

Interaction and Embodiment in Craft Teaching

Anniina Koskinen, Pirita Seitamaa-Hakkarainen and Kai Hakkarainen

Abstract

The aim of this article is to describe the embodied interaction between the teacher and students in a textile class from the sociocultural viewpoint. We focused on the embodied interaction between the teacher and the students and analyzed how the physical materials and the tools mediated appropriation of the craft knowledge. The analysis of embodied interaction is important for the development of craft education; by analyzing teaching and learning of craft in classroom brings forward various hidden means of interaction and multidimensional aspects related to learning craft skills. The study described in the present article was based on the videographic method, and it consisted of approximately 5 hours of video data for making garments in a textile class. Activities of 9 seventh-grade girls alongside their teacher were recorded. In this study, the focus was on the interaction between the teacher and the students in learning and teaching situations of the sewing phase. The method of data analysis was based on observation of episodes of embodied interaction. The results showed how the teacher demonstrated various skills with gestures. It appeared to be essential that the teacher use multi-faceted gestures so as to elicit students' advancing in their zones of proximal development. The results revealed students' embodied understanding, as well as how the tools in a craft class mediated cultural information.

Keywords: Craft teaching, scaffolding, embodiment, interaction, videographic method

Introduction

The aim of this article is to describe the embodied interaction between the teacher and students in a textile class. Usually the studies of interaction in teaching are based on verbal communication (Kumpulainen & Wray, 2002) and only recently have the embodied aspects of teaching and learning received more attention (Alibali and Nathan, 2007). There are only a few studies related on the nature of interaction in the teaching and learning of craft (Johansson, 2008; Illum & Johansson, 2012; Ekström & al., 2009). In this article embodiment is seen as a fundamental way of acquiring information and perceiving one's environment. Our body is a mediator between us and the world, and, thus, tools and practices used in craft activities become extensions of our bodies. Thus, the concept of the embodied interaction refers to both social interaction between the teacher and the students as well as a physical interaction with materials, tools and body. In craft activities, we think through our hands, and thinking is visible in our bodies (movements, gestures) (Merleau-Ponty, 2005; Hindmarsh et al. 2011; Patel 2008). Johansson and Illum (Johansson, 2006; Illum & Johansson, 2012) have conducted pioneering studies that have focused on verbal and non-verbal communication and embodiment in the learning of craft skills in the school context, and they have employed a sociocultural approach for analyzing learning and communication in the craft practises (see also Ekström & al. 2009). Earlier studies have shown that craft is a very interactive school subject (Johansson, 2008; Borg, 2009; see also Syrjäläinen, 2003) and learning new craft skills without embodied connection of materials and tools is almost impossible (Illum & Johansson, 2012; Ekström & al, 2009).

The Vygotskian (1978) cultural-historical view of learning has encouraged investigators to analyze teaching and learning processes where an adult provides scaffolding for the novice learner. Vygotsky (1978) introduced the concept of the zone of proximal development (ZPD). It is defined as a dynamic zone of

activity in which a person can perform something with assistance that they cannot perform alone (or can only do with difficulty). The research on cognitive scaffolding (Wood et al. 1976) and procedural facilitation (Bereiter and Scardamalia, 1987) has indicated that when provided with external, supporting tools, structures, and real-time guidance, students can be helped to succeed in cognitive processes that are otherwise impossible.

The sociocultural approach emphasizes that learning is mediated by sociocultural tools that are physical and intellectual in nature (Vygotsky, 1978). The sociocultural approach underlines interaction in a very broad sense that covers social interaction between the teacher and the students (between peers), but also interaction with materials and tools (Johansson 2006; Illum & Johansson, 2012). All these resources are used when students learn to do craft, both in interaction with other students or with a teacher and with material artefacts (Illum & Johansson, 2012). In craft, the visual and material artefacts and tools have a central role in mediating the thinking and learning processes. According to Johansson and Illum (2012) by analyzing teaching and learning of craft in classroom brings forward various hidden means of interaction and multidimensional aspects related to learning craft skills (Ekström, 2012).

To this date, only very few studies have focused on interactional work of teaching craft (Johansson, 2006). In all teaching, teachers naturally explain, exemplify, concretise, and reformulate through a range of communicative moves that intend to facilitate students' learning. According to Collins (2006; Collins et al. 1989), methods that emphasize the cognitive apprenticeship approach to learning offer students opportunities to observe, engage in, and build upon expert practices in the context. These teaching methods are based on verbal scaffolding (explaining and concretising) as well as observation of the performance (modelling). Modelling, coaching, and scaffolding are also the core of traditional apprenticeship of the skill, where learning is supported through the processes of observation and guided practice (Lave & Wenger, 1991; Collins, Brown, & Newman, 1989). Further, according to Alibali and Nathan (2007), the demonstration and modelling are needed especially when students are learning new procedures and skills. Alibali and Nathan (2007; 2012) analyzed embodiment in mathematical teaching and learning situations and showed how the teacher's gestures supported learning at the zone of the proximal development. The teacher used gestures to connect her speech to the physical referents, such as objects, activities, and associated visual representations (e.g., diagrams) (Alibali and Nathan, 2007). In addition, Alibali and Nathan (2007) found that the teacher uses more indicative gestures in response to the students' questions. Thus, these questions can provide cues to the teacher so that she can recognize where the extra support is needed (Alibali and Nathan, 2007).

In this article, we are primarily interested in teaching in the designated textile class. In this study, the focus is on the interaction between the teacher and the students in learning and teaching situations of the sewing of clothing. To learn new craft skills students need to experiment, handle, and think together with materials and tools. In this article we pay particular attention to the embodied nature of craft teaching situations; this perspective highlights the fundamentally "*social and physical nature of our experiences*" (Dourish 2001, p.100). Therefore, our analysis will focus on the verbal, non-verbal (i.e., bodily), and material interaction between the teacher and students. We will address the following research questions:

1. In what ways is the interaction between a teacher and a student constructed in the context of craft teaching?
2. In what ways is embodiment present in the social process of making of a garment?
3. How do the physical materials and the tools mediate information regarding craft making?

Embodied interaction and material mediation in craft teaching and learning

In recent years, the embodied dimension of artisans' work has gained increasing attention (Keller and Keller, 1996; Patel, 2008). Concepts such as tacit knowledge (Polanyi, 1969), knowing-in-action, and reflection-in-action (Schön, 1983) are attempts to characterize the knowing and practices of skilled performers in craft and artisanal fields (Ekström, & al., 2009; Patel, 2008). Research on embodied cognition and embodied knowing questions the traditional dualism of body and mind and emphasizes the role of the body, handling of tools and materials, use of space, and interaction with others in the thinking processes (for review, see Hall and Nemirowsky, 2011).

Patel (2008) has elaborated the concept of embodied thinking, which emphasizes the role of the body in the process of thinking, i.e., how bodies, handling of tools and materials, and actions in space are related in thinking processes. Embodied thinking is visible, for example, in gestures which are seen as activities of the body that reflect (or are co-produced with) thought. Besides facilitating problem solving and communication, gestures indicate the sensorimotor simulation involved in thinking processes (Hall and Nemirowsky, 2011; see also Alibali and Nathan, 2012).

When participants of a craft process are examined as beings embodied in socio-material worlds, the importance of the non-verbal, manipulative, and practical scaffolding becomes apparent. Teaching craft skills involves an enormous number of body movements and other figurative gestures. Gestures, such as pointing, and referring to objects and tools, support and guide the craft process along the verbal scaffolding (Johansson, 2006). Through such actions, a teacher deliberately shares attention with students regarding craft object and establishes associated joint intentionality. Accordingly, the body may be used to supplement speech, for example, by referring to some physical objects. People refer to an object by pointing to it, and they can describe an object's appearance, size, and shape with complex, figurative, hand movements (Streeck et al. 2011). Macbeth (2011) points out how understanding can be visible as embodied action in terms of expressing and sharing a targeted topic or using a certain tone of voice. In the class, the teacher and the students are constantly observing and evaluating each other's actions. To a teacher, the embodied indications of understanding are essential because they show whether the student shares the same intentionality or whether he or she has understood the instructions. As these gestures are considered to be visible signs of understanding, and not just mental actions, they can be analyzed (Ekström et al., 2009).

Interaction with diverse mediating artefacts has been found to be important in design and craft education (Hennessy and Murphy, 1999; Rowell, 2002). In craft, the interaction with tools, concrete objects, and materials is a central aspect of skill learning (Johansson, 2006; Rowell, 2002). Analyzing teaching in craft provides a new understanding of the material mediation of learning (Illum & Johansson, 2012; Ekström et al., 2009). Students receive bodily experiences when they handle tools and materials; they learn to know how things feel by touching, sound by hearing and look by looking at them. In the context of craft, the interaction with tools, concrete objects, and materials offers a potentially supportive and multifaceted environment for learning (Johansson 2006; Hennessy and Murphy 1999; Murphy and Hennessy 2001). They also provide a common referent for discussion between the teacher and the students (Johansson 2006). These material artefacts and tools can be considered to represent cultural knowledge and provide mediational means when students are working with these tools.

Method

The study described here is a videographic study that is inspired from the ethnomethodology (Goodwin, 2000; Knoblauch, Schnettler, Raab & Soeffner, 2009). According to Johansson (2011), a videographic approach is an adequate method to study craft teaching and interaction, especially to make hidden aspects of craft learning visible. Recently many learning science research projects have combined video research with intensive study of classroom teaching and learning situations since it provides many possibilities to analyze and archive detailed cases of teaching and learning situations (Derry, 2007; Derry & al., 2010). Further, the observation of embodiment is almost impossible without new digital audio and video technologies. The videographic research relies on the analysis of authentic teaching and learning in the ecologically valid real-world classroom settings. Thus, in this study we decided to use video recordings in order to closely examine teaching and learning in textile craft and for in-depth analyses of the teacher and students' embodied interactions. The data of the present study was collected in a two-week period in spring 2013 in an ordinary middle school located in the capital region of Finland. The school was selected because it provided easy access and permit to conduct video research. Figure 1 shows the classroom setting where the data was collected.

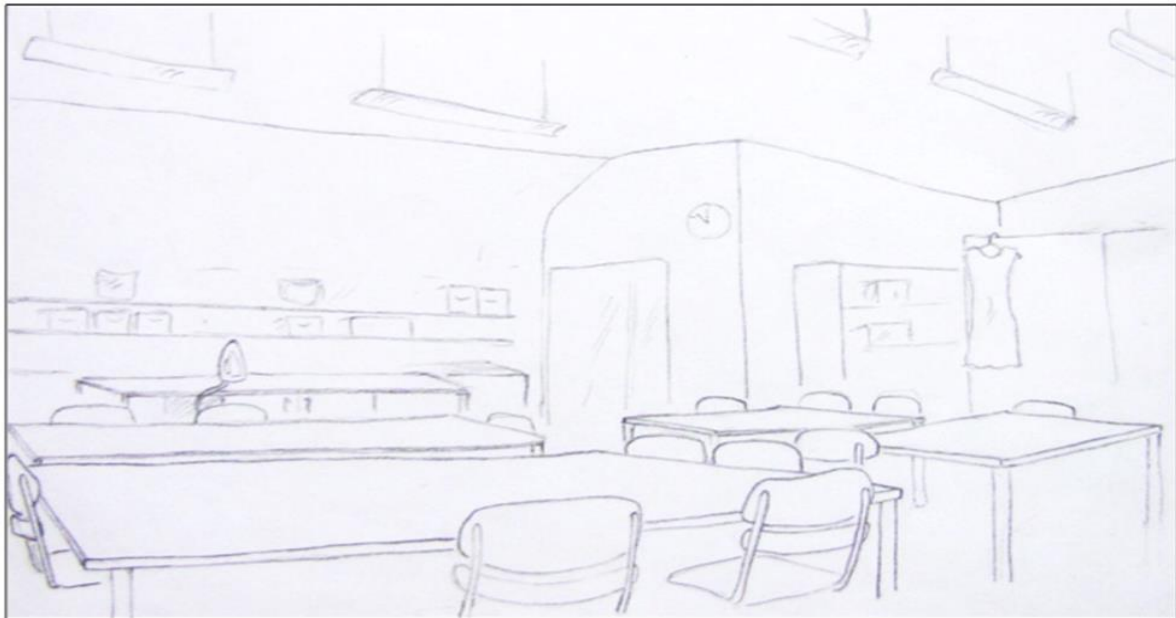


Figure 1. The classroom of the data collection.

The data consists of 4 hours and 52 minutes of video recordings of classroom activities and the focus was on the interaction between the teacher and the students in learning and teaching situations of the sewing phase. Each textile craft lesson was 75 minutes long. In the first week, the lessons were in the middle of the week and in the second week these lessons were at the beginning of the week. Activities of 9 seventh-grade girls, alongside their teacher, were documented.

The students were making their own individual garments. Before video recording lessons, the students had designed their own garments, and based on their designs, the teacher helped them to choose readymade patterns. The teacher emphasized the importance of learning to work independently. In order to support that effort, she had made a slide presentation (i.e., working instruction), where the students independently recorded their own progress or stages and they were able to check following work phases.

As stated earlier, in this study, we focused on embodied interaction between the teacher and students in learning situations of the sewing phase. Thus, it was important to focus video recordings on the teacher's and students' faces and body as well as to record their verbal interaction. Heath et al., (2010; see also Derry & al. 2010) describe three choices that the researcher has to make while pursuing videographic research: 1) find the action (i.e., which situations will be recorded), 2) avoid action (i.e., which situations will be excluded), and 3) frame the action (i.e. selection of the sample for further examination). However, when one must rely only on one video camera, all the richness of a learning situation is difficult to capture. In the case of videotaped data, seeing classroom situations from every participant's perspective is very challenging, and thus consideration must be paid to the fact that every recorded video sequence is the result of careful selection. So in this study, we decided to follow the teacher's actions (i.e., find the action), and for the analysis we selected those episodes that represented students' and the teacher's embodied activities (i.e., frame the action). The familiarity of the classroom and learning situations facilitated the making of these choices.

In the video research, the data analysis is usually based on disciplined observation of the video recordings (Derry & al, 2010). For the data analysis, we distinguished three aspects of activity to be followed: social situation, interaction and subjects' actions (see Wagner-Willi, 2006). Interaction and actions refer to the gestures, facial expressions and body postures and movements as well as the coincidence of speech and connection. For the video analysis, the content log of each lesson was constructed (Knoblauch 2006, p. 80; Heath & al., 2010 p. 62–63). Content logs are like field notes that provide a time-indexed outline of the events on the video (Derry et al, 2010). In Table 1, we present an example of the part of our content log. The unit of analysis was the episode; that is an event that continues until the situation changes marking the opening of another event. The change in the situation was in most cases prompted by a question or a remark from a student. To some extent, it was difficult to divide life in the classroom into separate episodes because they often overlapped or quickly changed. In this content log, the change in episode was based on who is in the centre of action (or who is the teacher addressing or teaching) in each particular moment. The content log represents all episodes observed on the video of each lesson. In Table 1, the left column represents time; the second column, the actor; the third column represents a short description of activities, and the final right column represent chosen episodes that were best suited for micro-level analysis.

Table 1. Content log of video recorded lessons (time, actor, activity and chosen episodes for micro-analysis).

Time	Actor	Activity	Chosen episodes
1:05:07	Kira	Designing collar on the dummy	
1:06:05	Ann-Sofie	Asking how to make a strap for the dress	
1:07:22	Sara	Asks: how to make those fold lines	xx
1:07:49	Ilona	Checking the sewing of the upper part of the dress	
1:08:24	Ann-Sofie	Asking if the sound of sewing machine is normal	xx
1:08:50	Erika	Walking in front of the teacher	
1:09:49	Ann-Sofie	The teacher listens to the sound of sewing machine	xx
1:09:57	Emma	Asks: how to sew the hemline?	
1:10:38	Ilona	Fitting the upper part of the garment	
1:11:40	Anni	Asking: what pattern pieces will be cut	

We were systematic rather than arbitrary when selecting episodes that represented embodied interaction between the teacher and the student. From 400 videotaped episodes, 18 episodes were used to represent the embodied nature of interaction that was clearly visible. These selected episodes illustrated best the embodied

interaction and we used these as interpretive narratives (Derry & al, 2010). Out of these 18 episodes, four were selected for a more detailed micro-analysis. The embodied nature of interaction in craft class was clearly visible to us in the majority of events but the selection of those four episodes was based on the quality of the video (e.g., visibility of the actors, sound, continuity).

It is most common in the educational research using video data that it encompass detailed analysis i.e., micro-level analysis of selected clips. From the whole dataset we selected those episodes where the teacher guided the student and where the embodied aspects of craft teaching appeared evident. The video clips selected were analyzed and transcribed at the micro level in order to trace the participants' interaction, i.e., what, how, in what manner the participants talked with each other. Documentation and analysis of integration between linguistic (verbal and written) and nonverbal communication (eye contact, gestures, body language, and body movements) became possible after viewing the video recordings repeatedly. The transcriptions enabled us to make the recordings communicable. In the detailed micro-analysis, sequence after sequence of the recorded data was defined – what people said and did as well as other things one can see on the video, things that might otherwise be ignored. The analysis of the data adopted a more interpretive, analytical approach; the construction of meanings in the social situation and the interpretation were highlighted. The interaction between the teacher and students was described as accurately as possible for the analysis and interpretation (see Wagner-Willi, 2006). We analyzed the possibly conflictual inter-relations between speech and actions. In the analysis, it was taken into consideration that the speech is divided into turns; the turns were marked with a numerical order.

In this article, the deficiencies of text-based presentation are resolved by presenting the results in the transcriptions and with drawings (i.e., cartoon) of the situations. Pauses in speech were marked with parenthesis, with the duration of pause inside (e.g., (3)). Very short pauses were marked with (.). Italics mean emphasis and co-occurring speech was marked with square brackets[]. Long vocals were marked with colons (e.g., a:::h).

Results

The pace of work was rapid during the craft lessons. The students were very active and motivated; immediately from the beginning to end of the lesson they worked purposefully and were focused on their own work. The teacher moved around the class, and she was always aware of what everybody was doing. She was constantly faced with questions for help from the students, and sometimes she did not even have to look at what the student was doing in order to help them. By "making rounds", the teacher monitors and assesses how the students are progressing (Greiffenhagen, 2012). This was not the main focus of this study, however, this was a very typical situation during all the lessons and it was specified in the field notes as follows: "*The teacher is moving around the class, never sitting down, or seemingly never taking a break. She is constantly faced with yet another problem or a question from the students. The students are quick to grasp the moment and take their turn in order to ask help. The teacher seems to know at all times what everybody is doing, because sometimes she doesn't even have to look what the student is doing, in order to give correct information or help to them.*"

In general the lessons consisted of a variety of kinds of situations and activities; sewing darts of the shirt, fitting the armhole of the shirt, attaching a collar, fitting the garment, cutting patterns and so on. Usually, in these situations the teacher became physically closer to the student, so that the student could more easily see what the teacher referred to when she was pointing or making other figurative gestures. The student instantly turned her gaze and direction of attention to the teacher's hand movements. Often the student indicated her comprehension by words (*so, I will sew this small line from here to there*) and, at the same time, she

demonstrated to the teacher that she understood instructions by copying the teacher's hand movements; by following, for example, the sewing line with her finger. Typically, in these interactive episodes both the teacher and the student's gaze were attached to the same object. Moreover, their bodies were bent over the table where the garment was located. Sometimes the teacher guided the student by shifting the position of the student's hands.

Often, the teacher helped the students with the fitting of the garment. The teacher used the dummy to model the fitting in order to develop students' spatial ability. It was easier for the students to understand the various pieces of the garment and how these pieces should be attached together when they saw them on the dummy. On the other hand the students sometimes solved problems through their own body and its dimensions. On some occasions, the teacher used her own body to help the student to envision for example how different heights of a waistband affect the draping and the design of the finished garment.

The interaction between the teacher and the student was aimed at working towards a common understanding. It was also very typical that in these kinds of teaching situations the teacher and the student used a lot of indexical expressions (*from here to there, this kind* etc.). Craft learning requires showing, seeing and demonstration. When teaching craft, the linguistic communication serves bodily communication, and speech and gestures complement each other (Streeck et al. 2011). The results showed how the teacher demonstrated skill with gestures and how the teacher and the student built a common participation framework. It appeared essential that the teacher applied gestures when the action, according to the teacher's view, was in the student's zone of proximal development.

Exhibiting understanding and embodiment

In the following episode Sari has received a task of sewing the armhole of her dress. The teacher has told Sari to ask help from Liisa, who has already done this for her dress. The two girls are making similar dresses. Sari is sitting by the sewing machine in the side, while the teacher is standing in the middle of the classroom. Sari asks advice from the teacher. In this episode, it is possible to see many of the embodied aspects of craft teaching. The teacher and student both use their bodies to express understanding (Sacks, 1992; Macbeth, 2011). The concepts and terms in craft can be ambiguous until they can be tied to the empirical knowledge of the student. In Finnish the word "armhole" (*kädentie*) consists of two parts: "*käden*", meaning the arm and "*tie*", which can be translated to "road" or "way". This adds to the ambiguousness of the term. This situation is illustrated in Figure 2a-2c.

Sari had asked Liisa for help, but unfortunately Liisa was not able to help Sari. For the girls, the term "armhole" is ambiguous, as we can see, when Sari tells the teacher that "Liisa wasn't sure that what is the armho-". Sari's voice grows quiet towards the end of the sentence. This indicates that she is unsure of what she is talking about. Sari is not sure she is talking about the right thing or that she is using the right terms. The teacher tells Sari to lift the dress by the shoulders "take the garment like this" (sentence 22). In Figure 2b, it is possible to see how the teacher supports the expression "like this" with gestures (she imitates the movement without the actual dress in her hands). Having lifted the dress Sari finally sees where the armhole is.

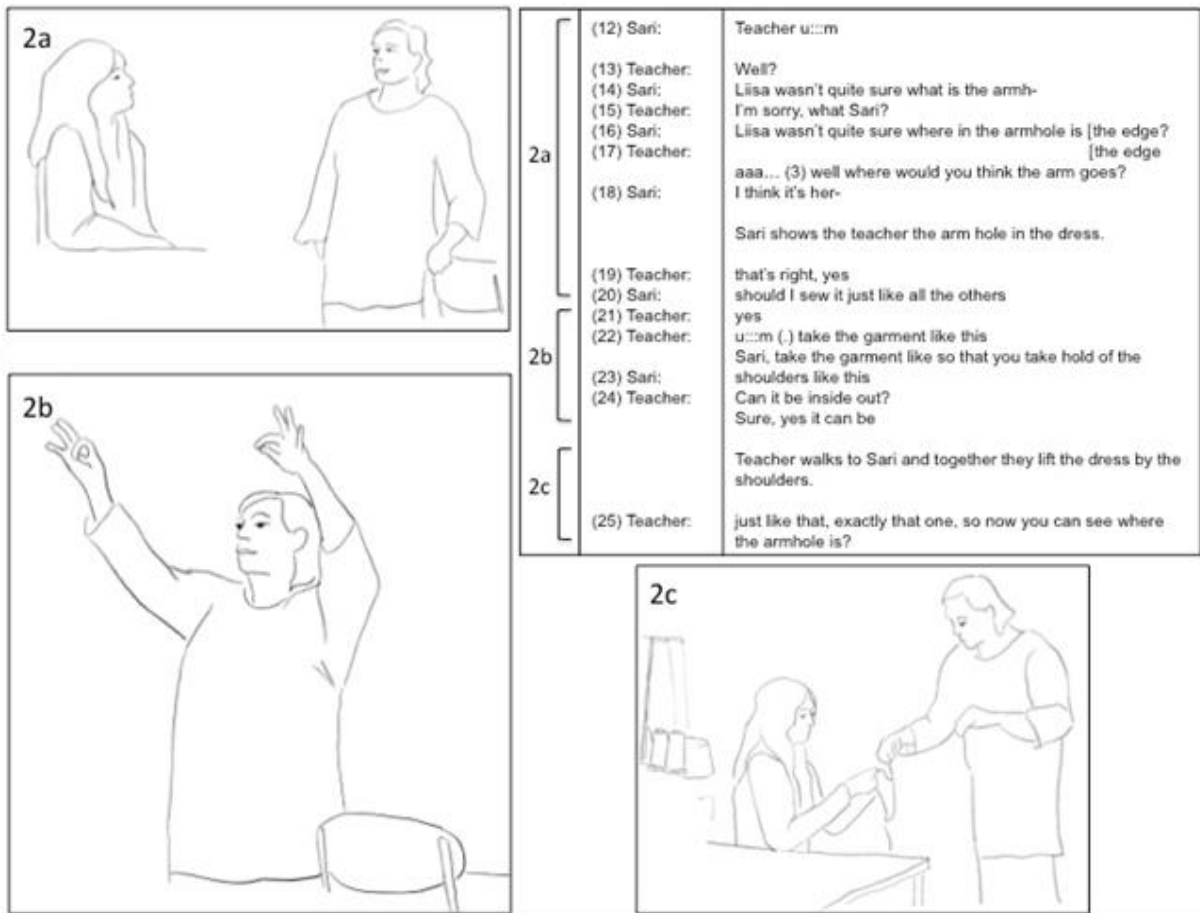


Figure 2a-2c. Embodied thinking and exhibiting understanding. The teacher and student discuss the armhole of a dress (2a). The teacher tells Sari to lift the dress by the shoulders (2b). The teacher walks to the student (2c).

The teacher assesses whether the student has understood the instructions (Hindmarsh et al., 2011) and then decides she needs more specific instructions. To ensure that the student (Sari) has understood what she is expected to do next, the teacher walks to Sari. In figure 3a-3c the teacher lifts the dress in front of her and now makes sure that Sari understands. Teacher says: “so now you see where the armhole is, don’t you? (sentence 25). Sari indicates her understanding by pushing her hand forward with a quick motion, as if imitating pushing the hand through a real armhole in a dress (In Figure 3a). In addition, she draws a circle around her extended arm with her hand and thus shows where the armhole would be (Figure 3b). These gestures provide the teacher information whether the student has understood or not. Understanding can be indicated in many different ways (Sacks, 1992). The student may verbally “claim” that she has understood, as in Sari: like this (26). In addition, sometimes the listener expects extra confirmation. Hindmarsh, Reynolds and Dunne (2011) noted that a teacher often expects embodied confirmation of shared understanding, beyond mere verbal claims. This kind of gesture can be as simple as a nod. In the previously described episode, we can see such embodied confirmations in Figures 3a and 3b.

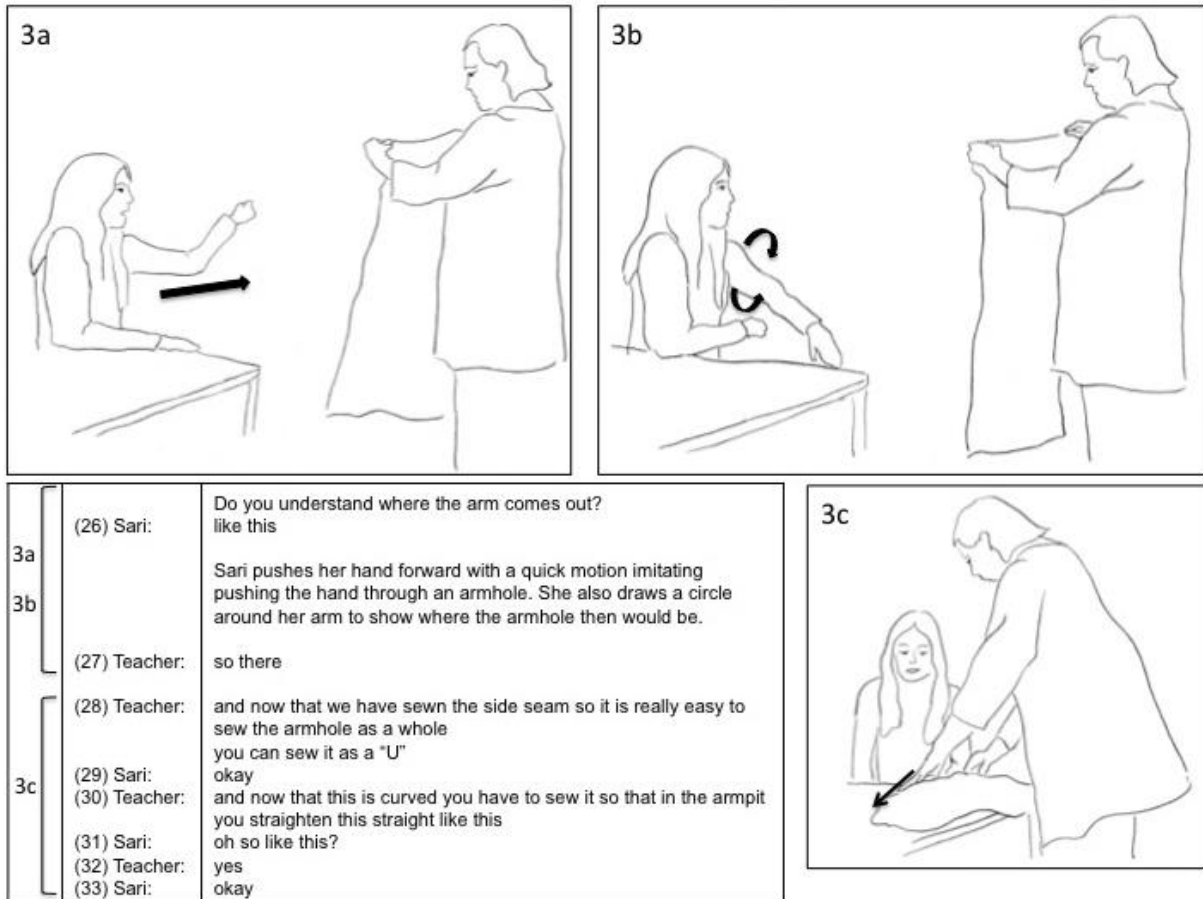


Figure 3a-3c. The teacher lifts the dress in front of herself and Sari indicates her understanding by imitating the movement of pushing her hand through a real armhole (3a). Student makes a round movement indicating where the armhole is (3b). The teacher interprets the student's gestures as visible signs of understanding (3b). The teacher shows Sari how to sew the armhole (3c).

In the last part of the episode, the teacher shows Sari how to sew the armhole (Figure 3c). The student traces a line where she would sew to show that she has understood. Gestures like these can either show understanding (Sacks, 1992) or they can also serve as questions. The student, so to say, asks the teacher by imitating her gestures (e.g., tracing a sewing line), *Have I understood correctly?* Sari asks the teacher *"Like this?"* while tracing the sewing line. This is a question. Expressions and gestures serve multiple semiotic tasks (Streeck et al. 2011). *"Like this"* is not an insignificant remark. For the teacher it showed that the student has picked up on the idea. It is no simple task to understand what to do simply by observing the teacher while she is performing the task. This requires the skill to pick the relevant points from the teacher's demonstration in order to skilfully execute the task in hand (Lindwall & Ekström, 2012). When the student is not fully capable of controlling the execution of a skill, she has to rely on the teacher to estimate the progress and the process. The utterance *"oh like this?"* combined with the gesture, is a message to the teacher that Sari has not only paid attention to the demonstration but also has understood. Nevertheless, it is also true that the student needed more support from the teacher and confirmation that she was performing adequately. Thinking and the cognitive state of the student were strongly embodied and reflected in the gestures of the student.

Cultural knowledge

The design and manufacturing process in craft is a cyclical and iterative process where the maker always returns to previous phases (Seitamaa-Hakkarainen, 2000). In this study the spiral nature of the design and manufacturing process in craft was shown when the students worked with the materials and tools in the class. The students had some experience working with sewing machines, but using these machines still caused some trouble from time to time. Even some time ago Miyake (1986) suggested how complex and difficult it is to understand the functioning of sewing machines. The garment is made in interaction with the materials, and so initial ideas become more accurate and nuanced. Following other students also gives one new ideas and hints regarding how to proceed. By working with tools and materials, the student begins to see what can be done with them. Nonetheless, in the beginning the student has to rely on the teacher's guidance.

By taking up sewing, the students learn in a dialogic process with the tools and materials, how the tools and materials work and how it is possible to reach the desired outcome. Learning is done in interaction and in embodied experiences (Illum & Johansson, 2012). Students get feedback from the tools and materials by using all of their senses. They look, touch, feel, and listen. In the next episode (Figure 4a-4d), Sonja is sewing the shoulder strap of her dress. Sonja listens to the sound of her sewing machine and decides that it does not sound like it did the last time. Sonja thinks there might be something wrong with the machine.

4a	(55) Sonja: is this normal this sound? can you come and listen? (56) Teacher: yes? (57) Sonja: I can hear a clunk-clunk-clunk-clunk (58) Teacher: umm turn the handwheel from there (3) is the needle all right? (59) Sonja: it is right here (60) Teacher: What? (61) Sonja: right here (62) Teacher: it catches yes? (63) Sonja: yes (64) Teacher: is the point of the needle ok, that it hasn't broken? (65) Sonja: it doesn't look like it (66) Teacher: just like that Erika	
4b		
4c	(67) Sonja: come and listen (68) Teacher: you can still hear it? well it's quite thick what you're sewing (.) you can still hear it? (69) Sonja: yes (70) Teacher: okay, wait I'll take a look at it	The teacher walks to Sonja's sewing machine.
4d	(71) Sonja: <i>listen</i> (72) Teacher: well? (73) Teacher: hmmm (.) it's just thick <i>look</i> now you have fabric four times as thick I think it's only because of the thickness	Sonja sews a little while and turns to look at the teacher inquiringly. Sonja continues to sew.

Figure 4a-4d. Cultural knowledge in the craft classroom. The student has a problem with a sewing machine. The teacher is placing her hand behind her ear indicating that she is listening (Figure 4a). The teacher proposes some possible reasons (4b). Student asks the teacher to come over and listen to the sound (4c) and the teacher proposes that the sound is caused by a thick material.

In this selected episode the embodied nature of craft teaching can be seen well. The teacher shows that she is listening to the sound of the sewing machine by placing her hand behind her ear (Figure 4a). This over-emphasized gesture indicates to the student that she has understood what the student is worried about, even though she is standing away from the student. The student and the teacher utilize the knowledge they have accumulated related to tools used in craft. The student recognizes a conflict between her background knowledge and the present situation. The student has collected information and knowledge through her senses by using the tools and has a sense of how a sewing machine should function and sound when it is working properly. This time the machine sounds different, and so Sonja summons the teacher to listen to the sound too. The teacher listened from afar and suggested some possible reasons for the different sound (e.g., the needle has broken). The teacher had more accumulated knowledge of how sewing machines work and how to solve most common problems. After the sound continued for a while, the teacher went to Sonja and stated that the different sound was caused by a thick material. In this episode, the teacher was utilizing her accumulated personal knowledge of sewing machines to solve Sonja's everyday classroom problem.

Discussion

We have focused on the embodied interaction between the teacher and the student and examined more closely how the embodied and interactive nature of craft learning and teaching can be seen in the action of both the students and the teacher. The results revealed how the teacher used embodied support when operating in the student's zone of proximal development (Vygotsky 1987). The teacher provided opportunities for the student to proceed with her craft work independently; however, the teacher was alert and monitored how the students are progressing. When a student asked for advice, the teacher usually came physically closer to the student. The teacher used figurative gestures together with indexical expressions for example when she imitated the lifting movement of the dress without holding actual dress in her hands. In a similar way the students also indicated their comprehension by figurative gestures indicating she has grasped the teacher's advice. These examples provide practical connection to educational practices in craft teaching and learning, i.e., how craft knowledge is extensively expressed in gestures and supported by indexical expressions. Further, in these embodied situations the teacher often expects verbal and embodied confirmation from the student. This is crucial because after that the teacher can leave the student to independently continue her work. Gestures in an interactive situation provide an informative source of evidence regarding the nature of craft knowledge. By using cartoon-like pictures for describing these situations, we aimed at correcting and resolving the deficiencies of purely text-based presentations. The associated figures highlighted the essential embodied hints and signs in the teacher's actions, which can be difficult or even impossible to verbalize or to describe. We aimed for highly informative, clear and easily readable way of depicting the actions of the teacher and the students.

In addition, in this article we emphasized how the teacher and the student tapped into and utilized the cultural knowledge that has accumulated in the tools in the craft class. The teacher and student have tacit knowledge of the tools in craft class, which they utilize when working with the materials and tools (Illum & Johansson, 2012).). Gradually the student assimilates cultural knowledge and is able to use it to facilitate his or her work process. That is to say, the student understands the purpose and use of various materials and tools. As a tool, a sewing machine is hundreds of years old; the manufacturing of sewing machines began in the USA in 1851. The sewing machine as a tool contains an immense amount of accumulated cultural knowledge that has evolved during centuries of usage and development.

The tools in a craft classroom are not just tools in the process of making craft products, but change and mould actions in the classroom., As to the blind, a cane is an extension to his or her hand when experiencing

the world, so are the tools used in craft a means of constructing and conceiving the world around (Merleau-Ponty 2005). The tool and the craftsman influence each other equally (Illum & Johansson, 2012). The students in a craft classroom give the tools their own meanings and collect experiences related to them in their memory. This knowledge is shared in interaction with other students, and so it is added to the accumulated cultural knowledge.

Many craft researchers have previously pointed out the embodied nature of craft knowledge. More attention should be paid to teacher's demonstration skills and other methods of modelling and coaching craft skills. In our view, teaching practices as well as pedagogical methods courses should address not only how to deliver lessons or facilitate classroom discussion, but also to address how body-based resources and speech promote craft teaching and learning. In the educational courses, the real-world videorecordings of craft teaching and learning situations should be used more extensively in order to analyze embodied interaction between the teacher and the student. This might provide an informative source of indication how important body-based interaction is in learning craft skills and knowledge.

We have pointed out how difficult it is for the student to understand two-dimensional patterns and how to transform pieces of fabric in to a three-dimensional clothing. To solve this dilemma the students and the teacher used their own bodies as a means of perceiving proportions as well as the construction and design of clothing. The student's own body can also be seen as facilitating the understanding of unfamiliar concepts (e.g., armhole). To our knowledge, this aspect of craft learning and teaching has been neglected in the research of craft science.

The interactive nature of craft and teaching craft poses a dilemma to the teacher. The teacher must, in addition to being an expert in his or her field, understand how to pass on this knowledge. Our analysis shows that craft is interactive in nature and in order to execute a particular skill appropriately, a student has to be able to read the embodied instructions the teacher is demonstrating. This is no easy task for the student. In the present study it can be seen how the teacher observes the student's expressions and gestures (embodied signs) in order to estimate whether the student has understood the instructions or not. Good interaction is working towards a common goal, understanding each other. In the present study, it became apparent how both the teacher and students observe each other in order to accomplish understanding. Understanding how learning crafts happen helps teachers to become better teachers.

References

- Alibali, M. W. & Nathan, M. J. (2007). Teachers' gestures as a means of scaffolding student's understanding: evidence from an early algebra lesson. In R. Goldman, R. Pea, B. Barron & S. J. Derry (eds.), *Video research in the learning sciences*. (pp. 349–365). Mahwah, N. J.: Lawrence Erlbaum Associates.
- Alibali, M. W., & Nathan, M. J. (2012). Embodiment in mathematics teaching and learning: Evidence from learners' and teachers' gestures. *Journal of the Learning Sciences*, 21(2), 247-286.
- Bereiter, C., & Scardamalia, M. (1987). *The psychology of written composition*. Hillsdale, NJ: Lawrence Erlbaum.
- Borg, K. 2009. Communication and learning in sloyd practices – a research project. *L. K. Kaukinen (Ed.) Proceedings of the Crafticulation & Education conference (pp. 191–198). Techne series: Research in Sloyd Education and Crafts Science A:14/2009.*
- Collins, A. (2006). Cognitive apprenticeship. In K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 47-60). New York: Cambridge University Press.
- Collins, A., Brown, J. S., & Newman, S. E. (1989). Cognitive apprenticeship: Teaching the craft of reading, writing, and mathematics. In L. B. Resnick (Ed.), *Knowing, learning, and instruction: Essays in honour of Robert Glaser* (pp. 453-494). Hillsdale, NJ: Lawrence Erlbaum Associates.

- Derry, S. J. (Ed.) (2007). Guidelines for video research in education. Recommendations from an expert panel. The Data Research and Development Centre. University of Chicago. Retrieved from <http://drdc.uchicago.edu/what/video-research-guidelines.pdf>
- Derry, S.J., Pea, R.D., Barron, B., Engle, R.A., Erickson, F., Goldman, R., Hall, R., Koschmann, T., Lemke, J.L., Sherin, M.G. and Sherin, B.L. (2010). Conducting video research in the learning sciences: guidance on selection, analysis, technology, and ethics. *Journal of the Learning Sciences*, 19(1), 3-53.
- Dourish, P. (2001). *Where the Action Is. The Foundations of Embodied Interaction*. Cambridge (MA): MIT Press.
- Ekström, A., Lindwall, O. & Säljö, R. (2009). Questions, Instructions, and Modes of Listening in the Joint Production of Guided Action: A Study of Student-Teacher Collaboration in Handicraft Education. *Scandinavian Journal of Educational Research*, 53(5), 497–514.
- Lindwall, O., & Ekström, A. (2012). Instruction-in-interaction: The teaching and learning of a manual skill. *Human Studies*, 35(1), 27-49.
- Ekström, A. (2012). *Instructional work in textile craft – studies of interaction, embodiment and the making of objects*. Studies in education in arts and professions 3. University of Stockholm.
- Goodwin, C. (2000). Action and embodiment within situated human interaction. *Journal of Pragmatics*, (32), 1489-1522.
- Greiffenhagen, C. (2012). Making rounds: The routine work of the teacher during collaborative learning with computers. *Computer-Supported Collaborative Learning* 7, 11-42.
- Hall, R., & Nemirovsky, R. (2012). Introduction to the special issue: Modalities of body engagement in mathematical activity and learning. *Journal of the Learning Sciences*, 21(2), 207-215.
- Heath, C., Hindmarsh, J. & Luff, P. (2010). *Video in qualitative research. Analysing social interaction in everyday life*. Los Angeles: SAGE.
- Hindmarsh, J., Reynolds, P. & Dunne, S. (2011). Exhibiting understanding: The body in apprenticeship. *Journal of Pragmatics*, 43, 489–503.
- Hennessy, S., & Murphy, P. (1999). The potential for collaborative problem solving in design and technology. *International Journal of Technology and Design Education*, 9(1), 1-36.
- Illum, B., & Johansson, M. (2012). Transforming physical materials into artefacts - learning in the school's practice of sloyd. *Techne Series A*, 19(1), 2-16.
- Johansson, M. (2006). The work in the classroom for sloyd. *Journal of Research in Teacher Education*, 13(2-3), 152-171.
- Johansson, M. (2008). Kommunikation i skolans slöjdpraktik. In K. Borg & L. Lindström. (red.) *Slöjda för livet: om pedagogisk slöjd*. (p. 145–157). Stockholm: Lärarförbundet.
- Johansson, M. (2011). Vad och hur gör de? [What and how you do it?] *Techne Series: Research in Sloyd Education and Crafts Science*, 18(1), 33-48.
- Keller, C., & Keller, J. D. (1996). *Cognition and tool use. The blacksmith at work*. New York: Cambridge University Press.
- Knoblauch, H., Schnettler, B. & Raab, J. (2009). Video analysis: Methodological aspects of interpretive audiovisual analysis in social research. In H. Knoblauch, B. Schnettler, J. Raab & H-G. Soeffner (eds.), *Video Analysis: Methodology and Methods: Qualitative Audiovisual Data Analysis in Sociology* (pp. 9–26). Frankfurt am Main: Peter Lang.
- Knoblauch, H., Schettler, B., Raab, J. & Soeffner, G. (Ed.). (2009). *Video analysis: Methodology and methods. Qualitative audiovisual data analysis in sociology*. Germany: Peter Lang.
- Knoblauch, H. (2006). Videography. Focused ethnography and video analysis. In H. Knoblauch, B. Schnettler, J. Raab & H-G. Soeffner (eds.), *Video Analysis: Methodology and Methods: Qualitative Audiovisual Data Analysis in Sociology* (pp. 69–83). Frankfurt am Main: Peter Lang.
- Kumpulainen, K. & Wray, D. (eds.) (2002). *Classroom interaction and social learning: from theory to practice*. London: Routledge.

- Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge university press.
- Macbeth, D. (2011). Understanding as an instructional matter. *Journal of Pragmatics*, 43, 438–451.
- Merleau-Ponty, M. (2005). *Phenomenology of Perception*. (Phénoménologie de la perception 1945). London: Routledge Classics.
- Miyake, N. (1986). Constructive interaction and the iterative process of understanding. *Cognitive Science* 10. 151-177.
- Murphy, P., & Hennessy, S. (2001). Realising the potential - and lost opportunities - for peer collaboration in a D&T setting. *International Journal of Technology and Design Education*, 11(3), 203-237.
- Patel, K. (2008). *Thinkers in the kitchen: Embodied thinking and learning in practice*. Ann Arbor (MI): UMI dissertation services ProQuest.
- Polanyi, M. (1969). *Knowing and being*. Chicago: The University of Chicago Press.
- Rowell, P. (2002) Peer Interaction in Shared Technological Activity: A Study of Participation. *International Journal of Technology and Design Education*, 12, 1, 1-22.
- Sacks, H. (1992). *Lectures on conversation*. Oxford: Blackwell.
- Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. New York: Basic Books.
- Streeck, J. Goodwin, C. & LeBaron, C. (2011). Embodied interaction in the material world: an introduction. In J. Streeck, C. Goodwin & C. LeBaron. (eds.), *Embodied interaction. Language and body in the material world. Learning in doing: social, cognitive and computational perspectives* (pp. 1 –26). Cambridge: New York: Cambridge University Press.
- Syrjäläinen, E. (2003). *Käsityön opettajan pedagogisen tiedon lähteitä: persoonalliset toimintatavat ja periaatteet käsityön opetuksen kontekstissa*. Kotitalous- ja käsityötieteiden laitoksen julkaisuja 12. Väitöskirja. Helsinki: Helsingin yliopisto, kotitalous- ja käsityötieteen laitos.
- Vygotsky, L. S. (1978). *Mind in Society. The Development of Higher Psychological Processes*. Cambridge: Harvard University Press.
- Wagner-Willi, M. (2006). On the Multidimensional Analysis of Video-Data: Documentary Interpretation of Interaction in Schools. In H. Knoblauch, B. Schnettler, J. Raab & H-G. Soeffner (eds.), *Video Analysis: Methodology and Methods: Qualitative Audiovisual Data Analysis in Sociology* (pp. 143–153). Frankfurt am Main: Peter Lang.
- Wood, D., Bruner, J., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 17, 89–100. Alibali and Nathan, (2011)

Anniina Koskinen is Ph.D. student at University of Helsinki SEDUCE- doctoral program studying embodiment and interaction in craft teaching. She was responsible of collecting video data and developed the method of analyzing the data. Koskinen and Seitamaa-Hakkarainen wrote the present article, together with Kai Hakkarainen.

Pirita Seitamaa-Hakkarainen is professor of Craft Studies at University of Helsinki. Her research interests focus on the design processes, as well as the facilitation of collaborative design through technology-enhanced learning environments. This research was funded by the Academy of Finland Handling Mind: Creativity, Embodiment and Design research project (under project no. 265922).

Kai Hakkarainen, Ph.D. (www.helsinki.academia.edu/KaiHakkarainen) is the professor of education at the Institute of Behavioural Sciences, University of Helsinki. With his colleagues, Hakkarainen has, for 20 years, investigated personal and collaborative learning processes at all levels, from elementary to higher education.