CHARACTERISING ON-LINE LEARNING ENVIRONMENTS

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ABSTRACT

We propose a central feature of on-line learning environments as *transactive communication* – where participants respond to and build on to each other's contributions, developmentally toward a mutual outcome. This differs from the more didactic, or at least tutor-controlled, dialogue that takes place in traditional learning environments. In the on-line setting, therefore, communication is particularly perceived to be an essential part of the learning process. This provides a strong motive for research to determine its characteristics and functions. The need for good systems for describing and understanding the *contexts* of learning activity is also crucial. Who is teaching what to whom and why – and why they are there to learn – is of course critical for the understanding and from this the prediction of good pedagogical strategy. At the micro and macro levels of analysis, then, we need to review, revise, develop and implement tools for research to inform good development of practice.

This paper depends upon ongoing work from all its authors. Different aspects have been presented and discussed across a range of settings, virtual and physical, over recent months as our research refines or revises our ideas. New work for this symposium presentation reports on our testing of theoretical frameworks and ways of applying them for good understanding and development of on-line learning communities. The paper provided here outlines our developing theoretical framework and methodological approach.

Keywords

communication, theoretical frameworks, socio-cognitive conflict, expert guidance, activity theory, situated participant reflection

THEORETICAL BACKGROUND

Research into collaborative learning within school and post-compulsory education, within distributed and face to face settings, provides us with some understanding of both the character and function of communication within learning situations. Further work is still required to uncover fully the circumstances that *promote* productive interaction, which is clearly critical in the development of optimal on-line learning environments. What has been achieved so far does, however, provide the basis for conducting research in a coordinated fashion. By sharing a common language, there is the possibility of integrating data across research initiatives.

Work over the past decade gives useful models of the types of dialogue that are important, initially derived from the theories of Piaget (1932) and Vygotsky (1978) and their followers. Subsequently, it has been expanded via empirical research on interaction and learning (Azmitia & Perlmutter, 1989; Cazden, 1988; Howe, Tolmie, Duchak-Tanner, & Rattray, 2000; Tolmie, Thomson & Foot, 2000). We have a well-developed framework that is grounded in both theory and data. At the core, are two basic processes: *socio-cognitive conflict* and *expert guidance*.

Socio-cognitive conflict

In the 1930's, working with children, Piaget proposed that whilst learning was a matter of individual cognitive adaptation to the world, there might be an important role for discussion between peers. In particular, where there was disagreement over expectation or interpretation of some event, this would cause as much conceptual conflict as actually experiencing events that departed from expectation. In both instances, this conflict would provoke a process of reflection and conflict reduction. Children would attempt to find improved conceptualisations that accounted for the apparent discrepancies. In this way, learning would take place.

Subsequent work by Doise and Mugny (1984) suggested that this process of 're-equilibration' might not require post-event reflection. It could occur through joint attempts to construct new conceptualisations at the point of disagreement. More recent work indicates that both processes occur (Howe, Tolmie, Anderson & Mackenzie, 1992a; Howe, Tolmie & Rodgers, 1992b; Williams & Tolmie, 2000). Furthermore, factors such as age, familiarity with subject matter, friendship, etc are significant. Basically, the more familiar participants are with resolving conflict in given circumstances, the more likely they are to negotiate some improved agreement 'on the spot'.

This later work pinpoint specific types of interactional turn as symptomatic of learning. Indeed, demonstrations that they are predictive of actual learning outcomes have validated their importance. The types of interactional turn are:
- proposal of idea,
- disagreement,
- justification,
- negotiation or construction of new explanation,
- testing of idea against novel circumstances,
- feedback 'from the world'
- connecting new experience to one previously discussed.

Expert guidance

According to Piaget, conflict and discussion of this productive kind can only occur among peers. When there is an imbalance of status, the less expert individual simply defers to the person with more expertise. Vygotsky (1978), however, proposed that under these circumstances, a different type of learning dialogue occurs within the zone of proximal development.

Vygotsky theorised that learners could perform at a higher level when working with more expert others who help direct activity. Learning thus occurs via the appropriation and internalisation of the 'moves' initially performed under guidance. Bruner (1985) and Wood (1986) suggest that this might take place through a process of scaffolding or contingent support.

Recent research confirms the existence and impact of this kind of 'tutor-ly' dialogue (Howe et al, 2000; Tolmie et al, 2000). It goes on to specify the following types of interactional turn as predictive of learning:
- requests for suggestions of move,
- suggestions themselves,
- prompts for consideration of other information,
- explanations of prompts,
- questions,
- feedback targeted to need
- instructions.

The level of sophistication of productive interactions (involving either peers or with experts) is likely to vary according to the experience of participants. Adult learners are more likely to engage in elaborate processes of cross-questioning and co-construction, and even adoption of tutor behaviours.

Community and culture

One further strand of behaviour in collaborative learning contexts, noted as important by socio-cultural, activity, and situated learning theorists (e.g. Crook, 1994; Leont'ev 1981, Engestrom, 1987; Wenger, 1998) relates to what might be called the 'social glue' of interaction. This includes strategies employed in managing and maintaining learning community activity. At the simplest level, this can be reduced to 'chairing' behaviour: interactional turns aimed at specifying what should happen when, and who is responsible for this. At a more sophisticated level, this might involve managing the process of uncovering and resolving conflicts, without provoking outright hostility.

These behaviours have been less researched than those relating to socio-cognitive conflict and scaffolding, but appear to be highly sensitive predictors of learning outcomes. For instance, overmuch routine chairing can lead to negative outcomes (Tolmie et al, 2000). At the more sophisticated level, interactions aimed at generating shared community views of activities and the appropriate conceptual backdrop to this, especially at an early stage, appear crucial to the success of collaborative outcomes (Lewis, 1997). There is also good evidence to suggest contextual variation in the incidence and effectiveness of these interactions, depending on for example the make-up of the community, or the channel of communication being used (mediated is less likely to be successful than f2f).

Theoretical perspectives from socio-cultural frameworks go beyond interactive learning behaviours and 'productive dialogue' to engage critical issues of *context, culture and resourcing* of the learning group. Activity Theory-based studies of 'distributed learning' over recent years combine a range of approaches to make sense of, rather than control for, the complexity of human learning mediated by information and communication technologies (Russell 2002). Activity theory (Leont'ev, 1978, 1981) examines behaviour in terms of three levels of description: activity, action, and operation. <u>Activity</u> is the superordinate unit of analysis, and characterises behaviour as involving a <u>subject</u> using <u>tools</u> (including writing and speech) to pursue an <u>object</u> (a global intention or purpose) For instance, presenting this paper constitutes an activity, and my understanding of the object of this exercise and how to go about it (what tools to use in what way) is integral to its performance.

One aspect of this understanding is knowledge of <u>actions</u> directed at specific goals which need to be taken to move toward the overall object. Actions are usually conscious, but comprise relatively unconscious <u>operations</u>, through which they are carried out. Thus if the object of the present activity is presenting this paper, making this current point is a contributory action, and articulating the words necessary to do so is a constituent operation. It is important to emphasise that it is the perceived activity which organises actions and operations, and gives them meaning.

The informing principle for us here is that the lynchpin of a successful learning support system, is *grounding*, shared understanding by all involved at the 'chalkface' - teachers, learners and support staff, in the collaborative effort for individual learning. The central concern here is to promote a conceptual development from 'learning network' to 'activity system' (Engestrom 1996, following work by Leont'ev, eg 1978, see also Scribner 1984 and Cole 1996). In the context of conferencing technologies, an activity system could comprise: the subjects or actors (teachers, learners, support staff – and what they bring with them in terms of experience with learning task, learning environments, their motivations, their personal and educational/professional contexts…) ; the object(s) of the activity (task goals, role of task in larger course goals, as perceived by different actors); the mediating tools of the activity (v-c equipment, CMC network, phone, voice, keyboard); the community (here, the learning community); the division of labour (say task roles and responsibilities of actors in context); and the rules, norms, conventions of appropriate action (lecturing, tutoring, assessment etc.).

Key to our work is the usefulness of an activity system as *context* – not in the sense of surroundings, but more as a functional system of social-cultural interactions. Russell (2001) suggests an understanding of context not as container, but as weaving loom…

> Michael Moore's theory of *transactional distance* (see Moore and Kearsley 1996 ch. 10 for a recent overview) offers another useful framework for understanding, which might also support prediction. Broadly, this relates to three aspects of the learning environment:
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> > *communication* between teacher and learner, between learners and learners, and the extent which this is resourced and supported in a given learning community;
> >
> > *structure* – this of the pedagogy, rather than the environment – the extent to which the learner is guided, prompted, 'programmed' toward the learning goal, the degree to which paths to understanding are prescribed and learning tasks ordered;
> >
> > *autonomy* – this aspect interdependent upon the others – the extent to which the participant has responsibility for his or her own learning.

IMPLICATIONS FOR THE INVESTIGATION OF ON-LINE LEARNING

Where does this leave us with respect to the investigation of productive communication in on-line learning environments? At the very least, these strands of research appear to provide a common framework or language for specifying the characteristics of on-line learning environments under different conditions. This is a crucial first step towards systematically discerning the influences associated with productive interaction. However, this is not sufficient in itself to move things forward, since we also need to agree how to use this framework i.e. a methodology.

Methodological approach

A common approach that formed part of a JISC funded project was the examination of on-line communication using a 'critical incidents' method (McAteer, Crook, Tolmie, Macleod, Musselbrook, Barrowcliff, 2000; McAteer, Tolmie, Crook, Macleod, & Musselbrook, 2002). This involved examining the communication records, but also collecting participants' recall of activities. The latter was stimulated by the presentation of communications records at researcher selected points of interest (e.g. tutor interventions) or else points identified by participants as being of significance. Analysis of communications is then based on both the direct records, and participant commentary on what they were thinking, feeling, or attempting to do at the given time.

The rationale was that the 'physical' record of communication is in itself too flat to be informative about the processes driving communication, effective and otherwise, in educational settings. Participants' commentaries are needed to make explicit the subjective effort after meaning that is central to the communicative process (cf. Clark & Wilkes-Gibb, 1986).

The precise format of how this approach might be used may need modifying according to the 'immediacy' of communication records. (For example, video of face-to-face communication is more immediate than records of computer mediated communication texts. The latter may need to be read through several times to generate the same impact.)

To carry forward the analysis of communication based on this approach, two systems are needed to analyse:
- communication records themselves,
- participants' reflections on and descriptions of the process.

Analysing communication records

In analysing communication records, there are both pragmatic and conceptual issues to be addressed. On the pragmatic side, messages need to be sampled (e.g. within threads at specific points), since the whole sequence is likely to be unwieldy, and then the analysis of these messages needs to be managed. A good approach could be to use software, such as NVivo, for the management and analysis of message texts. Texts are imported and elements coded as defined by a coding scheme. This makes coding more manageable and also allows subsequent reliability checks to be carried out in a straightforward fashion.

Coding communication records

This of course leaves open the question of what the coding scheme itself should look like. Taken together, the productive interaction elements referred to previously outline the types of communication that coding schemes dealing with learning environments ought to focus on. It would probably be mistaken to suggest that there is any single best formulation of such schemes: contextual variations will make it appropriate to work at a finer level of detail in some instances, whilst being less refined in others. In other words, coding schemes may vary from case to case, and need to be deliberated in relation to each – but all should be covered within the theoretical frameworks identified above.

In some instances, it will also be appropriate to relate coding of interactions directly to learning outcomes. This could include, for example, analysis of whether the frequency of certain types of communicative event, predicts grading or outcome of individual or joint products such as essays. This type of approach will serve to refine our understanding of the precise ways in which interaction generates learning. It could be used to investigate whether, for example, processes of co-construction have the positive impact that is supposed by teachers and researchers.

Analysing participants' reflections

As above, there are both pragmatic and conceptual issues to be considered. On the pragmatic side, one concern is how best to generate useful data in a form that is manageable for the purposes of analysis. Face to face or telephone interviews are possible, but since dialogue segments for text-bound communications need to be presented, and this can be done readily on-screen, there are possibilities for conducting the whole exercise on-line. This has the added advantage of saving time on transcription. One approach might be to use synchronous chat sessions between participant and researcher focused on selected messages from the communication archive. In this way, reflections are captured in a text form, ready for importing directly into NVivo, in the same way as the communication records themselves.

Regarding analysis of the content of participants' reflections, it seems logical to parallel the analysis of the communication records. There would therefore be a focus on the process of community construction and transfer of knowledge. The central concern must not, however, be so much what communications take place, but rather what drives and shapes these communications from the participant's viewpoint. It is useful to conceptualise communication as occurring between what Salomon and Perkins (1998) term 'learning entities' (groups and individuals), who are semi-autonomous agents, capable of making explicit decisions about their communicative behaviours, as well as reacting in a more intuitive fashion.

From this perspective, the issue for analysis is the extent to which participants are aware of the reasons for making particular interactional turns, and whether they do so as part of a deliberate strategy. This would include how far awareness varies from context to context i.e. what factors are involved in provoking it; and how far it relates to

variation in the types of communicative behaviours that occur (note the points above about increases in the sophistication – and therefore success – of communication with increasing experience).

WORK IN PROGRESS

At the micro level, work ongoing within our own research group (Chappel et al, this volume) draws upon a wide review of work related to the coding and representation of interaction within on-line learning environments to provide a set of descriptive categories which are grounded from the theoretical frameworks detailed above. Broad categories of description for communicative behaviours associated with socio-cognitive conflict, (convergence, divergence), with expert guidance (scaffolding, framing, dissemination) and with social management (facilitation, organization) have been derived. These have been applied to a small range of course conference archives and are now being tested more widely, for both on-line and face-to-face collaborative groups across different subject disciplines and learning contexts. Follow up interviews or, where suitable, focus group meetings are presenting learners and teachers with segments of archived records to situate participant reflection on episodes toward planned learning outcomes.

At the macro level, frameworks drawn from Activity Theory and Transactional Distance Theory provide larger units of analysis, 'theoretical lens' (Russell 2001) from different directions and at different levels of magnification to provide critical context and resourcing information against which to examine communication and reflection data. Work here is still at the review and framework development stage, testing through the on-line learning environments available to the research group.

Our symposium presentation will report pilot work towards implementation of both levels in the wider educational community.

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