity to reflect and negotiate together.

Roth (2008) sees discursive psychology as an appropriate theoretical framework for understanding the nature of the students' talk. In discourse psychology, the use of available interpretative repertoires, such as science, are analysed to develop knowledge regarding how individuals construct an identity through talk. Discourse psychology is interested in how discourse is used as a flexible resource in social action (Potter & Wetherell, 1987; Wetherell & Potter, 1992). The data in our own (Lundström et al., 2012) study was analysed within the framework of discourse psychology (Potter & Wetherell, 1987). Potter and Wetherell include in discourse all forms of spoken interaction, both formal and informal, and written texts of all kinds. This approach emphasises that the way we understand the world is historically and culturally dependent and thereby contingent (Potter & Wetherell, 1987). In line with ethnomethodology, discourse analysis focuses on how people use their language to do things: "People are using their language to construct versions of the social world. This construction implies active selection where some resources are included and some omitted" (Potter & Wetherell, 1987, p. 33-34). The aim is to investigate how people themselves manage, understand and use descriptions and the facts therein. By analysing the data from the video diary and the interview from the teenagers in the study, we had the opportunity to understand how the informants constructed their "swine flu world discourse." Their uses of language construct justification for their decision-making. Their influenza vaccination decision was, to a large extent, a matter of handling, understanding and managing all available and diverging information. These circumstances made discourse analysis a proper analytical tool of decision-making. Often, discourse psychology uses the concept *interpretative repertoire* instead of discourse to highlight the flexibility of discursive resources in social action (Potter & Wetherell, 1987). The teenagers' use of different resources could be analysed, for instance, by examining if and how they used interpretative repertoires from a scientific discourse.

In the first part of our study, we categorised different interpretative repertoires that were used by the teenagers in their decision-making about the new influenza and the consequent vaccination. At this stage, interpretative repertoires were classed into two main categories: experienced emphases and important actors. The use of the different repertoires was then, in the second part, used to analyse how this decision-making can be understood in relation to the students' discursive constructions of themselves in a specific social context. Scientific literacy will, in these terms, be a matter of constructing an identity (Brickhouse, 2001; Sadler, 2009), and it will be understood not only as an appropriation and use of discourses but also as meaning-making in relation to other fields. It must also be understood in relation to what happens with the use of science discourse or with school-science discourse when it is expected to be available in different contexts outside school. This is in line with Sadler's (2009) emphasis on the importance of students developing the ability to learn science in a community in which they can be central participants and in which they express their identities. The teenagers in our study used the different interpretative repertoires to construct an identity. Only one of the teenagers expressed an identity in which science seemed to be very important for her decision-making. However, the importance of knowledge about the influenza and the vaccination was detailed by several of the participants, indicating that the teenagers tried to understand science as a field of knowledge even if a scientific repertoire was not completely available. For example, we can look at two girls talking about risk:

- Amanda: *They do not know what can happen, with side effects and things like*
- *that. So I don't know, but I don't trust it at all, at all.*
-
- Sandra: *It is just ridiculous that people believe that you would start walking backwards and die, bla, bla.*

Both girls talk about risk, but while Amanda thinks the vaccination is a large risk and rejects the vaccination, Sandra thinks that fear is overestimated and chooses to get vaccinated. In this way, the two girls construct different identities and demonstrate different use, but also different views, of science knowledge. This analysis is made when combining the excerpts above with other parts of their video diaries and the interviews.

In this way, scientific literacy was not reached by all teenagers in this context. This result questions Ryder's (2001) conclusion that individuals acquire the scientific knowledge, expressed as functional scientific literacy, they need to make an important decision. The key is what you define as science knowledge and in what form it is to be represented by individuals.

Discussion and implications

In this article, I have discussed different aspects of how scientific literacy can be demonstrated through video diaries. The starting point was the call from van Eijck and Roth (2010) for research on the scientific literacy of individuals or groups. They discuss scientific literacy from the concept 'in the wild'. Scientific literacy, according to van Eijck and Roth, will be collectively shared with others and used to improve our lives, even if the expression 'in the wild' may be questioned. A situation where a researcher is involved, even from a distance, might not be regarded as being completely 'in the wild'. This article claims that a perspective in which context is regarded as decisive for action implies that research methods in which the investigations concern decision-making in daily-life must be performed in daily-life: "Focus in science education should be on participation in collective activities from which scientific literacy emerges in a process of knowing as distributed, situated and dynamic processes" (van Eijck & Roth, 2010, p. 192). If this decision-making can be captured by using video diaries, the gap in time between a decision and the reasoning about the decision decreases. Moreover, using video diaries will also decrease the gap between the participant and the researcher. In this way, video diaries meet the call from Roth and Lee (2004), who stress the importance of participating both in society and in science education research.

In the article, it has been argued also for analyses and theoretical framework that are in agreement with this context-dependent, participatory and dynamic view of knowledge. In our own study (Lundström et al., 2012), we used discourse psychology, which was appropriate in our context. However, other forms of discourse analysis and identity construction theories have also been successful in video diary studies (Brown, 2010; Gibson, 2005; Holliday, 2004). The article has also tried to meet the concerns of Pink (2001), who warns of the presumption of seeing video-filming as documenting the "truth" or the knowledge of other minds. Discourse psychology analyses what individuals do; it does not try to capture some essentials of the mind. It has been given examples, both from my own study (Lundström, 2011; Lundström et al., 2012) and from literature (Buchwald et al., 2009; Buckingham, 2009; Brown, 2010; Holliday, 2004), of the participating possibilities of video diaries. It has been shown that decision-making and reasoning can be shared with others in the construction of a discursive identity (Brown et al., 2005; Sadler, 2009).

As mentioned, Gibson (2005) and Pink (2001) argue that the informants present themselves according to what is expected of them and how they want to be perceived in relation to those expectations. These two views can sometimes be in line with each other, but sometimes not. This is a part of the reflexivity process which, according to Pink (2001), results in a negotiated version of reality. The video diary may, as reported above, include both formal reasoning about the topic given by the researcher and resistance to the adult world

(Lundström et al., 2012). Therefore, data in video diary studies of this type is different when compared to studies in a school context, where the researcher is often present during the data collection. Holliday (2004) brings forth the question regarding how the diarist presents himself/herself. Holliday suggests the video diarists are truthful and confessional, something Pink (2001) disagrees with. My conclusion is that this truthful, confessional mode may occur, but that it is mostly dependent on which identity the diarist constructs and on what themes are raised. It depends on what Buckingham (2009) refers to as the *possibility to speak* - if the diarist feels that he/she has the possibility to communicate his/her experiences.

However, some important conclusions about the difficulties incurred must also be noted. The format of a video diary does not invite in-depth science content reasoning; normally, video diaries will not be sufficient to investigate a definition of scientific literacy in which knowledge of science concepts is requested (Driver et al., 1996). As mentioned, the OECD (2003; 2007) stresses the students' deficiencies in using science content knowledge in an 'appropriate way'. The data from video diaries can be analysed from a perspective where the explicitly expressed use and actions are in focus. However, the data will not be easily analysed in concluding whether science content knowledge is used in an 'appropriate way'. Instead, a definition of scientific literacy in which use and participation is emphasised is more appropriate. For instance, Roberts' (2007) Vision 2 in scientific literacy is easier to investigate with the use of video diaries. This is in line both with Roth and Lee's (2004) urgent request of rethinking scientific literacy in terms of participating in society and with Brown's (2010) emphasis on democratic aspects in research. In our study, we have demonstrated how scientific literacy can be regarded as participating in social practices and constructing an identity (Lave & Wenger, 1991). This participation and identity construction is difficult to adequately describe in a school context.

The editing possibilities of the video diaries are decisive for the type of data that is collected. Cotton et al. (2010) recommend 'live' video diaries that are collected and then immediately handed over to the researcher. They regard this method of using video as interesting, and they claim that memory limitations of what happened can be excluded. However, the majority of the referred articles discuss the possibilities editing and, therefore, reflecting provide. Two different types of data occur, depending on whether the video diaries are 'live' or edited. I believe the edited version gives possibilities to capture the reflecting process that important decision-making often includes. It will bring in aspects other than scientific ones and thereby demonstrate how scientific knowledge is used in conjunction with other types of knowledge or values, for instance, where information is uncertain or contradictory.

In my view, the design of data collection will, to a significant degree, influence what type of speech the participant will use. Goldman-Segall (1998) sees the use of video images as a collaborative authorship and a co-construction; all participants construct an identity even if they do so in very different ways. An interesting next step would be to involve the participants even more in the analysis. In our study, they were involved through participating in the interview about the video diaries. By conducting another interview after the analysis, it would be possible to talk with the participant about the analysed identity construction the analysis presents; the informants could be asked to choose clips they think are the most important for their identity. It would also be significant to use more texts from the participants to see how the complexity in different knowledge, values and emotions influences decision-making and scientific literacy.

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