

Instructions at Work: A Case of Coronary Diagnostics

Berthel Sutter

Department of Human Work Science, University of Karlskrona/Ronneby, Soft Center, S-37225 Ronneby, Sweden

Tel: +46-457-385555, Fax: +46-457-27125

Email: Berthel.Sutter@iar.hk-r.se

Abstract: The aim of this paper is to explore the role of instruction as an integrated part of work activity. The perspective I take is an activity-theoretical conception of instruction integrated with three fundamental professional work practices, namely highlighting, use of coding schemes, and articulation of graphic representations. The empirical part of the paper consists of a patient case from a clinical heart conference that is studied in detail. The main outcome of the study is an analytical distinction between instruction as ("crystallized") artifact-bound representations and "live" or situated instructions. It is argued that all instructions are situated, and that situatedness is a doubly situatedness: both from the artifact-mediated tradition of the profession and from the ongoing interactions at work.

Keywords: performance support, workplace learning, activity theory

Introduction

The current understanding among researchers of learning and collaborative work in complex real-world settings is likely to have been substantially influenced by two seminal books: *Plans and situated actions* (Suchman, 1987) and *Situated learning: Legitimate Peripheral Participation* (Lave and Wenger, 1991). Both books stress the fundamental nature of situatedness of human practice and actions. As one of those who appreciate these books for their profound theoretical analyses of situated action and learning, and for their contribution to detailed work practice studies or studies of long term learning processes in communities of practice, however, I have lately come to believe that they, in different ways, underscore the important role that instruction, in diverse forms, plays in collaborative work and learning. In this paper I study the use of instructional resources in collaborative diagnostic work. The empirical example I analyze is taken from a patient case in one of the telemediated clinical heart conferences that were arranged during 1993-96 as part of an ongoing collaboration between two distributed teams of clinicians at two hospitals in the south of Sweden.

How do learning and instruction come about in complex real-world settings? A study on telemediated coronary diagnostics gave me the opportunity to attempt to answer this question. My focus is on instruction (and I take for granted that learning and instruction go together). In the analysis of how instructional resources are used in coronary diagnostic work, I take an activity-theory perspective on instructions at work. In this perspective I have incorporated a structuring of work used by Goodwin (1994). It is a structuring that differs from, but is compatible with, Leontiev's (1978) famous structuring of work activity into activity, actions/operations, where activity is object-oriented and more global, and actions are the goal-directed ingredients of the activity, and, finally, operations are the ways actions are enacted depending on the specific circumstances. The consequence of Leontiev's distinction for instruction is that you have to take into account *instruction as a special activity*, and also *instructional actions* that can be part of any activity, e.g. play, learning, and work. In the coronary diagnostic work I am studying, it is possible to discern diverse instructional actions that are embedded within the work activity. These instructional actions are the focus of my analysis.

Instructional actions at work are of many kinds. In the paper I utilize a classification of practices that Goodwin has used when discussing "professional vision," e.g. professional work, namely *highlighting*, the *use of coding schemes*, and the *production and articulation of graphic (material) representations*. In the paper I attempt to show how these ingredients of professional work are related to instruction.

Highlighting according to Goodwin is making "specific phenomena in a complex perceptual field salient by marking them in some fashion" (p. 606). From the instructional perspective I take, highlighting may be regarded as an action that in itself is instructional. By displaying a figure against a background, you instruct, i.e. you are highlighting a figure against a ground. Thus, highlighting means making topical: "Let's talk about this!"

The use of a *coding scheme* is a “systematic practice used to transform the world into the categories and events that are relevant to the work of the profession” (Goodwin 1994:608). The use of coding schemes, therefore, implies commenting on a topic that has been highlighted or that stands out “spontaneously” for competent members in a certain situation.

Activity-theory characterizes work as an activity that is oriented towards its object, and that is accomplished by goal-directed actions (Leontiev 1988). From such a view, it is understandable that the object of work has a “directing” or “guiding” function on ongoing work practice. (Imagined future influencing the present.) Also past actions crystallized in artifacts are “marked” by this goal-directedness. Therefore, the situated actions that are performed to get the work done, are shaped doubly. They are shaped by the object-orientation and goal-directedness of past work, embodied in the produced artifacts, when these artifacts are used. They are also shaped by the object-orientation and goal-directedness of the present work. This is the reason why the object-orientedness of work activity has an instructional character: a direction to go is pointed out. Or, in the words of Wartofsky (1979, p. xv): “The cognitive artifacts we create are models: representations to ourselves of what we do, of what we want, and of what we hope for.”

The third kind of action that Goodwin mentions as part of professional work is *production and articulation of graphic representations*. – A central artifact in the heart conference is the so called angio video, an X-rayed film of the working coronary. Another central mediating artifact in the heart conference is a *graphic representation* included in the patient journal. It is a sketchy picture of the heart displaying the three main coronaries. To this picture, the radiologist adds the results of the coronary angiography by drawing and by writing numbers, which indicate location and amount of stenosis (indentation). How articulation of graphic representations connects to instruction, will be discussed below.

A Case Study

At a clinical heart conference about ten patients are discussed during one hour. There are two parts in every case: anamnesis (about two minutes) and showing, discussion and decision (3-4 minutes). From a case, (patient 9, late May 1996) I will discuss the beginning of the second part (12 turns out of 50). The results with regard to highlighting, use of coding schemes, and articulation of graphic representations to organize perception, are shown in Table 1. My way of categorizing the actions of the participants in the heart conference can be inferred from the comments in Table 1. However, I will say a few words about it.

The main highlighting method at the clinical heart conference is the presentation of the angio video. It is a technology displaying sequences of the x-rayed coronary in action that are shot from different standard angles. This means that the cine run successively highlights one critical part of the coronary after the other. In that sense highlighting is going on during the presentation of the angio film. The cine run at the heart conference is thus a highlighting procedure. This kind of highlighting is however rough and unfocused, and therefore, the participants focus by additional highlighting when they feel this is necessary. A common way of doing this is the running commentary that the presenting radiologist often lets accompany the angio film sequences. But even this way of highlighting has a routine character, thus being a “weak highlighting” (in Table 1 I call it “voicing/highlighting”). More strong highlighting is accomplished by means of deixis or (professional) concept designation.

The coding scheme that is used in the case in point is the coding scheme “Fifty Percent.” It is a standard procedure that says that if the diameter of the dubious vein is at least 50% indented compared to the adjacent vein, then the indentation should be regarded as significantly sick.

By articulating the graphic coronary representation in the patient journal that the participants have at hand, the suspected parts of the coronary are pinpointed. Thus, articulating means transforming what is “said” in the graphic picture into the oral mode of the meeting and at the same time re-highlighting what has already been highlighted in the graphic picture.

Table 1. Instructional resources used in a clinical heart conference.

Legend: “Radiologist Karlskrona” is the one who presents the angio video. “Lund” is the surgeon or the radiologist in the other sub-team at the University Clinic in Lund.

	SPEAKER	TALK	COMMENTS
1	Radiologist, Karlskrona	Yes ... this is the area of ... PTCA	The angio video is a series of x-ray representations. Here it is running and showing a picture of the left coronary. - The radiologist is voicing what is seen on the angio. It is a way of highlighting by means of lay or professional concepts. - “This” = highlighting by deixis.
2		Yes, it is not possible to stop the tape but	The technology at the heart conferences usually enables the radiologist who runs the angio video to voluntarily freeze the picture, but for some reason it does not work here.
3		It really looks like it did	- Voicing/highlighting of angio film representation
4		Thus we can measure it to quite close to 50%	The radiologist is looking down at the patient journal with its graphic representation used by the participants in the heart conference. - Articulation of graphic representation. - Use of coding scheme Fifty Percent
5		But the eyes really say, I think, that it is less	- Voicing/highlighting of angio-film representations - Indirect use of the coding scheme Fifty Percent, and contesting of the concrete measure of the coding scheme Fifty Percent
6		And actually it looks like it did immediately after PTCA July -93	- Voicing/highlighting of angio-film representations - Indirect use of the coding scheme Fifty Percent, and contesting of the concrete measure of the coding scheme Fifty Percent
7		In any case, there is no sure progress	- Voicing/highlighting of angio film representations - Indirect use of the coding scheme Fifty Percent, and contesting of the concrete measure of the coding scheme Fifty Percent
8	Lund	Does she have the area of dilatation exactly <u>there</u> at the s-curve?	- Highlighting by deixis
9	Radiologist, Karlskrona	<u>There</u> yes exactly	- Highlighting by deixis
10	Lund	Yes	
11	Radiologist, Karlskrona	Sorry, I didn't point correctly, Anders, I pointed at the circumflex (laugh)	See commentary in text.
12	Lund	Well well, but the s-curve at the LAD?	- Retrospective highlighting by means of concepts (lay and professional)

Now, let us look at Table 1. The angio video is a tool that can be used for highlighting, although as mentioned, its way of highlighting is often blunt. The video shows sequences of the coronaries in action, and this is more like an overview. To pick up a word that the radiologist uses, the picture only shows an area: “Yes ... this is the area of ... PTCA” (line 1). This kind of highlighting is ubiquitous in the heart conferences.

For the conference system used in the heart conferences, a “highlighting device” is deployed, a cursor, which can be regulated by means of a special kind of joy-stick. With the aid of this device, the radiologist who is showing the angio video, can use the cursor to highlight what he wants to comment on in the angio film. In the sequence I present in the paper, however, the cursor is not used by the radiologist.

Another function of the video system that can be used for highlighting is the “still”/“freezing”: the film is stopped and the picture is “frozen” for inspection. In this specific case, the film cannot be stopped for some reason (line 2). At line 4 the radiologist glances in the patient journal and uses the graphic representation of the coronary and its marked points that indicate possible significant stenosis (indentation of 50% or more).

Other tools for highlighting are linguistic expressions used in connection with the video. This can be accomplished in different ways. At line 1, there is highlighting through deixis: “Yes... this is the area of ... PTCA.” As the picture on the screen is not focussing, what “this” refers to may be unclear. A more focussed way of highlighting through deixis can be seen later in the displayed sequence: “Does she have the area of dilatation exactly there at the s-curve?” (line 8), and the response of the radiologist: “There yes exactly” (line 9). At this point the coronary is shown on the screen. By describing a characteristic part of what is shown (the s-curve), the Lund-radiologist focuses what was already highlighted by the angio film.

At line 12 one of the clinicians in Lund is using words to highlight in retrospect what is not still on the screen, but was there some seconds ago: “well well, but the s-curve at the LAD”.

Yet other tools for highlighting are written records, or the graphic representation of the coronaries. On one occasion in the start sequence the radiologist who is showing the video looks down at the patient journal (line 4) and articulates orally what it says: “Thus, we can measure it to quite close to 50%.”

An interesting detail in the start sequence of the angio shows that the actors have a potential variety of tools for highlighting, and if some of them “fail” or turn out to be non-effective, others are used instead. In the actual sequence, the cursor is not used by the radiologist, it is laying passively in the upper part of the video display. The working highlighting-device here is the angio video, which successively shows topics that are commented. But, as mentioned, the angio video is not very focussed as a highlighting device, it displays too much of the coronary at once to always be very informative. It is not “positioning for perception” to use Goodwin’s expression (1997, p. 126). Instead of using the designed highlighter, the cursor, the radiologist in Karlskrona highlights by using professional concepts (e.g. “circumflex”). But abruptly, a video shooting is finished and the angio picture disappears, the screen turns black with the exception that the white pointer now can be seen very clearly, it really stands out. At that moment it is evident that the cursor has been laying passively in the upper right corner of the screen. The radiologist finds it necessary to repair what may have caused a misunderstanding, so he corrects himself: “Sorry, I didn’t point correctly, Anders, I pointed at the circumflex” (line 11). But obviously, the colleague in Lund was not misled by the passive cursor and he highlights orally what he has paid attention to: “well well, but the s-curve at the LAD” (line 12).

At line 4, the radiologist uses the coding scheme Fifty Percent. Also at lines 3, 5, 6, and 7 references are made to that coding scheme, albeit not explicitly.

Thus, at least three kinds of work practices can be seen in Table 1: highlighting, use of the coding scheme 50%, and articulation of a graphic representation.

Discussion

In my investigation, an activity-theory instructional perspective “truffled” with three work-practice concepts from Goodwin was confronted with an empirical case. The results that came out of this encounter are summarized in Table 2.

The columns in Table 2 stand for a distinction between “crystallized instruction” on one hand, and situated instruction or “live” praxis on the other. Crystallized instruction can have the form of linguistic representations, for example as plans for future actions or accounts of past actions. It can also have the form of “externally embodied representations” (Wartofsky 1979, p. 202), either as material artifact-built-in representations or as graphic representations.

Three kinds of crystallized instruction are displayed in Table 2: physical-artifact representations, linguistic representations, and graphic representations. I think it makes sense to say that an instruction frame is involved in the practice of articulating material, linguistic, and graphic representations: you articulate something in order to organize perception (for yourself and for your colleagues). This means that there is an “educational program” disguised as a standard procedure. However, a graphic, linguistic or material representation is not an instruction prescribing actions in detail. No instruction can in detail prescribe what actions to perform. Every action is open until it has been accomplished, as we have learnt from the situated-actions perspective. An instruction is rather a specification intended as a resource for acting with discretion according to the circumstances. Thus, for example, by articulating a graphic representation, this artifact is brought to life in a certain situation.

The second column of Table 2 shows the “live” or situated instructions that this study claims to be important. These instructional actions are embedded within the activity of work: highlighting, use of coding schemes, and articulation of graphic representations.

Table 2. Instructional resources in coronary diagnostic work.

CRYSTALLIZED INSTRUCTION (Artifact-bound representations of human activity)	SITUATED or “LIVE” INSTRUCTIONS (Actions embedded in work activity)
<ul style="list-style-type: none"> - Physical-artifact (material representations) (e.g. angio video) - Linguistic representations (e.g. coding scheme Fifty Percent; curriculum; plans and accounts) - Graphic representations (e.g. sketch of coronary in patient journal) 	<ul style="list-style-type: none"> - Highlighting (lines 1, 8, 9 12) - Use and contesting of coding schemes (lines 3, 4, 5, 6, 7) - Articulation of graphical representation (line 4)

The work the clinicians accomplish in the heart conference that the columns in Table 2 attempt to illustrate, does not stand for two main ways of instructing, a “crystallized way” and a “situated way.” The separation corresponding to the columns is only an analytical distinction. In reality actions and activities are intertwined. The only actions that exist are situated actions, but my point is that situatedness is also contingent on the artifacts used in the situation. For example, at line 4 the radiologist orally articulates a graphic representation in the patient journal. The graphic representation consists of a sketch of the heart displaying the three main coronaries. To the sketch are added lines and numbers as a result of the outcome of a coronary angiography. The radiologist’s oral articulation is thus not only articulated by him alone, it is a collective product, bridging past and present actions, and mediated by artifacts.¹

As I have suggested above, coding schemes are of special importance for work activities. They are connected to objects of work, they summarize past professional competency, and their uses display the discretion and the responsible action of contemporary working. They encode what to do, and thus encompass a sort of work-related instruction.

The focus of the analysis of this paper is instructional actions. A first conclusion is that among the interactions that constitute human interactions at work, instructional actions play a very important role. Working together means instructing each other while doing the job. Instruction may be given in different ways, and in this study two ways of instructing can be discerned, highlighting and the use of “representations of human activity” in the form of “crystallized” instruction. These two kinds of instructional actions are, as all situated actions, *situated* and *mediated* by artifacts. The character of these two instructional actions is different, however. Highlighting is special in that it is very flexible and highly dependent on the actual situation. It is accomplished by “barehanded man’s” use of gestures and voice, and sometimes underlined, as we have seen, by use of lay or professional concepts and special devices such as the audio video and the cursor. Highlighting implies an invitation (“Let’s talk about this!”) and concerns what topic to put on “the agenda” for discussion. The other kind of instructional actions, the use of artifact-bound representations (“crystallized” instruction), concerns what is already on the agenda by means of highlighting (plus the participants agreement on that). Of special importance in the empirical example presented here are coding schemes, representing linguistic pointers towards the objects of work, and articulation of graphic representations. This use of artifact-bound representations means reuse of resources that in the past have been used in human activity and “stored” in artifacts. The use of those artifacts thus brings to life “experiences”, “recommendations”, and “advice.” The use takes place as situated actions, so how the advice or recommendations from the past are used depends on circumstances in the situation. The instructions from the past may at any moment be contested, fully or in part, but in the long run one cannot avoid using the resources of one’s own culture. Inevitably, there will be “instruction from the past.”

My second conclusion is that instruction takes place at, at least, four levels. Two of those levels have been discussed in this paper, highlighting and use of artifact-bound representations. The former is more basic in that it accomplishes the construction of a topic, a topic that in the next step, by use of artifact-bound representations, is commented upon and discussed by the participants. If I am right about the four levels of instruction, there are two levels left to explain. I will do that shortly. Even more basic than highlighting, I think, is the influencing of each other that goes on “automatically” in interaction with other people. It is the stuff that ethnomethodologists are studying, the producing of social order, as when walking in a crowded street or finishing a telephone conversation. The fourth level of instruction is of course instruction as a specific activity, instructing as part of an educational program, be it as apprenticeship learning, vocational training, polytechnic education or whatever. (In the coronary work setting described in this paper, there is an instructional plan, a curriculum for apprenticeship learning, that I am not going to explain here. See Sutter 1999: 408-9, for some details.)

I am sure that the reader, now, if not before, will raise objections. So much instruction! Isn’t that exaggerated? My answer is that in a time when learning is often discussed as if learning goes on without instruction (as activity or instructional actions), I think it is more to the point to reverse the presupposition and counter with a question: Is there, ever, learning without instruction?

Endnotes

(1) This is, I believe, what Suchman (forthcoming) and e.g. Schmidt (1997) are struggling with in their reconsideration of Human/Machine and of the relation between situated actions and plans. My way of tackling this problem is to search for connections between the two entities as various kinds of instructions. What is summarized in Table 2 can be regarded as my tentative attempt to contribute to the task that Lucy Suchman formulated in her draft paper Human/Machine Reconsidered: “to develop a discourse that recognizes the deep mutual constitution of humans and artifacts without loosing their particularities.”

References

- Goodwin, C. (1994). Professional Vision. *American Anthropologist*, 96, 3, 606-633.
- Goodwin, C (1997). The blackness of black: Color categories as situated practice. In: L. B. Resnick, R. Säljö, C. Pontecorvo, and B. Burge, Eds., *Discourse, tools, and reasoning. Essays on situated cognition*. Berlin, New York: Springer.
- Lave, J. and Wenger, E. (1991). *Situated learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.
- Leontiev, A. N. (1978). Activity, consciousness, and personality. Englewood Cliffs: Prentice-Hall.
- Schmidt, K. (1997). Of maps and scripts. The status of formal constructs in cooperative work. GROUP'97, ACM Conference on Supporting Group Work, Phoenix, Arizona, 16-19 November 1997. New York: ACM Press.
- Suchman, L. (1987). *Plans and situated actions. The problem of human machine communication*. Cambridge: Cambridge University Press.
- Suchman, L.. Human/Machine Reconsidered. Draft paper for "The Japanese Bulletin of Science".
- Sutter, B. (1999). "Instruction and learning in the development of telemediated coronary work." Researching Work and Learning A First International Conference. Conference proceedings. University of Leeds, UK, 11-12 September 1999.
- Wartofsky, M. (1979). *Models. Representation and the Scientific Understanding*. Boston: Reidel.