

Learning Issues in Problem-Based Learning: Situating Collaborative Information Seeking

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Abstract

Information seeking is typically situated within an interpersonal and problem-solving context. We have examined the process by which a group of medical students engages in collaborative information seeking within a pedagogy known as Problem-Based Learning (PBL). Here, the identity of *learning issues* (LIs) persists through successive phases of recognition, researching, reporting, and reflection. These explicit learning issues help to structure the interplay of individual and group efforts. A detailed theory and effective procedures have been developed to guide skilled tutors in coaching groups through collaborative information seeking around learning issues in face-to-face meetings. We are now exploring computer support to enhance this particular conception of knowledge seeking and to enable distance collaboration. The introduction of technology into PBL has implications for all four phases of the processing of LIs. Collaborative information environments offer the potential for integrating knowledge from different phases and supporting aspects of collaboration. We use a metaphor of *interpretive perspectives* to help individuals and groups create multiple dynamic representations of shared knowledge to meet various interacting needs.

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Learning Issues and Collaborative Information Seeking

We begin by arguing that collaborative information seeking needs to be understood broadly, not simply as a process of information retrieval, but rather as situated within a larger activity system. The encompassing activity includes the circumstances under which the need for the information originally arose, the means by which the task of seeking the information was organized, and the use to which the retrieved information is subsequently applied. It is our position that to focus on or privilege any one component of this elaborated activity produces a distorted and reductionist picture of the underlying phenomenon.

To provide flesh to this discussion, we describe an instantiation of collaborative information seeking in a setting of adult education. We examine the means by which a particular group of adult learners (medical students) come to recognize deficiencies in their collective understanding and redress them. In the collaborative method of teaching in which they are working, these agenda items that structure their self-directed study are termed *learning issues* (LIs). LIs serve to index and structure the collaborative problem-solving process. They provide continuity over time and across meetings, and are invariants that link phases of individual and collaborative effort. LIs provide a means of accountability in a method that does not presuppose a fixed curriculum and is driven by the learners' needs and interests. They are, therefore, an institutionalized mechanism for inquiry and learning in settings of joint problem solving and as such provide a useful model for studying and discussing collaborative information seeking.

Phases of Processing a Learning Issue

The teaching method we will describe is known as Problem-Based Learning (PBL). It incorporates aspects of collaborative, learner-directed, and case-centered teaching (Koschmann, Kelson, Feltovich, & Barrows, 1996; Barrows, 1994). Though PBL is currently used in a variety of domains and educational levels, our work has focused on a particular implementation of PBL used in the first two years of a medical school curriculum. In this setting, students gather with a faculty tutor/coach to discuss selected clinical cases drawn from actual practice. Topics that come up in these discussions for which background research is required are recorded by the group as LIs. The processing of these items can be roughly divided into four phases: *recognition*, *researching*, *reporting*, and *reflection*. We will describe each in turn.

Recognition. It is the policy of the PBL implementation that we studied that LIs are always formulated by the learners, not dictated by faculty. As a practical matter, a topic of discussion must satisfy three conditions to become a LI: there must be a recognizable knowledge deficiency, the learners must see the deficiency as relevant to or necessary for eventual medical practice, and there must be consensus about the timeliness of undertaking the study (Koschmann, Glenn, & Conlee, 1997; in press). Strategic and tactical concerns, therefore, have considerable bearing on

the question of whether or not to nominate a topic as a LI. The discussions leading to the production of a LI afford opportunities to articulate new knowledge, both in the sense of joining new conceptual understandings to old and of providing a basis for collaborative sense-making (Koschmann & LeBaron, 1998). When consensus is achieved in the group that an item should be treated as a LI, it is recorded on a white board along with data from the case and group-generated hypotheses about the basis of the patient's problem. What is actually posted on the list of LIs for the group, however, is just a token, meaningful only to the group and only in the context of the case under study.

Researching. While recognition of a LI requires coordination in real-time, the researching of LIs takes place asynchronously outside of formal meeting time. Coordination of this phase of the activity, therefore, has special requirements. The effort of investigating the list of LIs is divided among the members of the group. There are clear pedagogical benefits to having learners jointly construct a search strategy, assemble input from multiple sources, and collaboratively interpret their findings. Loosely-coupled collaborative researching occurs naturally to some degree in PBL, but it is not a formal part of the method. It should be noted that the object we term a LI is merely a token, a sign indexing a perceived deficiency in understanding. As individual learners begin to explore the topic using print, electronic, and human resources, the scope and nature of the issue may change for them. However, absent any formal means for communicating among members of the group between meetings, it is not possible to renegotiate the collective understanding of the LI.

Reporting. When the group reconvenes after a period of self-directed study, the findings of each of the individual members are reported back to the other members of the group. It is an important requirement of the method that the newly acquired information be tied back to the case under study. The list of hypotheses about the current case is reviewed in light of the research that members bring back to the group and the case is generally rethought in the context of this new information (Glenn, Koschmann, & Conlee, in press).

Reflection. As a part of the process, students in a PBL curriculum engage in two types of reflection with respect to their processing of a LI. First, they discuss and evaluate the adequacy of the resources that were used as a basis for researching the issue. Second, the students both self-assess and are assessed by their peers with respect to their participation as self-directed learners. This reflective component of the process contributes to the learners development as life-long or "termless" (Koschmann, in press) learners.

Computer-Supported Problem Based Learning

One area of interest for us has revolved around the question of the roles that technology might play in supporting PBL (Koschmann et al., 1996). There are many directions in which this

can be explored, but we will limit our discussion here to the replacement of the white board with an electronic analog and its implications for the processing of LIs.

Microgenetic studies of face-to-face PBL meetings (Koschmann et al., 1997; in press) would suggest that pedagogically important activities such as *LI recognition* must, by virtue of their highly-interactive character, take place in real-time. The utilization of various forms of communication technology (e.g., chat, voice-only, video conferencing) may make it possible to conduct synchronous "meetings" in which the participants are geographically distributed, assuming that all have access to a shared representation of the boards. Introducing a digital replacement for white board, therefore, may allow us to relax the constraint that participants be co-located. Careful research is called for here, however, since past studies of PBL interaction have documented the importance of gaze, gesture, and shared inscription in face-to-face meetings (Koschmann & LeBaron, 1998; Lemke, in press).

Replacement of the white board could produce some benefits to the *researching* of LIs, as well. One valuable feature of the digital emulation of the white board is that it can support collaborative learning both within and between meetings. Appropriately designed software (e.g., Stahl, 1998) could also support a more tightly-coupled version of collaborative information seeking. A digital version of the board may supply a new level of structure to the group's record keeping and make explicit links between the LIs and the emerging data and theories of the case under study. We are exploring the use of *interpretive perspectives* (Stahl, 1993; Stahl et al., 1998) on shared information space to help individuals and groups structure displays to meet their personal or shared needs. Perspectives is a filtering mechanism to produce malleable representations of shared knowledge, dynamically configured for an individual or group.

During the *reporting phase* of LI processing, the information sharing software can be used to compare earlier discussions of hypotheses with the research phase data to generate revised hypotheses. The ability to retrieve, arrange, and display detailed information from each phase of the PBL process would greatly enhance the face-to-face collaborations which currently rely on scraps of paper, ephemeral marks on a white board, and overloaded human memories.

Finally, having a more structured shared representation of the case under study would support *reflection* on the process in important ways. The "board" would not only contain a list of LIs as decontextualized tokens, but also links to theories and lists of resources used, providing a trace of information seeking activities for all members of the group. This would not only provide a valuable record for later study, but also a useful object for self- and peer-assessment.

We are clearly still in the very early stages of developing these collaborative information environments. We look forward to the comments and suggestions of other workshop participants on the possibilities of developing environments to support this form of collaborative information seeking.

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