

RESEARCH

A Bit More than a Fly on the Wall: Roles and Responsibilities in Design-Based Research

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This article highlights roles and responsibilities in design-based research (DBR) by analysing the micro-communication processes between two science teachers and one researcher. Despite DBR being a practice-oriented methodology, we know little about micro-communication processes with regard to how roles and responsibilities are fulfilled and perceived. We draw upon certain concepts from frame analysis when exploring three areas of concern: (1) the participants' framing of their own and each other roles and responsibilities, (2) the flexible researcher role in micro-communication processes, and (3) the teachers' different framing of education and research. Our analyses reveals that the researcher's role is framed as an observer while the teachers are the ones who implement the artefact being tested. Additionally, the flexible researcher appears more equipped to handle micro-communication processes and the teachers' different framing can be useful for development of the study. Finally, we present some final reflections based on our findings.

Keywords: teacher-researcher collaboration; micro-communication processes; design-based research; frame analysis

Introduction

'I am unsure of what you are going to explore. Are we the ones planning outdoor education while you register what you see?' (Arya, Introductory meeting).

The above quotation originates from one science teacher, Arya, who raises questions concerning the roles and responsibilities in the present design-based research (DBR) study. Arya seems to perceive the researcher's role as that of an observer who process what is happening much like a fly on the wall. By analysing the micro-communication processes between two science teachers and the first author (henceforth called the researcher), we explore the roles and responsibilities in a study concerning outdoor education in science at the upper-secondary level.

The present study is guided by Wang and Hannafin's (2005) definition of DBR as 'a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development, and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually-sensitive design principles and theories' (pp. 6–7). With regard to DBR, this definition includes

the aim (improve educational practices) and the approach (iterative cycles in collaboration). It also indicates among whom (researchers and practitioners) and where (real-world settings) the DBR is conducted, as well as its outcome (context-sensitive design principles and theories). Collaboration among researchers and teachers are important for inclusion and participation, however, reflections concerning how roles and responsibilities are negotiated appear to be under-researched.

Although educational researchers and teachers may share a number of similarities, they work in separate cultural communities (Caplan, 1979). On one side, teachers work within organisational structures with all of their practical implications and complexities (Doyle, 1986; Penuel et al., 2015). Teachers frequently seek practical approaches and want to gain knowledge that can improve their teaching (Kolmos, 2015). On the other side, DBR researchers work within an academic culture and 'research often proceeds slowly, as researchers prioritize generating evidence through cycles of inquiry and analysis before they are ready to recommend action.' (Penuel et al., 2015, p. 188).

There is a broad consensus that teachers' professional knowledge concerning educational practice is a key factor in DBR (Christensen, Gynther and Petersen, 2012; Juuti and Lavonen, 2006; Wang and Hannafin, 2005). Teachers should be encouraged to participate in DBR, especially to identify problems and articulate solutions (Christensen, Gynther and Petersen, 2012). The DBR discourse appears to be concerned about the lack of teacher involvement in

the research (see, for instance, Engeström, 2011; Kolmos, 2015). Additionally, Lorentzen (2017) uncovered through a critical discourse analysis of several DBR articles, that teachers are repeatedly positioned as passive objects.

The DBR researcher plays an important role in building bridges between educational research and educational practice (Design-Based Research Collective, 2003). The DBR researcher operates by steering and administrating the direction of the research, which can lead to a power structure that favours the researcher (Barab and Squire, 2004; Wang and Hannafin, 2006). However, the researcher's role is flexible and can act as a designer not only of the research itself but also of pedagogy (Christensen, Gynther and Petersen, 2012).

According to Anderson and Shattuck (2012), researchers and teachers have different roles and responsibilities in DBR. They recognise that 'teachers are usually too busy and often ill trained to conduct rigorous research,' whereas the researcher 'is often not [sufficiently] knowledgeable of the complexities of the culture (...) of an operating educational system to effectively create and measure the impact of the intervention' (Anderson and Shattuck, 2012, p. 3). However, there appear to be implicit understandings of the roles and responsibilities of researchers and teachers based on prior research. Thus, it may be difficult to navigate the DBR literature on these issues.

We draw upon frame analysis as a theoretical framework. Frame analysis can provide us with insights into micro-communication processes concerning roles, responsibilities, and power structures in teacher-researcher collaborations (Coburn, 2006; Coburn, Bea and Turner, 2008; Penuel, Coburn and Gallagher, 2013). Framing is understood as how people perceive and communicate reality (Goffman, 1974). This article explores (1) aspects that appeared to characterise the participants' framing of their own and each other roles and responsibilities in this DBR-study (2) how a flexible researcher role affected micro-communication processes, and (3) in what way the teachers' framing of education and research influenced the teacher-researcher collaboration in the present study.

Frame Analysis

Frame analysis is an established concept in the social movement and policy studies research literature, and it relates primarily to studies with large social groups and often to the implementation of new policy structures (Ketelaars, Walgrave and Wouters, 2014; Snow and Benford, 1988). Undoubtedly, the best-known spokesperson for frame analysis is Erving Goffman, a Canadian-American sociologist and writer. Goffman (1974) claims that definitions of social situations are constructed in accordance with basic frames of understanding. These frames permit us to make sense of events by letting us divide experience into easily manageable wholes. According to Goffman's work, the concept of framing indicates the definition of a specific situation. We 'locate, perceive, identify, and label' the situation in order to answer the question 'What is going on here?' (Goffman, 1974, p. 21). According to Penuel, Coburn and Gallagher (2013),

the negotiation of frames directs responsibility towards certain participants of the study:

The framing of problems within research–practice partnerships is especially critical to re-organizing the relations between research and practice within design-based implementation research, because the frames negotiated explicitly name particular groups of researchers or practitioners as responsible for designing and implementing solutions. (p. 244).

The frames and relations between teachers and researchers is dynamic; thus, roles and responsibilities in the teacher-researcher collaboration may need to be reorganised during the course of collaboration.

In frame analysis, we find two intertwined key processes – namely, frame alignment and resonance. We utilise Cynthia Coburn's (2006, p. 347) definition of frame alignment: 'The actions taken by those who produce and invoke frames in an attempt to connect these frames with the interest, values, and beliefs of those they seek to mobilize (Snow et al., 1986; Williams and Kubal, 1999).' She goes on to state that 'Individuals and groups attempt to construct ways of framing the problem that provide "conceptual hooks" (Zucker, 1991) allowing targets of mobilization to link the frame with other things they know, experience, or believe.' (Benford and Snow, 2000; Snow et al., 1986). In the present study, this definition of frame alignment shapes two different sides of the teacher-researcher collaboration. The researcher produces and invokes frames for the intended targets of mobilisation, which are the teachers in this case. We understand frame alignment as a gradient – not as being dichotomously aligned or not aligned (Ketelaars, Walgrave and Wouters, 2014).

Frame alignment is dependent on how participants respond, and this process is called resonance (Coburn, Bea and Turner, 2008). Resonance revolves around frames' potential to create a connection with the teachers and motivate them to act or support a decision (Coburn, 2006; Penuel, Coburn and Gallagher, 2013). Binder (2002, p. 220) builds on the metaphor of striking a guitar and getting a 'deep responsive chord,' which refers to the resonance that the player feel on the guitar's body. Additionally, the participants' resonance may create resonance with the researcher (Ketelaars, Walgrave and Wouters, 2014).

Framing processes can be challenged when participants provide counter-frames with alternative portrayals of the situation, which often have contrasting implications for roles, responsibilities, and resources. These counter-frames may be operating over time as frames are reframed during negotiations (Coburn, Bea and Turner, 2008).

Methods and Materials

The Scope and Context of the Study

The overall aim of the study arises from the need to explore challenges connected to outdoor science education in an upper-secondary school. Research has estab-

lished that outdoor education is a useful contribution to science education (Fägerstam and Blom, 2012; Rickinson et al., 2004). Nevertheless, the use of learning arenas, such as a nearby forest or other nature areas, is minimal at the upper-secondary level (Fägerstam and Blom, 2012; Glackin, 2016). The researcher developed an artefact to assist teachers in their efforts to conduct outdoor education (Figure 1). The artefact is structured after the three-fold principle of preparatory work, conduction of outdoor education and supplementary work. It is a theoretical model that is based on a synthesis of existing research on out-of-school settings (including museums and science centres) at all levels of general science. Hence, the artefact was tested for its adaptability and applicability to outdoor science education in the Norwegian upper-secondary context. The study follows national ethical guidelines and has been approved by the Norwegian Centre for Research Data. In addition, we attempted to strengthen our awareness of relational ethics. In particular, the participants' right to autonomy and the researcher's impact on relationships with and among the participants (Merriam and Tisdell, 2016).

In addition to prior research on out-of-school settings, the artefact is based on selected literature that is compatible with the researcher's framing of outdoor education – specifically, the point concerning students' outdoor activities (3b in Figure 1). For instance, the researcher values student activity and experience-based education in keeping with John Dewey.

Selections and Data Material

The study was conducted at one upper-secondary school in Norway, which was selected out of convenience. Based on the criteria provided by the researcher, the head of the science department invited teachers to participate. The most important criteria were voluntary participation and, if possible, teachers from both sexes were preferred. The teachers who volunteered were Arya and Gustav (pseudonyms). Arya, who is in her mid-forties, has worked at this upper-secondary school for one year. She holds a master degree in microbiology and has previously worked as a primary teacher. Gustav is in his late thirties and has four years of experience at the present school. He holds a master degree in natural resource management. The researcher forms the third part of the group. Like Gustav, she has a background in natural resource management and has an interest in outdoor life. Before she started her PhD, she had two years of experience in a science teacher education programme.

The artefact (Figure 1) has been tested and developed in three iterations over the course of a school year (2014–2015). The second iteration is excluded from this article, as practical issues at the school caused it to deviate from the research design. The main data for this article were derived from an introductory meeting, two workshops, and two reflection meetings (Table 1). Description of the actual performance is given in X (forthcoming).

The purpose of the introductory meeting was twofold: (a) to brief the two teachers on preliminary aims of the

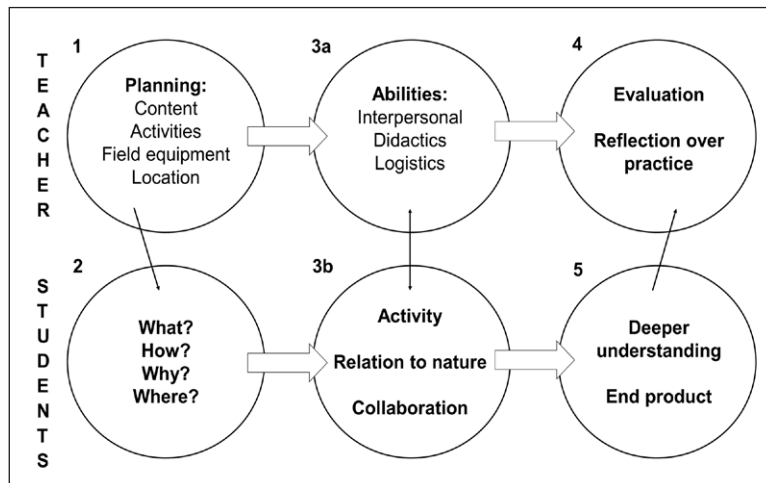


Figure 1: The artefact of outdoor science education.

Table 1: An Overview of the Data Material.

	Introductory meeting	First iteration	Third iteration
What	First encounter between the researcher and the teachers	Workshop Reflection meeting	Workshop Reflection meeting
Files	Audio Field notes	Audio Field notes	Audio Field notes
Duration	Semi-structured interview: 16 mins Researcher's reflections: 2 min 41 sec + notes	Workshop: 2 h 20 mins Reflection meeting: 50 mins	Workshop: 1 h 9 mins Reflection meeting: 57 mins
When	21 August 2014	WS: 27 October 2014 RM: 4 December 2014	WS: 28 May 2015 RM: 18 June 2015

study and (b) to conduct a semi-structured interview (Kvale and Brinkmann, 2015) to explore the teachers' experiences and interests. The purpose of the workshops was to plan outdoor education, whereas in the reflection meeting, the intended aim was to reflect on the outdoor education that was conducted. The reflection meeting was conducted as a semi-structured interview (Kvale and Brinkmann, 2015).

The lead author transcribed, structured, and coded the audio files using NVivo 11, and communication, such as vocalisation, laughter, and irony, were registered. Field notes and reflections by the researcher (both audio and written material) were used to strengthen or weaken the assertions that appeared during the analyses.

The lead author interacted with the participants of the study and facilitated the generation of data. The second author has contributed with theory perspectives, data analyses and discussion of findings.

Data Selection and Analyses

Consistent with DBR methodology, the researcher conducted formative analyses between each iteration of artefact testing (Reeves, 2006). The analyses were an iterative process of discussing preliminary findings between the two authors, both of whom were familiar with the context of inspecting and identifying issues in the material (Erickson, 2012). We will portray the main steps in our analyses, first, by describing the data-driven process and, second, by examining how the analyses is influenced by frame analysis.

The beginning of our analyses was exploratory, open-ended, and data-driven. To look for patterns, the researcher freely generated codes based on inductive reasoning (Leedy and Ormrod, 2015). The preliminary analysis of open coding led to an emphasis on negotiation sequences, which are an important micro-communication process in collaborative partnerships (Penuel, Coburn and Gallagher, 2013). We understand negotiation as a dialogue that is characterised by discussion and argumentation, whereby we negotiate a desired outcome or resolve differences. These were dialogues where the participants of the study disagreed and attempted to reach an agreement. In addition to negotiation sequences, we analysed meta-reflections about roles and responsibilities and about being a participant in this study. Further, we identified *which* topics the participants (Arya, Gustav and the researcher) negotiated, *how* we put forward arguments, and *who* negotiated which topics. Finally, we identified connections by asking *why* these processes appeared. After exploring these questions, we discovered that there were several complicated micro-communication processes occurring. To provide further insights into these processes, we used a lens that was inspired by frame analysis.

We obtained a selection of negotiation and meta-reflection sequences from the data-driven process. These were analysed using the following concepts from frame analysis: framing, frame alignment, resonance, and counter-framing. The degree to which frame alignment was present in the occurring situation was based on resonance

or lack thereof. Resonance was based on the replies from the receiver of the frames. In cases of lack of resonance, the receiver may have responded using a counter-frame. The following excerpt illustrates how we analysed the empirical material by using frame analysis:

Researcher: I was thinking about a nature trail (...) It's only a suggestion from me.

Gustav: Then we could have repetition from ecology! [the subject matter of ecology].

Researcher: And the trail could be digital – upload[ing] questions on their [students'] mobile phones.

Gustav: Oh, but then you distance yourself from nature.

The researcher put forward a frame of understanding how to conduct outdoor education (using a nature trail). This frame is aligned with one of the teachers, which generates resonance when he develops this frame further by including subject matter. When the researcher suggest a digital trail, which in a lesser degree aligns with Gustav's frame of outdoor education, he argues against a digital trail. This can be interpreted as a counter-frame as he negotiates the operating frame.

Excerpts were selected based on the following criteria: (a) they were concentrated in time and space, (b) they had overlapping micro-communication processes, (c) had perspectives concerning roles and responsibilities and (d) practical/technical negotiations (for instance, negotiations about the meeting time the next day) were excluded. The selected excerpts were analysed thoroughly (sentence by sentence) to arrive at an understanding of intertwined micro-communication processes.

Findings and Discussion

Roles and Responsibilities

Our main finding related to aspects that appear to characterise the participants' framing of roles and responsibilities concerned the distance between 'us as teachers' and 'you as a researcher.' The personal pronouns used by both the researcher and, in this case, Arya underscored the fact that the teachers were the insiders while the researcher was the outsider:

Arya: I am unsure of what you are going to explore. Are we the ones planning outdoor education and you register what you see?

Researcher: Yeah, I'm thinking we'll plan it together.

Arya: But we are the ones teaching?

Researcher: Yes.

Arya: And you'll write articles?

Researcher: Yes, it is a part of my PhD education, and the artefact is my main focus, where I bridge theory and practice.

Arya: When you say that, I think at once that outdoor education is a challenge (...).

Researcher: I can understand what you mean, but I will meet those challenges with you.

(Excerpt A, Introductory meeting)

It seems important for Arya to get clarification regarding the roles and responsibilities of the participants in the study. She appears to frame her role as a teacher and enactor, whereas the researcher is an observer who holds a traditional researcher role. Arya clarifies the teacher's role as a 'teacher' and her responsibility as 'teaching' and the researcher's role as an 'observer' and her responsibility and agenda as 'writing articles.' The researcher reports that the articles are a part of her PhD education and that the artefact is her main focus. The researcher's use of 'my main focus' and Arya's use of 'what **you** are going to explore' indicate that the researcher has ownership of the study. During briefing about the study, the artefact, as well as arguments in favour of outdoor education, were presented. This may explain Arya's lack of resonance as she frames outdoor education as 'a challenge.' We interpret Arya's statement as a counter-frame because she provides an alternative portrayal of outdoor education. Arya's counter-frame generates resonance with the researcher when the latter states, 'I will meet those challenges with you'. The researcher also attempts to enhance collaboration when planning outdoor education by saying 'we'll plan it together.'

The researcher did not account for assigning roles and responsibilities during the introductory meeting, despite this being stressed in several studies (Benford and Snow, 2000; Coburn, 2006; Penuel, Coburn and Gallagher, 2013). However, roles and responsibilities are not necessarily obvious for the researcher before he or she has entered the school gate and met the participants of the study. If roles and responsibilities are too fixed, this may restrict the inclusion of teachers in the study.

The next time that roles and responsibilities were negotiated, the researcher maintained an operating frame of her role as an observer. At the same time, the following are examples of how the researcher attempted to include the teachers in the study:

Researcher: I would sit and observe during the preparatory work.

Arya: Before we go outside, right?

Researcher: Yes, or the preparatory work could also be outside. I don't want to put that premise on you, so that's fine by me if you want to have the preparatory work outside....

Arya: Yeah, but it is perhaps better to have it inside.

Researcher: Yes, you could, but we can plan it in this meeting. In the conduction [outside], I will observe and perhaps wear a head camera. But I will take notes as well; I like to write simultaneously. It means that during the conduction, I would not act as a teacher; I would act as ... perhaps a bit more active than a fly on the wall. I could speak to the students and stuff like that, and if I see that things get out of hand. But it is you who are the teachers.

(Excerpt B, Workshop I)

The roles and responsibilities of the teachers and the researcher are further illuminated in this excerpt. The researcher describes her role as observational during the

preparatory work, but it can be more participatory during outdoor education. In the final phrase of this excerpt, the researcher modifies her frame as an observer by using the idiom 'a bit more active than a fly on the wall.' Being a fly on the wall refers to the role of a researcher who does not interact or interfere with the participants of the study. The researcher is firm about the role of the teachers and their responsibility (managing the class outside). The researcher adheres to her methods of generating data and her role while doing so (observing/wearing a head camera/taking notes/not managing the class). These responsibilities seem to be appropriate, as the teachers may have limited responsibility for data-generation methods and more responsibility for design implementation and development. The researcher is, however, flexible regarding intervention and wants to involve the teachers while implementing the artefact into their practices. It appears to be a tacit reconciliation of the principle of the artefact (preparatory work, conduction of outdoor education and supplementary work), as the principle is not being negotiated. The researcher appears to use this principle as an operating frame and premise for the planning. As long as Arya and Gustav accept this premise, the researcher invites the teachers to be a part of the decision process. The researcher is resigned to her role as an expert, especially when stating that 'we can plan it in this meeting.' In using the personal pronoun 'we,' the researcher is attempting to enhance joint collaboration with the teachers.

Gustav seems to have a lesser need than Arya to know the researcher's role in a meta-perspective. Instead, he reflects on his role in the study. Additionally, the message that outdoor education makes a useful contribution to science education creates alignment and generates resonance with Gustav, although he also mentions the difficulty of conducting outdoor education:

Researcher: Do you have any immediate thoughts on how you see yourself in this study?

Gustav: Ehm, what are you thinking of?

Researcher: Do you think that you have any particular experiences concerning outdoor education?

Gustav: Yeah, I have competences concerning [the fact] that I am very interested in being outdoors, hunting, and so on. I enjoy that. But I don't know if that's relevant in this study. I feel like I'm being interrogated! (...) Otherwise, I believe in this way of being concrete, and there are many possibilities in the outdoors for concrete approaches.

Researcher: Have you had any experience with outdoor education?

Gustav: I was really interested in outdoor education when I studied teaching. Then the everyday life came [as a teacher], and I don't get to do as much of it [outdoor education] as I would have wanted.

(Excerpt C, Introductory meeting)

Gustav may appear slightly insecure about his role as he seems to doubt whether his information about his hobbies and outdoor experience is relevant. He also seems uncomfortable with being questioned by the researcher. Gustav

reports that he was interested in outdoor education when he studied education, but due to the limited possibilities for outdoor education in everyday life, he does not ‘get to do as much of it as [he] would have wanted.’ This may indicate that he sees this study as an opportunity to implement outdoor education in his teaching practice.

Even though the artefact created alignment and generated resonance with Gustav, it aligned with Arya only to a limited degree. Thus, during a formative analysis that occurred after the introductory meeting, the two authors assessed the artefact to be imprecise and not sufficiently sensitive to context. The two authors determined that the planning of outdoor education was a challenge that needed to be addressed so that the artefact could become credible, especially to Arya. Although the artefact was not amended, the authors created a context-sensitive design that was derived from it (Figure 2). The context-sensitive design was created to incite action by inviting the teachers to play a more significant role in the study by designing outdoor education. Before the first workshop, the researcher added the suggestion of a teaching session based on the topic ‘Radiation and Radioactivity,’ as presented in Figure 2. Next, we will explore how the context-sensitive design influenced the teacher–researcher interaction and, in particular, the researcher’s role.

The Flexible Researcher Role

The following excerpt contains numerous micro-communication processes. However, we will shed light on the flexible researcher role.

To clarify, we understand the researcher role as an umbrella term that incorporates several positions. Inspired by the frame alignment idea, we identified two researcher positions that draw upon Coburn’s definition (Coburn, 2006, p. 347), which was presented in the outline of this article. The first position is connected to the actions taken by those who produce and invoke frames, and the second position is connected to how those frames are intended to seek to mobilise. In this study, the researcher appears as the one who produces and invokes frames whereas the

teachers are the intended recipients of mobilisation. We have chosen to label the positions ‘the action-taker position’ and ‘the mobilised position,’ respectively. Our analyses uncovered that the researcher also holds a mobilised position during certain parts of the study.

In Excerpt D, the participants begin to plan outdoor education using the context-sensitive design. The context-sensitive design creates a frame for the planning of outdoor education. We have divided the excerpt into four parts (D1–D4) with our interpretations included below each part. The participants plan outdoor education and the excerpt starts with the researcher suggesting a nature trail (Figure 2):

Researcher: I was thinking about a nature trail (...) It’s only a suggestion from me.

Gustav: Then we could have repetition from ecology! [the subject matter of ecology].

Researcher: And the trail could be digital–upload[ing] questions on their [students’] mobile phones.

Gustav: Oh, but then you distance yourself from nature.

Researcher: Yees... [the researcher stretches the vocal].

Gustav: But they need to move around?

(Excerpt D1, Workshop I)

In this excerpt, the researcher holds an action-taker position: She invites the teacher to take part in the planning by stating ‘It’s only a suggestion.’ She offers a proposition but implies that the teachers have the power to disagree or suggest something else. However, the nature trail is aligned with how Gustav frames outdoor education. He generates resonance, proposes ecology as part of the science content, and wants to develop the suggestion further. Thereafter, the researcher holds a mobilised position by suggesting a digital nature trail as she builds on the current suggestion. However, it is unclear whether she is mobilised by her own or Gustav’s suggestion. The

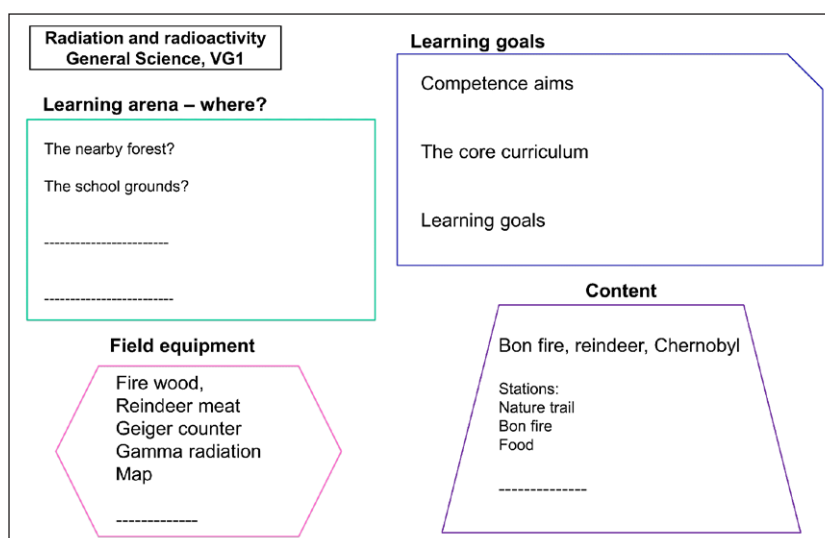


Figure 2: An excerpt of the context-sensitive design used during the first workshop.

researcher's improvised suggestion moves the focus from subject content (ecology) to outdoor education pedagogy (introducing a digital nature trail). However, to a minor degree, the use of a digital nature trail creates alignment with Gustav. He seems to present a counter-frame as he negotiates the operating frame by expressing his belief that technology creates distance between 'yourself' and 'nature'. The researcher chooses not to argue any further and replies yes, waiting for him to elaborate. Gustav seemingly questions or calls for students' movement as a part of the outdoor education.

In the next section, the researcher has to negotiate between two operating frames that appear incompatible:

Arya: Or we could include Geocache, so they need to look for the questions. It's very cool!

Gustav: But they need to put away their phones so that they don't start Googling the answers.

Arya: Yeah, but that doesn't matter. If they are going to use Geocache, they will need their mobiles.
(Excerpt D2, Workshop 1)

The two teachers' different ways of framing outdoor education are explicit here. Arya argues in favour of a digital nature trail, with mobile phones serving as an important tool for learning outside. Thus, the researcher's earlier suggestion regarding a digital nature trail creates alignment with Arya's framing of outdoor education. The alignment generates resonance, and Arya suggests the use of the app Geocache. The use of mobile phones creates alignment with Gustav to a minor degree. This minor degree of alignment is probably connected to his belief that technology creates distance from nature, as he may view nature as pure and natural (Lee, 1993). Further, we interpret that Googling the answers is not compatible with his frame of learning outside. However, Arya continues the negotiation by responding to Gustav's argument and argues for the use of mobile phones.

After these two frames are displayed, the researcher suggests a compromise:

Researcher: They can get questions they can't Google!

Arya: Questions they can't Google?

Researcher: Questions where there are no definite answers. Perhaps questioning ecological relations, maybe open-ended questions.

Arya: I think it would be hard to find those types of [science-related] questions.

(Excerpt D3, Workshop 1)

Arya seems to call for clarification when she asks what the researcher means by questions that cannot be Googled. The researcher replies that she is referring to open-ended questions, and by doing so, she aligns with Arya's framing to use technology and, at the same time, acknowledges Gustav's argument that students should not Google the answers. However, the researcher's explanation of open-ended questions creates only a minor degree of alignment with Arya. Arya argues that those types of questions are

'hard to find.' This can be related to the belief that school science should consist of established knowledge, which is a belief that is not unusual among science teachers (Tsai, 2002). When faced with two apparently incompatible frames, the researcher has a responsibility to maintain the collaboration and drive the planning forward, which indicates that she occupies the action-taker position. However, the researcher's suggestion to use non-searchable questions is improvised, and the absence of theoretical research terminology implies the researcher holds the mobilised position. Therefore, this may be an example of the researcher simultaneously holding both research positions, but the mobilised position appears the communicated one.

The next section illustrates how the action-taker position surfaces and creates alignment with Arya concerning the use of open-ended questions:

Researcher: Okay, for instance, in geology, I know that other researchers have done [a study], where the students explore what kind of rock material the opera house [in Oslo] could be built with. There is no definite answer to that. [talking with a deeper voice than above (D1–3)].

Arya: Yeah, or what kind of succession phase we see right now!

Researcher: Yeah, great suggestion. Research shows that there isn't that much learning with pat answers, but rather how to use them.

(Excerpt D4, Workshop 1)

The researcher appears to adopt an action-taker position by referring to research literature and talking with a deeper voice, which the two authors regard as being more authoritative. The researcher's suggestion of an open-ended question is aligned with Arya, who generates resonance by promptly suggesting another open-ended question. The action-taker position becomes prominent when the researcher uses the phrase 'research shows' in her argumentation. Gustav remains quiet during the last two parts (D3 and D4) of the excerpt; perhaps there remains a minor degree of alignment between him and the idea about a digital nature trail.

So far, we have illustrated a situation in which the researcher shifts between two research positions in a scenario in which the participants have negotiated while planning outdoor education. Next, we will elaborate on the two research positions and then return to the teachers' different framing in the following chapter.

In leading micro-communication processes, formalness and authoritativeness are among the characteristics that the two authors use to describe the action-taker position. Thus, the action-taker position may be similar to what is considered the traditional researcher role (Engeström, 2011). The responsibilities for the action-taker position is to steer negotiation processes and maintain the collaborative partnership. However, if the researcher adopts only the action-taker position, power will lie primarily with the researcher, which can hinder teacher involvement. The lack of teacher involvement may obstruct the

development of design principles that are sufficiently context-sensitive (Jen, Moon and Samarapungavan, 2015). The context-sensitive design, which includes the nature trail idea, enabled for the flexible researcher role as it facilitated for mobilisation of the researcher. The mobilised position includes both the teachers and the researcher in the design process, which is similar to what Christensen, Gynther and Petersen (2012) describe. Based on our analysis, the mobilisation of the researcher contributed to a participatory researcher. For instance, we found that there was a connection between the mobilised position and ‘teacher talk’ in our data material. According to Penuel, Coburn and Gallagher (2013) ‘a good researcher can talk about problems of educational practice using language that a teacher (...) might use, and does not talk just in ways that are recognizable to other researchers’ (p. 252). Thus, the language that the researcher used can be indicative of the position that she held. The shifting that occurs between the two researcher positions corresponds with McKenney, Nieveen and van den Akker’s (2006) claim that the researcher should prepare to take on the additional roles of designer, advisor and facilitator without losing perspective of the researcher role.

Different Framing Is an Asset

In the following, we explore how the teachers’ perceptions of education influence the collaboration between the teachers and the researcher. As revealed in the excerpts above, the two teachers express different framing concerning the purpose of outdoor education and research. In the next excerpt, there appears to be a difference in Arya’s and Gustav’s framing about the purpose of education in general. The following excerpt is selected from a discussion about the learning outcome of outdoor education. Gustav expresses an uneasiness about the ‘new public management’ way of thinking and refers to students being units on a production line:

Gustav: It’s this production way of thinking. It seems that we are making production units. Like, mental illness with young people is increasing. Maybe it’s because they feel like production units?

Arya: But there is a lot of focus on that [mental health].

Gustav: Yes, there is, but there are so many signals the other way.

Arya: But when we were outside [in the forest], do you think that would help the class environment?

Gustav: Maybe not necessarily as a one-time thing. But a canoe trip for two to three days at the beginning of the school year, I believe that a teacher could have utilised this trip to create a better class environment.

(Excerpt E, Reflection meeting I)

In this excerpt, Gustav expresses that today’s educational system has a negative influence on students’ mental health. His way of framing schooling creates a minor

degree of alignment with Arya. Arya provides the counter-frame that ‘there is a lot of focus on that,’ which does not create alignment with Gustav. Instead of arguing further, Arya directs a question to Gustav regarding outdoor education as a means to improve the class environment. Gustav argues by elaborating on his belief about how nature contributes positively to the class environment.

Gustav repeatedly brings up this topic, and he seems uncomfortable with students being units on a line. In the following section, we see an example of the same topic as above (Excerpt E), but the conversation takes a different path due to Arya’s absence from this meeting. Without Arya, Gustav and the researcher humorously exaggerate the metaphor:

Gustav: The whole concept [of education]... For me, it is so apparent how pathetic it is. What you are doing is to ‘decorate the bride’* to make her look good. But she isn’t more good-looking; there are just several layers of makeup. You don’t do anything with the real cause of the problem. Everyone should go through the production line.

Researcher: Yeah, everyone is going to be Toyotas, and if one part is missing...

Gustav: ...we ‘hit’ you, and maybe you become a Toyota with lots of dents, but you ARE going to be a Toyota (laughing). (...) These are living human beings. It is torture to form people into given shapes.

(Excerpt F, Reflection meeting III)

* *‘å pynte på brura’ - a saying in Norwegian meaning that something appears better than it really is.*

Today’s school system appears to be in conflict with Gustav’s views on the purpose of education. He implies that he does not enjoy having the role of watching over the ‘production line’ to control whether the students are in the correct ‘given shapes.’ Due to an absence of counter-frames, there is an alignment between the researcher and Gustav, but there is only a minor degree of negotiation. It appears that the researcher strengthens Gustav’s framing instead of challenging it, as Arya did (Excerpt E). Additionally, Gustav and the researcher have moved the reflection from outdoor education towards education, which may not support the purpose of the study.

The two teachers express different framing regarding the purpose of outdoor education, education, and research. Based on the data, the researcher’s framing coincides more closely with Gustav’s beliefs than with Arya’s. Both the researcher’s and Gustav’s frames regarding outdoor education and education are met with resistance from Arya. The third reflection meeting was conducted at the end of the researcher’s fieldwork. As a group, we collaborated throughout a school year and built relationships during this time. Although the researcher met resistance from Arya concerning outdoor education, her participation was an asset to the study. Arya regularly provided the ideas that we ended up using, perhaps due to her ability

to see outdoor education in relation to the science subject at hand. Next, the participants plan outdoor education around the subject of consumption. The planning process was stagnant for almost 20 minutes, and the main idea until now concerned the use of a bonfire.

Gustav: It must be a point in itself that they [students] go outside.

Researcher: Yes.

Gustav: (...) Like you said, [name of the researcher], we have a fire and....

Arya: Or, we could have a place where they find out where the product is made, where it's utilised, and where the waste goes!

Gustav: Yes, this is great! Different places!

Researcher: Wow, that's cool; manufacture, consume, waste [taking notes]!

(Excerpt G, Workshop III)

Gustav and the researcher raised the idea of a bonfire as an important element in outdoor education, which may be connected to an outdoors culture (Gundersen et al., 2016). It seems that Arya is, to a limited degree, confined within the same culture. Instead, she suggests a three-pronged product that comprises manufacture, consumption, and waste. This suggestion aligns with the views of both the researcher and Gustav, which results in a renewed drive to continue planning. From this point, the micro-communication becomes similar to what we saw in Excerpt D (including shifting positions and negotiations). Consequently, the fact that the teachers have unique and different framing is useful for the collaboration and for development of the study.

Some Final Reflections

Wang and Hannafin (2005) state explicitly that there should be 'collaboration among researchers and practitioners' in DBR studies. However, roles and responsibilities in teacher-researcher collaboration are under-researched in DBR. Thus, we explored three areas of concern (1) aspects that appeared to characterise the participants framing of their own and each other roles and responsibilities, (2) how a flexible researcher role affected micro-communication processes and (3) in what way the teachers' framing of education and research influenced the teacher-researcher collaboration.

A vital discourse in DBR relates to the inclusion of teachers in different phases of the study (Engeström, 2011). As mentioned earlier, teachers may be too occupied by their own practice and may not be trained to conduct rigorous research (Anderson and Shattuck, 2012). Thus, we propose that the study's research design is flexible in terms of the inclusion of teachers and the phases of the study in which they are included. Roles and responsibilities of the participants may influence when to include teachers. In this study, we identified roles and responsibilities that seemed natural for the two different practices. Methods of data generation were the responsibility of the researcher, while the teachers had the responsibility to implement the artefact to their teaching. Hence, it seemed suitable

that the collaboration between teachers and researcher was enhanced during implementation of the artefact.

The researcher categorised her role as 'a bit more active than a fly on the wall.' Clarifying how a researcher can operate in a DBR study appears important, as (science) teachers may have a perception of the researcher's role as invisible and not intervening in reality. The researcher became mobilised during the workshops, and we argue that the context-sensitive design facilitated the mobilised position. We believe that meetings with a stricter agenda – that is, the researcher asks questions and steers the meeting, as is done in semi-structured interviews – will most likely favour the action-taker position. More freely structured meetings, such as workshops in which researchers and teachers work alongside each other, may create possibilities for the researcher to hold the mobilised position. This can be useful information when deciding on the research design for a study. Additionally, analysing the researcher's role in terms of her holding an action-taker position or mobilised position has raised our awareness of the flexibility of the role. The flexible researcher appears more equipped to handle the numerous micro-communication processes in teacher-researcher collaboration. Additionally, a flexible researcher role can contribute to maintain collaboration during negotiation sequences among the participants and to steer and administrate the study.

Finally, we argue that teachers should not be passive objects (Lorentzen, 2017); rather, they should be seen as individuals with different framings of education, research, and research topics. Hence, we emphasise that teachers cannot be considered a homogenous group called practitioners or teachers. Frame analysis uncovered that misalignment can be an asset and can contribute to mobilisation. However, we notice that frame alignment is given a positive value in some studies (see, for instance, Coburn, Bea and Turner, 2008; Ketelaars, Walgrave and Wouters, 2014). These studies deal with large social groups, for which alignment seems to be a necessary condition for mobilisation. Alignment may not seem as important for mobilisation in smaller teacher-researcher collaborations. Frame analysis has provided concepts that are useful for understanding the relationships between the participants in this study.

Competing Interests

The authors have no competing interests to declare.

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