"Case n' Point": Discovering Learning in the Nonce

Timothy Koschmann, Southern Illinois University, Dept. of Medical Education, tkoschmann@siumed.edu
Alan Zemel, University at Albany, Dept. of Communication, azemel@albany.edu
Michael Neumeister, Southern Illinois University, Dept. of Surgery, mneumeister@siumed.edu

Abstract: We present a single-case analysis of the taking of a stitch within a surgical procedure. All work carried out in the OR of a teaching hospital is held to exacting standards and scrutinized at all points regarding its adequacy. We examine how this kind of assessment is carried out with respect to a particular stitch taken by a surgeon-in-training in the course of a long and complex surgery. Our analysis offers an alternate way of talking about learning, treating it as an occasioned and interactional phenomenon. Learning, by this view, represents a special kind of performance done [1] publicly [2] for assessment and [3] with a displayed orientation to the next-time through. Implications for research in the learning sciences are developed.

Ways of Considering Learning

A father assists his daughter who is attempting to ride a bicycle on a playground. He encourages her saying, "It's okay, honey, you're *learning*." In another setting, an adult who is in the process of acquiring a second language engages in an exchange with a native speaker and says to himself, "I'm really *learning* this language!" Our interests are in ways that the term *learning* gets employed in these situations. What about the child's behavior in the first instance makes it recognizably learning? In the second, what is the adult doing when he says that he is learning? Is it just, in both cases, that they seem to be getting better at *X* or are they actually doing something when they say they are learning?

Psychologists talk about learning in terms of change over time. A classic definition was provided by Hilgard and Bower (1966) who stipulated:

> Learning is the process by which an activity originates or is changed through reacting to an encountered situation, provided that the characteristics of the change in activity cannot be explained on the basis of native response tendencies, maturation, or temporary states of the organism (e.g., fatigue, drugs, etc.) (p. 2)

Though much has been written since about how learning might be theorized (see Koschmann [2011] for a more detailed discussion of contemporary theories of learning), most current formulations conform to this definition at least to the extent they require the detection of change across situations. They may differ regarding how to characterize the changes, but some sort of change across situations appears to be criterial. Detection requires a "same-but-different analysis" (Koschmann, 2013) on the part of the observer, in that, in order to register as learning, the activity can't be so radically changed that it is no longer recognizable as what it is (i.e., maze running, doing maths, speaking French). Given this orientation to recognizable change, measurement becomes a preeminent concern. Educational psychologists, from Thorndike on forward, have designed their experiments such that different instructional regimens serve as treatment variables and performance measures serve as the dependent variable. But, operating under this paradigm, learning becomes doubly "occult" (Koschmann, 2002)"it cannot be seen on any particular occasion and it can never be observed directly. It is only known through its effects and it is only observable through the test instrument.

The question we would like to raise here is whether or not it might be feasible to treat learning as a concrete matter, as something available in the moment. Is it, in other words, investigatable as an occasioned matter? Is the little girl on the bike doing something that is recognizably and accountably learning? Can we, as in the example of the adult L2 learner, recognize learning when we are doing it? If we can answer these questions in the affirmative, it would suggest that psychology's formal definition of learning may not be the only way in which the phenomenon can be understood, that there are ways of recognizing learning as it is being produced. But this then opens into a larger question of just *how* this gets done and that is the question that motivates the current study. When complete, we would like to be able to say something about our common sense methods for recognizing and displaying learning. At the same time, we would like to be able to say something about how learning, so understood, is related to instruction. We see these inquiries as closely intertwined with the conference theme of "Learning and Becoming in Practice."

Analysis

One might expect the operating room (OR) of a teaching hospital to be a "perspicuous" (Garfinkel, 2002, p. 181) setting for exploring how learning and instruction are done in situ. Here, a continuous supply of newcomers cycle through, leaving the program as certified practitioners. All work carried out in the OR is held to exacting standards and is carefully scrutinized regarding its adequacy. But, it is essential, for the purposes of training, to provide opportunities for trainees (i.e., surgical residents) to attempt technical elements of the procedure. These two, sometimes conflicting, agendas must somehow both be satisfied, but in a way that ensures that the patient receives the best possible care. Opportunities for practice can only be afforded if the elements fall within the present capabilities of the trainee and responsibility for making this determination rests with the supervising surgeon, the attending. Displaying and recognizing developing capacities, as a result, are organizational necessities within this environment.

Preliminaries

The study utilizes recordings from the SIU Surgical Education Video Corpus, a collection of recordings gathered over a dozen years at several surgical training sites. (1) We will present here a single-case analysis focusing on a fragment of interaction that occurred within a particular surgical procedure. The procedure was a Mastectomy and Free-Flap Breast Reconstruction. It required over nine hours to complete and involved three surgical teams. We will focus specifically on a single exchange during a critical part of the breast reconstruction between ATT, a highly-experienced plastic surgeon, and RES, an upper-level surgeon-in-training.

Figure 1. RES inserts the needle in the proximal vessel.

Figure 2. Curved needle grasped in a needle-holder.

In a free-flap procedure, the missing breast is reconstructed from tissue harvested from some other part of the patient's body, in this case the patient's belly. The transplanted tissue is referred to as the "flap" and its vascular bundle is referred to as the "flap pedicle." The most technically difficult part of a free-flap procedure is to re-connect the blood supply to and from the transplanted flap. The joining of two vessels is referred to as a 'vascular anastomosis'. Two anastomoses are required in a TRAM Free-Flap procedure, one to re-connect the primary artery and the other to re-connect the vein, known respectively as the arterio-arterial (A-A) and the veno-venous (V-V) anastomoses. An anastomosis of two vessels is formed by making a series of stitches, enough to ensure that there are no visible gaps and that a tight seal is established. In the surgery observed, a dozen sutures were required to complete the A-A anastomosis. Our analysis will focus on the production of the first.

"Case 'n Point"

As we join the scene, ATT and RES stand on opposite sides of the operating table. A two-person, stereo-microscope is suspended over the table between them. Some vascular surgery can be done with minimal magnification, but the vessels involved in a free-flap anastomosis are relatively small and microsurgical technique must be employed. Because of the diminutive size of the structures with which they are working, everything under the microscope is manipulated using specialized instruments. A common tool is a kind of forceps resembling a long-handled tweezers referred to colloquially as "pick-ups." The surgeons must steady their hands by bracing them and resting them on the patient's body. As shown in Figure 1, both surgeons work with a tool in each hand. Appendix A represents the talk and some of the visible action that took place during the production of the first and second sutures of the A-A anastomosis. It was prepared using the standard transcription conventions of Conversation Analysis (CA). (2) The transcribed segment occurs shortly after the completion of the V-V anastomosis which was constructed by ATT with RES assisting.

Producing serviceable sutures is one of the first skills acquired by a surgeon. There are many kinds, the simplest being the interrupted suture. The procedure for making one involves hooking a curved needle through the respective edges of the two sections of tissue to be joined or "approximated." For an instrument tie, the needle is held using a special-purpose needle holder (see Figure 1). "Taking a bite" with a needle holder is a two-step process (Anderson & Romfh, 1980). The needle-holder is commonly clamped to the middle of the needle, so when the needle is inserted, it can only be pushed to this point. It must then be released and pulled through from the opposite side. This is repeated for the second piece of tissue, the one to be approximated to the first. Having pulled the needle through both sections, the trailing segment of suture becomes the working end for knot-tying purposes, while the thread attached to the needle becomes the standing end. They are joined using a "surgeon's knot", basically a modified square knot. It consists of a loop of fixed perimeter and two or more "throws" or wrappings of the loose ends (Edlich, 2008). The suture is completed by snipping off the free ends or "ears" of the joining strand.

As the fragment begins, we find RES issuing a directive to the scrub nurse to provide a needle-holder loaded with a needle and 9-0 suture. Unless otherwise specified, when an instrument is requested, the person

issuing the request is the expected recipient and that is the case here. By calling for the needle-holder, RES positions himself as the party responsible for performing the next item of business, the joining of the patient's truncated internal mammary artery to the dissected artery within the flap pedicle. The two surgeons individually prepare for the joint task ahead of them—ATT readying the vessel ends and RES organizing the needle with suture attached. The vessels must be lifted and supported while the stitches are being taken. Also, to successfully and precisely place the needle, the artery wall must be supported from the other side. As assistant, all of this work falls to ATT. As they begin, he inserts and expands a pick-up inside the distal (i.e., on the flap-side of the finished anastomosis) vessel (lines 6-7), giving RES better control of the needle placement. RES pushes the needle halfway through the arterial wall (lines 8-9), releases the needle-holder, and then re-uses it to draw the needle the rest of the way through (lines 10-11).

Next, a decision must be made about where to have the suture pass through the other, the proximal, vessel. This planning work takes the form of an insertion sequence embedded within the unfolding project to produce the first stitch. Misalignment of the two segments could lead to twisting of the anastomosis that might produce problems later. RES consults ATT before proceeding (l. 13). His query comes with a candidate answer embedded, displaying his ability to independently make the necessary judgment. It is accompanied by a swiping gesture performed with the needle (lines 14-15). The gesture, passing over the lower lip of the artery, is precisely coordinated with his enunciation of "that's" (cf., Hindmarsh & Heath, 2000). ATT first stretches the distal segment to line it up with the proximal. The movement serves both as a visual test of alignment and as a mediated point (lines 18-19). RES then proceeds to insert the needle at the identified position.

Having come to concordance on where the needle insertion should be made, RES proceeds, but there is another question about placement and this one pertains to how far back from the tissue edge the needle should be set. This judgment RES makes without consultation (l. 21). Immediately after RES sets the needle in the second (proximal) vessel, ATT issues a double directive pertaining to [1] the next stitch ("Take the next one bigger bites") and [2] the needle set or "bite" just accomplished ("take tha' one (0.6) j's a little bit bigger"). (3) The latter is produced without an accompanying gesture.

The attending's turn begins with "Take the next one." Though what follows pertains to the current bite ("tha' one"), RES may only be attending to the first part. Before ATT's turn is complete, RES proceeds to pull the needle through the proximal segment (l. 23) before issuing a receipt token (l. 27) to ATT's eventually completed turn.

His receipt is ambiguous—is he responding to the first directive, the second or both? Rather than immediately withdrawing the needle and repositioning it, he draws up on the suture, tugging the two artery segments together (lines 29-30). This constitutes a practical test of the suture in progress — both with regard to its strength and the alignment of the two segments. Unfortunately, when tension is placed on the suture the second bite fails (l. 31). ATT registers the problem using a non-lexical expression of dismay (l. 32). RES's reply (l. 34) relates the problem to the issue previously raised by ATT.

Instructing and Learning in Interaction

What is it about this brief fragment that offers an impression of instruction going on? What about it suggests the possibility of learning? In a now classic paper on the nature of instructional talk, Mehan (1979) offered two hypothetical exchanges, one that went like this:

> Speaker A: What time is it, Denise?
> Speaker B: 2:30
> Speaker A: Thank you, Denise.

and another that went like this:

> Speaker A: What time is it, Denise?
> Speaker B: 2:30
> Speaker A: Very good, Denise.

The two sequences differ only in their third turns. In the first, we have a receipt and acknowledgement of the information offered, in the second, an evaluation of the information provided, suggesting in Mehan's terms that the question had a "known answer." The third turn in this way produces what came before it as an assessable (and potentially correctable) performance. But it does more—it serves to establish what will count as accountably correct performance. (4) This, then, becomes, what we have referred to elsewhere (Zemel & Koschmann, in press) as, a "learnable." At the same time, it assigns different epistemic roles to the parties, establishing one as knowledgeable with respect to the matter in question (the *instructor*), the other as standing in need of instruction (the *instructee*). These things are the earmarks of an instructional organization.

We can see a semblance of this in the analyzed fragment. The functional equivalent of the instructor's third turn can be found in ATT's double directive begun in l. 22 and completed in l. 25. Coming directly after the insertion of the needle in the proximal vessel, the attending's second directive calls for a correction to be implemented by RES. Other-correction is usually dispreferred in non-instructional talk (Schegloff, Jefferson, & Sacks, 1977) and the presence of correction here is part of what gives this an instructional character. This correction-initiation in this particular position accomplishes exactly the things we described with respect to Mehan's "What time is it, Denise?" example— it positions the parties in certain epistemic roles and produces, for current purposes, a normative order for bite setting. (5) Strictly speaking, it has some differences from the Mehan example, as well. Mehan's example involves positive assessment in the third turn, where here we have a negative assessment. In the classroom, we might find direct correction in the third turn rather than correction-initiation (but see McHoul, 1990). Nonetheless, we have no trouble recognizing this sequence as instructional. Indeed, it is more than instructional, it can be heard as a form of caution, though what it is cautioning against is left to the recipient to work out.

But if we see instruction here, do we also see learning? By 'learning', of course, we are referring not to the operationalized construct employed by educational psychologists, nor are we talking about some kind of hypothesized mental event. We are orienting instead to something that can be seen and heard within the participants' unfolding interaction. The instructional sequence consists of an elaborated performance begun at l. 8 and continued to l. 21 carried out with considerable assistance from ATT. After ATT's appraisal at lines 22 and 25, RES supplies a nominal uptake token (l. 27), but this, at best, represents an avowal of understanding, not a demonstration. Indeed, he does not make an immediate move to correct the faulty needle placement in the proximal segment. The subsequent failure of the stitch, in effect, serves as its own practical assessment. We see the sequence produced as learning with RES's "Case n' point" (l. 34). In accounting for their unfolding work in just this way, he links the failure of the stitch to ATT's prior caution. He formulates their current situation as a case of a stitch production in which one of the bites allowed too little cuff and, as a consequence, failed. In a way that his earlier receipt token (l. 27) did not, this formulation concretely demonstrates his understanding of the ATT's warning and "witnessably" (Rawls, 2002, p. 51FN) produces this as a learning sequence. Like the instances of instruction produced earlier, learning also entails assessment, but in this case it is self-appraisal by the learner that is critical, rather than other-assessment (and correction initiation) by the instructor. It is RES's treatment of the local occurrence as documentary evidence of a general principle, i.e. as a "case," that accomplishes an orientation to 'a next time through'. In this way, our analysis reveals a different way of thinking about learning as an occasioned and interactional phenomenon. It represents a special form of performance done [1] publically [2] for assessment and [3] with a displayed orientation to the next-time through.

Discovering Learning in the Nonce

Just as Wittgenstein (1958a, 1958b) used posed examples as vehicles for exploring particular philosophical questions, we can utilize the analyzed episode as a "propaedeutic case" (Garfinkel, 2002, p. 75) for thinking through what we take learning to be. Our analysis makes two important contributions in this regard. First, the Thorndikean tradition in educational psychology rests on the presumption that learning cannot be seen, that it is an "occult" phenomenon (Koschmann, 2002). With this analysis we demonstrate that it can in fact be observed in the course of its production, at least within this attested example. This is a significant finding.

Second, we saw in this analyzed example something interesting about the relationship between instruction and learning. While it is often assumed that one brings about the other, we see in this episode that the practices whereby learning is produced can, in at least some cases, be displaced from the practices whereby instruction is produced. This is not to suggest that the two forms of action are independent. Indeed, in the case analyzed, RES's 'learning' displayed his appreciation of the matter that he and ATT had jointly produced as 'learnable' within the instructional sequence. So the learning was sequentially tied to the instruction that came before, though the practices through which the instruction was produced were analyzably distinct from those that constituted the learning. That the two can be examined separately is a special feature of instances of instruction and learning like the one presented here.

Though our findings call into question a basic presupposition of the Thorndikean program, we would not like to suggest that the program itself is thereby rendered invalid or dismiss its accomplishments out-of-hand. Thorndike sought to put the study of learning on a scientific footing and, to do so, he imposed certain requirements on how the phenomenon could be approached. He believed that learning was inherently tied to assessment. He was, in this way, appealing to a common sense understanding of what it means to learn something, that we often impose checks or tests on ourselves and others to see whether learning has occurred. In our analysis we too found that appraisal and assessment are integral to both learning and instruction when they are studied in unfolding interaction. So assessment in some sense appears to be key to how we understand learning in all cases, but we may differ in terms of where we proceed from there. One part of the belief structure that produces learning as occult, is the belief that learning is only appreciable as change over time. Again, this appeals to our everyday sense of what it means to learn, but at the cost of making it impossible to locate the

phenomenon within actual unfolding conduct. In the surgical procedure from which the analyzed excerpt came, it would have been possible to examine RES's subsequent stitches for evidence that he had 'learned' from the "Bigger bites" lesson. Such an analysis would not necessarily differ from the ways in which we sometimes apply the term 'learning' in everyday circumstances. Both approaches require a "same-but-different analysis" (Koschmann, 2013). But we clearly need more empirical research into how these different conceptualizations, learning-as-change-over-time and learning-as-occasioned, are related.

Historically, educational research has advanced by axiomatizing learning, by stipulating from the outset what learning might be. We are not taking issue specifically with any of these formulations, but are instead calling into question this general way of doing business. If we are to achieve an empirical science of learning, ought that not engender some foundational inquiry into its central phenomenon, into the nature of learning itself? It is essential within any scientific enterprise to strike agreements pertaining to what it is that we are undertaking to study. But when it comes to learning, we seem to be locked into endless cycles of definitional propagation. Worse, we have, at least in some cases, adopted definitions that render the phenomenon of interest off limits to direct study. The current paper represents an effort to depart from this tradition. It could be characterized as an inquiry into what people do when they describe themselves as learning. Rather than stipulating *a priori* what it might be for the purposes of our investigation, we have sought to locate it within our empirical materials. We have taken it up as an endogenous matter and have sought to return it to the site of its production. In so doing, a whole new world has opened before us, one ripe for further exploration.

Endnotes

(1) Signed consent to record a surgical procedure is sought from the patient upon admission to the hospital. Advance consent is secured from all other participants (i.e., attendings, fellows, residents, medical students, staff) prior to recording in the OR. The consent forms for the participants and patients are associated with a collection protocol approved by the institutional review board (IRB). For purposes of confidentiality, recording is only begun after the patient has been completely draped. Also, all proper references (e.g., patient names, names of practitioners and institutions) appearing on the recording are redacted prior to study. To actually do research with the materials in the corpus, investigators must submit a second protocol, a use protocol, with the local IRB.

(2) The full set of conventions is described in Jefferson (2004). In brief, special brackets are used to mark the onset of overlap between transcribed elements (i.e., turns at talk or other transcribed conduct). Numbers enclosed in single parentheses represent periods of silence measured to a tenth of a second. Standard punctuation marks such as periods and question marks are used to denote delivery with falling (or rising) intonation. Colons are used to display sound stretching. Text enclosed between degree signs represents talk delivered at diminished volume. Annotations supplied by the transcriber are enclosed in double parentheses. These are most often used to describe visible conduct occurring in conjunction with the talk. The column appearing on the left side of the transcript presents the times, measured in hours, minutes, seconds, and frames, at which the actions, either talk or embodied conduct, were initiated. Line numbers are added on the far left to simplify reference in the text.

(3) Anderson and Romfh (1980) write:

> A minor well-conceived expansion of vocabulary will allow a surgeon to communicate with his helpers with less misunderstanding. It is an ambiguous instruction, for example, to tell an assistant placing a stitch to "take a bigger bite." Such a request could mean: make more progress between stitches; make a wider cuff; or take a thicker cuff of tissue. Planning a vocabulary that will allow you to communicate by non-ambiguous, specific instructions will greatly facilitate coordination between surgeons and assistants. (pp. 178-179)

It would appear that surgeons must struggle, just as we as analysts do, to find the right words to describe these practical matters.

(4) "What these direct instructional sequences yield, and what they are posed to yield, is something like accountably correct answers, and, by implication, knowledge and competence" (Macbeth, 2004, p. 704).

(5) It is important to note that it is not simple assessment that marks an exchange as recognizably instructional, but rather assessment coming on the heels of an assessable performance, the assessment and the assessable performance being reflexively related. It should also be noted that we are not claiming that this is *only* way in which instruction can be enacted. There may be and likely are any number of other organizations yet to be uncovered and documented.

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Appendix A

Excerpt 1: First stitch (#04-010)

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 1  08:06:27;07 RES:  I'll take the nine oh
 2  08:06:28;18       (45.1)
 3  08:06:53;04       ((ATT organizes the distal artery segment using pick-
 4                    ups in his r. and l. hand))
 5  08:07:13;21 ATT: °°u:::h°°
 6  08:07:31;24       ((ATT inserts pick-up into distal segment opening it
 7                    in preparation for receiving the needle))
 8  08:07:32;25       ((RES inserts needle through distal segment using
 9                    needle-holder in r. hand))
10  08:07:41;10       ((RES pulls needle through distal segment with
11                    needle-holder))
12  08:07:48;26       ((RES loads needle in needle-holder))
13  08:07:54;07 RES:  I'think ⌈that's about the bottom don't you?
14  08:07:54:12               ⌊((RES swipes needle along lower lip of
15                    proximal segment))
16  08:07:55;26 ATT:  I think that's pretty close to being yea::h right
17                    (0.6) ⌈right (0.2) ther::e
18  08:07:57;10             ⌊ ((ATT gestures with stretched end of the
19                    distal segment))
20  08:07:59;09       (13.0)
21  08:08:07;15       ((RES inserts needle into the proximal vessel))
22  08:08:11;28 ATT:  Take the next one ⌈bigger bites and take tha'one =
23  08:08:12;21                         ⌊ ((RES pulls needle through with
24                    pick-up))
25  08:08:14:00 ATT:  = (0.6) j's a little bit bigger
26  08:08:15;11       (0.4)
27  08:08:15;23 RES:  Kay.
28  08:08:16;00       (1.6)
29  08:08:16;14       ((RES tightens suture, drawing the two artery ends
30                    together))
31  08:08:16;27       ((suture tears out of the proximal vessel))
32  08:08:17;17 ATT:  °nyeh°
33  08:08:17;24       (0.8)
34  08:08:18;19 RES:  Case 'n point
35  08:08:19;15       (7.3)
36  08:08:20;26       ((RES re-loads needle into needle-holder))
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