Instructed Learning: An Integrative Perspective on Classroom Practice and Learning

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Abstract: The dichotomisation of teaching and learning has constrained our theorizing and misrepresented the nature of activity in institutionalized learning environments such as classrooms. Several languages other than English have a single term that signifies both teaching and learning. The term instructed learning is proposed as a suitable label for the conjoint practice engaged in by teacher and learner(s) in classroom-like settings. Such a term better reflects the interrogative, negotiative and reflective practices that our recent research associates with sophisticated classroom practice and accords appropriate agency to both teacher and learner within the practice of instructed learning in which they are co-participant.

Teaching/Learning

Previous research, and much of our theorizing, has tended to dichotomize teaching and learning as discrete activities sharing a common context. It will be argued below that this dichotomization is a particularly insidious consequence of the constraints that language (and the English language, in particular) imposes on our theorizing. It is a major premise of this paper that such dichotomization misrepresents both teaching and learning and the classroom settings in which these most frequently occur. It is appropriate to make some specific points in support of this position. There is no intention to challenge the separate integrity of "teacher" and "learner" as labels for individuals engaged in particular practices or discourse modes. Rather, classroom research should be predicated on the possibility that classrooms are more effectively understood as sites for bodies of mutually-sustaining practice that in combination characterize the process I will call "instructed learning." I open my argument for the utility of *instructed learning* by examining the language in which our theories of learning have been constituted.

Any discussion of learning as a social activity calls inevitably upon the writings of Vygotsky. It appears that readers of Vygotsky in English have been denied a richness of meaning present in the original Russian text. Consider the key differences in two published translations of the same passage:

> From this point of view, instruction cannot be identified as development, but properly organized instruction will result in the child's intellectual development, will bring into being an entire series of such developmental

processes, which were not at all possible without instruction (Vygotsky, 1982, p. 121, as cited in Hedegaard, 1990, p. 350).

The translation used by Hedegaard is referenced: "Vygotsky, L.S. (1982) Om barnets psykiske udvikling [On the child's psychic development]. Copenhagen: Nyt Nordisk." In this translation, the juxtaposition of "instruction" and "development" is an uneasy conjunction, although the suggestion that "organized instruction will result in the child's intellectual development" seems transparently appropriate. The passage in this form can be read as a celebration of the role of instruction in facilitating intellectual development in directions not otherwise possible. However, in another translation *of the same passage*, but this time in the widely-cited 1978 translation published as *Mind and Society*, we find:

> From this point of view, learning is not development; however, properly organized learning results in mental development and sets in motion a variety of developmental processes that would be impossible apart from learning (Vygotsky, 1978, p. 90).

In this translation, the distinction that is being drawn between learning and development takes on special significance, and it appears to the reader that Vygotsky's point is to distinguish intellectual development through maturation from intellectual development in response to the environment (which would include instruction). However, the phrase "properly organized learning" need not connote instruction as this is conventionally understood, since "properly organized learning" could conceivably consist of structured occasions for children to interact with their environment without the mediation of an adult or more competent other but just by immersion in particular environments – as might be the case on a trip to the zoo or a visit to an art gallery.

The pivotal assertion that must be understood is whether Vygotsky was asserting the impossibility of certain forms of intellectual development "without instruction" (which presumes an actively interactive more competent other) or "apart from learning" (which on one level seems a tautology, but which could also be interpreted as equivalent to the assertion that properly organized interaction with the environment is essential for certain forms of development to occur). This distinction is non-trivial, since it calls into question the significance of the mediation of another more able individual (the teacher/instructor). Given what we know of the significance Vygotsky attached to the role of the teacher, it would appear that the most appropriate reading of the major premise is "a variety of developmental processes would be impossible without instruction." This accords with the significance attached, in the passage quoted below, to the child's interaction with

"people in his environment" rather than just with all aspects of that environment, with or without the mediation of others. This reading is supported by Davydov (1995), who stated that for Vygotsky teaching and learning were collaborative activities.

The 'conflicting' translations arise because of a duality of meaning in the original term employed by Vygotsky. This duality has been noted previously, but its significance seems to have been given scant consideration in the interpretation and application of Vygotsky's work.

> The theoretical framework of Vygotsky entails specific understanding of learning, development, and the goal(s) of development. In Vygotsky's usage, the term obuchenie, frequently translated as learning, more accurately indicates the interaction of teacher and student.
> (Wertsch & Sohmer, 1995, p. 332)

As we have seen, the same term ("obuchenie") is also translated as "instruction" and clearly shares with corresponding terms in other languages the capacity to invoke both teaching and learning, as these are named in English. Once this duality of meaning is recognized, our reading of Vygotsky and our theorizing about the teaching/learning process are greatly enriched. For example, in one of the most famous passages from the translated Vygotsky, the word "learning" can be replaced by the word "teaching" and the resultant text is still meaningful – but, perhaps, with a different meaning.

> We propose that an essential feature of learning [*teaching*] is that it creates the zone of proximal development; that is, learning [*teaching*] awakens a variety of developmental processes that are able to interact only when the child is interacting with people in his environment and in collaboration with his peers. (Vygotsky, 1978, p. 90)

With regard to the passage just quoted, the suggestion by Wertsch and Sohmer that the word in question be read as "the interaction of teacher and student" makes the latter half of the passage almost tautologous with regard to the role of the teacher and inconsistent with regard to peer collaboration. A more useful reading is obtained if the term "obuchenie" is interpreted as evoking a conjoined practice in which both teacher and learners participate. This joint participation in a single body of practice does not require that participants contribute to the practice in the same way. It does, however, commit us to a reading that simultaneously invokes the presence (and participation) of both teacher and learner. Such a social interactive

reading seems wholly consistent with Vygotsky's identification of the primacy of social interaction in the learning process.

Issues of culture and language

How are we advantaged by the reconstructed reading of Vygotsky afforded us through our recognition of his use of a term simultaneously invoking teaching and learning? It may be comforting to feel that we have an improved understanding of what Vygotsky intended, despite inconsistencies in translation. It is at least as interesting, however, to reflect on the significance of the translators' difficulties in interpreting a term that simultaneously invokes both teaching and learning, and the implications that this has for the cultural-specificity of teaching and learning as 'bodies of practice.'

Speakers of Russian are not alone in their use of a term that combines both teaching and learning. In Japanese, "tagushushido" combines teaching and learning in the same way. In Dutch there is one term that means both learning and teaching: "leren". To distinguish between the practices of teaching and learning, the Dutch say "leren van" to signify "learning" and "leren aan" to signify "teaching". A teacher is a "leraar" and a student is a "leerling" (I am indebted to Martin Van Reeuwijk for explaining all this to me). In French, the term "didactique", and particularly Brousseau's use of that term (Brousseau, 1986), invokes a mutuality of responsibility and participation not always found in American or Australian interpretations of the classroom.

In searching for a comparable term in English, the best I am able to suggest is *instructed learning*. This places the emphasis on learning as the goal process and product of the interactions under consideration, while simultaneously situating that learning in an instructional context. Such a term suggests a setting that has been designed or chosen for its instructive potential. This requires that there be an "instructor", who may or may not be physically present and participant in the learner's interactions with and within that setting, but who contributes to the *instructed learning* occurring in the setting.

Issues of intentionality and agency are central to the choice of *instructed learning* as the most appropriate label for the construct that we might otherwise call "teaching/learning". The characterization of such learning as 'instructed' calls into being the intentions of an instructor and the participation of a learner. If *instructed learning* is used in reading the Vygotsky passages, quoted above, the resultant passages provide the necessary duality of agency to both teacher and learner. The key passage becomes "*instructed learning* is not development; however, properly organized *instructed learning* results in mental development and sets in motion a

variety of developmental processes that would be impossible apart from *instructed learning*" (Vygotsky, 1978, p. 90, amended in italics).

What are the consequences of inscribing this conception (*instructed learning*) in our reading of classrooms? If our framing of "instruction" in language presumes a "learner" and if "learning" is inextricably entwined with an "instructive" setting (consistent with the primacy accorded by Vygotsky to social interaction), then our interpretations of the activities of the classroom should identify communal practices and progressive participation in a common discourse as essential features, rather than fragment the classroom into teaching and learning activities undertaken by different individuals[1]. *Instructed learning* achieves this integration succinctly. Is it "learning" or "teaching" that creates the zone of proximal development? Vygotsky's intention, surely, was to signify that it was in social interaction, in *instructed learning*, where learners and teacher interact, and where the more able-other will frequently be a classmate, that the zone of proximal development was co-constructed for each participant (rather than by each participant).

And what of the issue of agency? How are the participants in the classroom positioned by *instructed learning*? How might they answer the question, "What is it that you do?" For the teacher, the answer is "I instruct the learning of mathematics or science or geography or . . ." This usage distinguishes "teaching mathematics" from "instructing the learning of mathematics" by invoking the agency of a learner, whose activities are to be promoted by the instruction. There is an old adage used by primary (elementary) school teachers in Australia to distinguish their activities from those of their secondary (high) school counterparts. It is asserted that secondary school teachers teach mathematics (or science or whatever), while primary school teachers teach children. *Instructed learning* identifies the object of instruction as being the activities of the learner. This seems a potentially more fruitful conception of the teacher's role than either of the stereotypical images invoked by the adage just cited.

For the student the answer might be "I am instructed in my learning of mathematics", but this accords the agency of the learner a passive character. The student's answer might be better phrased as "My learning (of mathematics) is instructed." This places the activity of learning at center stage and situates that

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[1] This perspective can be usefully contrasted with that of Simon and Tzur (1999), among others, who investigate "teacher practice" on the basis of research questions such as, "How does this teacher endeavor to teach his or her students mathematics that is beyond what the students already know?" Within this question, we find reaffirmation of institutionalized relationships between agency, activity and product: teachers teach mathematics, students know mathematics. The legitimacy and the viability of these relationships are challenged quite explicitly in the remainder of this paper.

learning (i) in an instructional setting, and (ii) in implicit interaction with other(s). Analogous to the point made above, it is the student's learning that is instructed. The object of instruction is not 'mathematics', but nor is it 'the student'. Accepting this usage accords some parity of agency (but not equivalence of action) to both teacher and learner.

Metaphors that dichotomize (and their entailments)

The urge to dichotomize seems as universal as the inclination to theorise through metaphor. In fact, both relate to our attempts to categorize our world. The work of Sfard (1991, 1998, 2000) provides a useful introduction to the key issues. When Sfard (1998) refers to "the difficulty with telling the metaphorical from the scientific" she appears to be attempting to disengage the product ("scientific knowledge") from the process by which it is constructed and perhaps by which it is constituted (the use of metaphor in analogical reasoning). The need to make this distinction is doubly strange given Sfard's earlier writing in which she characterised processes and objects as "different sides of the same coin" (Sfard, 1991, title). Sfard's (ironic) acknowledgement of the indispensability of metaphor to theorising is well conceived. However, the distinction she seeks to draw is unnecessary, by her own authorities: "The line … is a thin one – if it can be drawn at all" (Scheffler, 1991, as cited by Sfard, 1998).

More recently, Sfard described mathematics as "a discursive steering between metaphor and rigor" (Sfard, 2000, p.325). The point at which the metaphorical origins of theory are actually relinquished is moot, and it is questionable as to what remains other than a form of codified metaphor. Elsewhere, in contrasting "the acquisition metaphor" with "the participation metaphor", Sfard exploits both metaphors effectively to challenge the need to choose between them (Sfard, 1998). Ironically, however, Sfard is as guilty of dichotomization as those who advocate exclusive acceptance of either alternative. As already stated, by challenging the need to choose between dichotomous categories, Sfard nonetheless reifies the categories themselves and appears to endorse the clustering of all theories of learning into either of two 'camps'. Any such generalised clustering runs the risk of concealing significant difference, as the use of 'gender', for example, may conceal important distinctions of race, ethnicity, language or socio-economic status. Even if we acknowledge the utility of both Sfard's metaphors, or of others, we should also accept as significant to our theories the entailments of those metaphors in which they are constituted. Rigor (or precision) can be seen as an interpretive activity that reconstructs metaphor in a fashion more specific to the context of its use. Nonetheless, the metaphoric entailments remain, however codified and disguised, since those entailments "serve as bridges between new contexts and old discursive habits" (in the happy phrasing of Sfard, 2000, p. 324) and represent at bottom the

meaning we each variously ascribe to the object constructed, be it mathematical or otherwise[2].

In our struggle to develop theories of learning applicable to instructional settings, we must monitor the associative richness of the terms we employ. The goal of such monitoring is not parsimony of association, since an overly precise term may exclude important conceptual connections. One feature of English, for example, is the capacity of some terms to invoke process and product simultaneously. Such 'ambiguity' is a tool to be used selectively and deliberately. The richest writing in any language trades on this: the ability of a word or phrase to invoke a multiplicity of images and associations. On occasions such ambiguity is a structural component of the language itself. In English, the gerund situates itself at the heart of our experience. "Understanding", "Learning", "Teaching" – process or product? By integrating such 'ambiguities' into our theorizing we strive to balance richness and precision. *Instructed learning* is posited as having an analogous associative richness, essential if we are to capture the individual and the social within the same body of practice and in relation to the same setting.

At first glance such 'ambiguity' may appear to transgress the precepts of 'precision' and 'reliability', hallmarks of the Cartesian universe. Precision and reliability in combination capture a paradigm that posits an unchanging external reality (i) that can be measured/described precisely, and (ii) that has attributes sufficiently static for a measurement to endure as a useful descriptor[3]. Similarly, the utilisation of statistical evidence to infer causality appeals to an image of mechanical linkage between these relatively stable entities that is insufficiently subtle to accommodate the iterative and reciprocal refinements of practice and meaning through which (and of which) the social systems in which we participate are constituted[4]. The viability of this statistical paradigm in assessment and in research is currently under

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[2] Lakoff and Johnson (1999) concur with this position. They state: "Many, if not all, of our abstract concepts are defined in significant part by conceptual metaphor. Abstract concepts have two parts: (1) an inherent, literal, nonmetaphorical skeleton, which is simply not rich enough to serve as a full-fledged concept; and (2) a collection of stable, conventional metaphorical extensions that flesh out the conceptual skeleton. . . . Metaphorical thought is what makes abstract scientific theorizing possible" (Lakoff & Johnson, 1999, p. 128).

[3] Moss (1994) usefully raises the possibility of assessment validity without reliability, and discusses the conditions under which reliability is and is not an essential warrant. I suggest that her arguments be extrapolated to encompass research.

[4] Salomon (1993) adopts the idea of reciprocal influences "as the model for the interaction between individuals' cognitions and distributed ones" (Salomon, 1993, p. 122). This paper employs a variant of this conception of reciprocal influence as the mechanism by which activities in the individual and social domains are reflexively related.

challenge. Assessment schemes are being proposed that improve what they measure as they measure (see, for example, Lesh & Clarke, 2000). Action Research and contemporary interpretations of the Teaching Experiment seek to improve what they study and study that improvement in cyclic iteration. The challenge for researchers is to develop theories and matching methodologies that model complex social systems undergoing continual change, account for the incremental changes to participating system elements, and inform and facilitate the study of such systems[5].

This brief discussion of metaphors and their entailments was intended to highlight the importance of accepting complexity as an unavoidable characteristic of systems and individuals[6]. Rather than taking the minimization of complexity as the structuring principle of our research, we must accept the obligation to justify each occasion when attributes of the same system (or individual) are either aggregated or dissociated. These alternatives represent another dangerous dichotomy. The criteria for aggregation or dissociation must include more than just statistical considerations. Happily, the role of theory in such decisions is accepted in principle, if not always in practice. It will be argued later that a systemic perspective can offer a simplification of the entanglements arising from theories that take the individual as the primary unit of analysis. Acknowledgement of the complexity, multi-dimensionality, and interconnected structure of a construct such as classroom practice compels us to question not just the methodological paradigms by which the construct has been researched previously, but also the language within which we have previously framed our descriptions of the construct.

Issues of agency

The passages from Vygotsky quoted earlier should not be read as assigning the agency, either for learning or for the creation of the zone of proximal development, exclusively to either the teacher or the learner. On the one hand, this diffusion of agency challenges the extreme view (sometimes mistakenly identified with radical constructivism) that the individual is the sole creator of their world. Equally, individual agency consists of more than interpreting the world in our own image (that is, construing the unfamiliar in terms of the familiar). We also act in the world and, by participating in the activities constituent of those settings in which we find ourselves, we shape those activities and reflexively and iteratively contribute to their modification. It is by this process of alternate interpretation and action that individual participation in a social situation is iteratively constructed.

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[5] The development of an "ecological psychology" (Greeno, 1997, p. 15) is one direct and appropriate response to this challenge.

[6] Rich (1979), as quoted in Lather (1986), argues: "Truth is not one thing, or even a system. It is an increasing complexity" (p. 187). This is in happy correspondence with the position advocated in this paper.

Classroom interactions are predicated on an interpretive affiliation that situates the learner with respect to the values and goals of others in the learning environment (the classroom) and an interpretive characterisation of the other, by which the capabilities, motivations, values and actions of other participants in the classroom are inferred and this characterisation is then iteratively refined through on-going social interaction (see Clarke, 2001, for an empirical grounding of this perspective).

We also find the issue of agency addressed in the recent debate over the function of intersubjectivity in the radical constructivist position (Lerman, 1994, 1996, 2000; Steffe & Thompson, 2000). Lerman's reference to "constructivism's view of the autonomy of the individual in the construction of her or his knowing" (Lerman, 1996, p. 140), through his identification of constructivism with learner autonomy, characterises the constructivist position in a form that accords primary agency to the individual but precludes any integration of the social into the learning process. This interpretation is open to challenge as a legitimate characterisation of the radical constructivist position (for example, Steffe & Thompson, 2000).

The legitimacy of the distinction between the personal and the social within constructivism is not in question. Steffe (1995) drew the distinction between the social and the personal in absolute terms by stating that "Individual-environment interactions and interactions within an individual constitute nonintersecting domains" (Steffe, 1995). However, to draw the distinction between social and cognitive processes is not to preclude the influence of one upon the other (in either direction). Cobb (1994) framed the relationship as one of reciprocal contextuality, where the reflexivity between social and cognitive processes can be located in the implicit presence of each theoretical perspective in the other.

> Learning as acculturation via guided participation implicitly assumes an actively constructing child … Learning as cognitive self-organization implicitly assumes that the child is participating in cultural practices (Cobb, 1994, p.17)

Clarke and Helme (1998) posited an individual constructive process whereby context as experienced by an individual could be usefully conceived as an individual construction. Clarke (1996a) proposed a process of iterative refinement of representations as one possible model for negotiation, and consequently a mechanism whereby social interaction might be related to cognitive reorganisation. Both these papers attach significance to the interpretive activity of the individual in 'making sense' of their world through the situations and experiences with which they engage. In the Classroom Learning Project (Clarke, 1998, 2001), one of the original motivations for the use of video-stimulated recall with students was the

need to investigate whether the social negotiation documented on videotape corresponded in any sense to a mental process (recountable by students) that also possessed negotiative characteristics. In this project, social negotiation was utilised as a window on learning. The underlying assumption being that actions and statements made in social learning settings (in this case, classrooms) are somehow reflective of the mental processes associated with learning[7]. In particular, the progressive refinement of practice in that setting was construed as the enactment of that learning process.

Tudge, in extrapolating Vygotsky's zone of proximal development to apply to student-student peer interactions, combined the assertion "for collaboration to lead to development, interactions should be within the less competent partner's zone of proximal development" (Tudge, 1992, p. 1365) with the further proposal that "The zone is thus something that is *created* in the course of social interaction" (Tudge, 1992, p. 1365, italics in the original text). The issue of agency is glossed over here (although Tudge quotes as definitive the 1978 translation, cited above, that accords agency to "learning"). By persisting with the Vygotskiist requirement that one of the participants in the interaction be typified as "less able", Tudge institutionalizes a differential in power, and implicitly in agency, in collaborative learning situations. This is unnecessary and arguably counter-productive. In arguing for the reconception of teaching and learning as contributory processes within the conjoint process of *instructed learning*, it is important to demonstrate the viability of such a socially integrative view of learning and to contrast this perspective with the need to categorize one participant as less able than another and thereby reify teacher and learner roles where these are not essential. Equally, it is important to challenge empirically the need to identify agency within learning exclusively with either the individual or with the interactive practices 'prescribed' by the social situation.

In a recently completed study of classroom learning (Clarke, 2001), several instances were documented where pairs of students interacted successfully in the completion of mathematics tasks. The data suggest that, while students may contribute in different ways to a peer collaborative problem solving situation, the absolute typification of one student as less able and, by implication the major or even sole beneficiary of the interaction, can misrepresent the interaction and undervalue the contributions of that 'less able' student to the collaborative accomplishment. Consider an example drawn from that study. Karen and Lauren are attempting two tasks: "Find the height of a stack of one million sheets of paper"

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[7] Sfard makes a very similar point in proposing that "investigating communication with others may be the best route to discovering the mechanisms of human thinking" (Sfard, 2000, p. 296).

(Episode 1) and "How many sheets of graph paper would you need to show one million one millimetre squares?"(Episode 2).

In Episode 1, the classroom dialogue has been 'parsed' by partitioning the text according to the occurrence of "negotiative events" within an "episode" (Clarke & Helme, 1997; Clarke, 1998; Clarke, 2001). A "negotiative event" is defined as the smallest unit of social interaction (communicative exchange) motivated by the resolution of a single issue or uncertainty. Karen and Lauren are student interviewees, S20 and S22 are other students, and T is the teacher (Mrs Brown). The challenge here is to provide illustration, through empirical data, of collaborative activity in which participants interact on the premise that terms employed during interaction by one participant will be construed by the other in such a way as to advance their collaborative purpose (in this case, the solution of a mathematics task). Since *instructed learning* is a form of collaborative activity, the processes from which such activity is constituted must be identified empirically. Such collaborative interactions as those documented below suggest that a form of 'conjoint' subjectivity (that is, intersubjectivity) is in operation during collaborative activity. The transcribed dialogue throughout all four negotiative events provided evidence (see Clarke, under review) of this intersubjectivity as a pre-existing accomplishment of the dyad (Lauren/Karen) through the history of their previous interactions, and of the iterative refinement of that intersubjectivity in the course of Episode 1. The agency for this refinement (and the associated learning) is a distributed one, shared by Lauren, Karen, their classmates, and the teacher (via task selection). Both Episodes 1 and 2 can be read for their documentation of the development of the conjoint subjectivities of the two students[8]. In reading Episodes 1 and 2, please consider them as challenging:

(i)   The necessity of the teacher's active interaction for the promotion of learning;
(ii) The identification of the primary agency for learning with one "more able" participant;
(iii) The exclusive association of "intersubjectivity" (or conjoint subjectivities) with academic meanings rather than with academic <u>and</u> social practices <u>and</u> meanings.

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[8] The use of the term "conjoint" is a deliberate attempt to respect the integrity of the individuals' separate subjectivities, while acknowledging their simultaneous development through joint participation in a collaborative enterprise. This usage is, I feel, more appropriate than the more common 'intersubjectivity.' Use of intersubjectivity runs the risk <u>either</u> of locating the emergent (intersubjective) meaning in the disembodied aether of their social interaction, or of postulating a degree of correspondence of meaning between elements of the individuals' separate subjectivities that cannot be reasonably inferred from the data of their social interaction.

Ultimately, Episodes 1 and 2 will be discussed from the perspective of *instructed learning*. In this regard, the extremely low profile of the teacher (in both episodes) has strategic importance in the elaboration of instructed learning; certainly not because the teacher is irrelevant, rather because the learning documented in Episodes 1 and 2 must be seen as "instructed" despite the lack of explicit teacher involvement.

Episode 1

	Turn	Transcript
E	1	L: [writing] Five hundred sheets. Height equals.
V	2	K: OK, question two [Find the height of a stack of one million sheets of paper].
E		
N	3	L: Does everyone understand what we did with number one?
T	4	K: No, but. Anyway. Five hundred sheets.
	5	L: And how many sheets do we need?
1	6	K: Five hundred sheets of what? Five hundred sheets.
	7	L: Their height equals five point eight.
	8	S20: We've done that.
	9	K: I know. But we've got to do it all together so.
	10	L: One point oh times ten to the power of six divided by five hundred.
	11	K: Oh yeah sure everyday what are you talking about? What are you talking about?
	12	L: Finding out how many five hundreds there are in a million.
	13	K: How many five hundreds there are in a million. That would make it one thousand. How many thousands are there in a million? That would make a thousand, two thousand. What? [to another S]. I have a lot to say.
	14	L: [uses calculator] Two thousand. Well done!
	15	K: This is called skill. This is what you do. Five hundred into a one hundred which is two. Then you do a hundred [correcting herself] which is a thousand.
	16	L: Times five point eight. Shush.
	17	K: Which is two. Then you do a thousand into a million which is a thousand, so one thousand times two is two thousand.
	18	L: Eleven thousand six hundred.

	Turn	Transcript
E V E N T 2	19	T: With your working out folks I want you to tell me what you are mult— Matthew— what you are multiplying by, and you simply put a little arrow telling me what and why.
	20	K: What are we doing? Is it a million sheets of paper though?
	21	L: Yeah. One point—
	22	K: We're doing a million sheets of paper.
	23	L: Yeah, you need—
	24	K: Yes we do. We do, shut up.
	25	L: Therefore,
	26	K: Huh? I did that wrong.
	27	L: One [inaudible, working]
	28	K: Two thousand times five point eight is eleven, six, zero, zero.[ie 11,600]
	29	L: [sounding out letters] M-ms?
	30	K: Centimetres—which would make it eleven point six metres, right?

	Turn	Transcript
E V E N T 3	31	L: Or eleven—yeah. It'd be eleven point six metres, wouldn't it, 'cause you take off one to get the centimetres, and another one, yeah. [pause]
	32	K: [looking up] That's quite high, isn't it?
	33	L: All right. And you've got to point out what the units (?) are, right?
	34	K: You've got to point out what the what is?
	35	L: We have to show what we're multiplying by. [S22 says something to Karen, Karen laughs]
	36	S20: That's not how you know, you look like you know what you're doing and you just do it.
	37	K: Exactly, you go into a state of total concentration, it lasts about two seconds, that's when you get the answer, and then you don't know what you're doing, so it doesn't matter. Five hundred sheets equals, height equals five point eight centimetres. I don't even understand what I wrote. [pause as Lauren, Karen write]

	Turn	Transcript
E	38	K: But why do we divide a million by five hundred to get that answer?
V		
E	39	L: Because you know, if you know what the height is—
N	40	K: So what am I doing. Tell me what I'm doing here, tell me what I've done.
T		
	41	L: All right. You know that five hundred sheets equals fifty-eight—
4	42	L and K: Five point eight centimetres.
	43	K: There is a point there, it's up there.
	44	L: Oh, I can't see it.
	45	K: Get some other glasses.
	46	L: Now, we need to know—we need to know the height of a million sheets of paper. Therefore you must divide a million by five hundred and times that number by five point eight.
	47	K: [writing] Equals two thousand. Sheets of paper.
	48	L: OK.
	49	K: Two thousand times five point eight centimetres equals eleven thousand six hundred centimetres, equals eleven point six metres of paper. [bell rings]

Each revisiting of the problem solving process, evident above, appears to serve a distinct purpose: to identify a possible solution, to establish conjoint understandings of the procedure, or to review the method of solution for viability, validity and/or completeness. These structural elements within the text may reflect parallel structures within the process of learning.

Episode 2

Turn	Transcript
1	S19: It says how many sheets of graph paper would you need to show one million one millimetre squares.
2	L: To show one million, you know you don't divide it by one hundred, because there's more than a hundred one millimetre squares. I mean you're going to find the area of this.
3	K: What?
4	L: You've got to find the area of this, there's more than one hundred one millimetres.
5	K: That's right. I was doing length by—oh screw that.
6	L: One hundred one millimetre squares.Take length—
7	K: Um, there's how many down here?
8	L: And along that side there is—

9	K: Ten, twenty, thirty, forty, fifty. How many are there down there?
10	L: There's a hundred one millimetres there.
11	L: No, there wouldn't be.
12	K: There wouldn't be, that's not right.
13	L: There'd be two hundred and fifty.
14	K: Yeah.
15	L: Yeah, there'd be two hundred and fifty.
16	K: And we just totally screwed it all—
17	L: Length of graph.
18	K: OK, so it would be length times width [inaudible]
19	L: And uh, two hundred and fifty millimetres. Width—
20	K: What's width?
21	L: That's—
22	K: That's ten, twenty, thirty, forty, fifty, etcetera.
23	L: eighteen, one hundred and eighty.
24	K: Times one hundred and eighty. OK here we go. Two hundred and fifty times one hundred and eighty equals forty-five thousand. OK, that's forty-five thousand. We need a million. What's a million divided by forty-five thousand and times it by that?
25	L: Hang on, hang on, hang on, hang on. Don't go too fast. OK. Therefore there are forty-five thousand million mm squares.
26	S20: Forty-five thousand million?
27	L: Yeah.
28	S20: Forty-five thousand.
29	K: Twenty-two point two.
30	L: On one piece. Of graph paper.

I propose that Episodes 1 and 2 provide an important demonstration of the pre-existence within the Lauren/Karen dyad not just of conjoint subjectivities with respect to the meanings of the mathematical terms they exchange during their interaction, but also the pre-existence of established ways of working as a dyad (that is, of social and mathematical practices). Lauren's contributions to a negotiative event are frequently interpretive or explanatory with respect to the task or a particular procedure (for example - Episode 1: Turns, 12, 31, 35, 39, and 46: and Episode 2: Turn 4). Karen, on the other hand, advances the discussion by asking many questions of Lauren (and, implicitly, of herself), and by verbalizing calculations (Episode 1: Turns 15, 17, 28, 37, and 49: and Episode 2: Turn 24, provide good examples of this).

The co-construction of these patterns of dyadic practice involves the iterative refinement of the conjoint subjectivities of Lauren and Karen, just as is the case for mathematical meanings. However, in this case, the matter of the meanings relates to the form (rather than the substance) of the individuals' actions and statements, and the product of this process of iterative refinement is a body of dyadic practice specific to the Lauren/Karen dyad. The teacher's subsequent characterization of the interactions as "Lauren helping Karen" seems a misrepresentation (and oversimplification) of a very effective and quite complex form of dyadic practice. The agency for the promotion of learning resides in the social interaction of Lauren and Karen, and by implication in those persons, present or absent, who contributed to the formation of the setting in which the interaction occurs.

The theory of learning that emerges is one that starts from the social situation of the individual in interaction with others, but which accords a significant role to the individual's interpretive activity. Particular significance is attached to social interaction, and learning proceeds by the iterative refinement of intersubjective [conjoint] understandings that include social, scientific and mathematical meanings, as well as values and modes of collaborative practice. These understandings are enacted as a progressive increase in valued practice, including the appropriate utilisation of technical language (see Clarke, 2001).

In Summary

In reconceiving classroom activity as *instructed learning* our goal becomes the creation of classroom settings that optimally afford the interrogative, negotiative and reflective practices that our recent research associates with sophisticated academic/classroom practice as well as promoting increasingly consistent, accurate, sophisticated and successful participation in the practices of the discipline with which the classroom is associated (be it mathematics, geography or literature).

Anderson, Reder and Simon (1997) in their published debate with Greeno (1997) make the comments that "Much of the argument is about language" and "We will address these criticisms, which seem to be more linguistic than substantive" (Anderson, Reder, & Simon, 1997, pp. 18-19). The issue of the language in which we frame our theories *is* a substantive one[9]. As will be evident from the theme of

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[9] Consistent with my assertion in the introduction to this paper, excerpts from poetry and literary fiction can provide examples of particular theoretical positions, expressed with a richness not always found in technical/academic writing. I have already employed the writing of Wallace Stevens in this way. In this spirit, I quote from a work of fiction by Gene Wolfe: "Certain mystes aver that the real world has been constructed by the human mind, since our ways are governed by the artificial categories into which we place essentially undifferentiated

this paper, I am suggesting that the form in which we have conceived of classroom practice (in English, at least) has been severely constrained by the vocabulary at our disposal. Anderson, Reder and Simon (1997, p. 19) bewail the lack of "consistent and objective definitions of key terms" in the literature on situated learning. The development of such a common vocabulary by which we might discuss learning and teaching (or *instructed learning*, as I would have it) is an admirable goal. However, the aspiration to consistency of referent in relation to such terms may be difficult to achieve. The goal of objectivity of definition is untenable (unless the context is severely constrained or precisely specified)[10].

One of the entailments of working in the social sciences is the obligation to recognise the social-situatedness and cultural specificity not just of the matter of our research but of the language in which we frame our accounts of that research[11]. If, as I argue, language places substantial constraints on our theorising, it follows that the benefits of reviewing and reconstructing that language are commensurably significant.

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things, things weaker than our words for them" (Wolfe, 1980, pp. 11, 12). This offers a powerful representation of one version of the radical constructivist position.

[10] Mishler (1990) is quoted to good effect in this regard by Moss (1994). Mishler situates "reliability, falsifiability, and objectivity" within social discourse as "rhetorical strategies . . . that fit only one model of science" (Mishler, 1990, p. 420, as cited in Moss, 1994, p. 10)

[11] The extent to which research accounts are directly reflective of their theoretical orientations can be seen clearly in Simon and Tzur's (1999) use of "accounts of practice." Such a phrasing bears superficial similarity of expression to the terminology of this paper, yet the practice referred to is "teacher practice." Simon and Tzur propose "account of practice" as a suitable unit of analysis for the examination of the interrelationship of teachers' knowledge and their practice. Simon and Tzur's research program is coherent and entirely consistent with their theoretical stance; it presumes, offers and studies a very different vision of the classroom from the integrative perspective of *instructed learning*.

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