

Dewey's Contribution to a Standard of Problem-Based Learning Practice

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ABSTRACT: Although we already have many theory-based definitions and procedural descriptions of problem-based learning (PBL), we currently lack anything that could serve as a practical standard, that is an account of the critical practices that make an instructional activity recognizable as PBL. I argue here that the notion of *inquiry* developed in the writings of the American educational philosopher John Dewey could be useful in illuminating the features of observed interaction that would be relevant to a description of instructional practice. An example is provided based on a segment of recorded interaction in a tutorial group in a problem-based curriculum at a U.S. medical school. Within this segment, a conflict emerges among the students with respect to their planned handling of a case. Through their discussion, the students determine what they would need to know in order to resolve the conflict, or in Dewey's words to make an "indeterminate situation determinate." The paper calls for additional work to produce a large corpus of fine-grained descriptions of instructional practice from a variety of PBL implementations. Such a collection would provide a basis for the eventual development of a PBL standard.

Keywords: problem-based learning, Deweyan inquiry, interactional analysis

INTRODUCTION

In a newly published book, Bowker and Star (1999) make a distinction between a classification and a standard. A *classification*, they write is "a spatial, temporal, or spatio-temporal segmentation of the world" (p. 10). A *standard*, on the other hand, is "any set of agreed upon rules for the production of (textual or material) objects" (p. 13). Classifications and standards pervade our lives in ways that are often transparent to us. As Bowker and Star elaborated, the two types of phenomena are closely related. Every standard, for example, generates an implicit classification scheme based on compliance or failure to comply with the standard. All classification schemes, on the other hand, must eventually be standardized lest they be "ad hoc, limited to an individual or local community, and/or of limited duration" (p. 15).

What we need at the moment is a practical standard for problem-based learning (PBL). Such a standard would be the logical starting point for any effort to assess PBL as a teaching method, since until we have found a reliable means of describing what we mean by PBL, any efforts to formulate guidelines for instructional practice will be without foundation. Any sort of standard, of course, must start with a description of the phenomenon of interest. With regard to PBL, however, there are several different of types of description possible and not all are equally useful for developing a standard.

One category of description could be termed *theory-based*. Definitions of PBL expressed in terms of abstract theories of pedagogy and learning abound within the educational literature (e.g., Koschmann, Kelson, Feltovich, & Barrows, 1996; Norman, 1988; Norman & Schmidt, 1992; Schmidt, 1983). Such forms of description are useful for positioning an instruction innovation with regard to other pedagogical theories, but are not adequate for defining a practical standard. To see why, let us examine an example of one such definition offered by Koschmann et al. (1996). By this formulation, PBL was defined as "a collaborative, case-centered, and learner-directed method of instruction" (p. 96). *Collaborative instruction*

was defined within this formulation as "methods [of learning] in which teachers and students abandon their traditional classroom roles in favor of more collegial roles as collaborating learners" (p. 114).¹ Similarly, *case-centered instruction* was defined as "the class or methods in which teaching is primarily devoted to the study of authentic problems or cases ... [s]pecifically excluded would be any curricular model that is organized around discipline subject matter, delivering abstracted concepts or mode[ls], with cases merely used as exemplars" (p. 92n). Finally, *learner-directed method* was described as instruction in which "the student must identify what he or she needs to know, what resources are needed, and the most effective and efficient use of those resources" (p. 116).

Though this nested set of definitions may be helpful in setting out how PBL is related to other instructional methods, it is expressed at too high a level of abstraction to serve as a practical standard. When it comes down to evaluating an actual implementation many questions with respect to the design and enactment of a curriculum are left unanswered (e.g., Can lecturing be employed and the implementation still be considered "collaborative"? What defines an "authentic problem or case" in case-centered instruction? How is learning to be assessed in a way that is consistent with a learner-directed method of instruction?) Definitions framed in terms of abstract theories of learning and instruction, as a result, are simply too loosely specified to serve the task of classifying actual implementations.

A second type of description found in the PBL literature are *procedural*. Procedural descriptions attempt to define a method algorithmically by describing the steps or components by which the method is accomplished (e.g., Barrows, 1988, 1994; Koschmann et al., 1996; Schmidt, 1983). This is useful in providing an orientation to newcomers. Unfortunately, procedural descriptions, like theory-based descriptions, do not provide an adequate basis for developing a standard of practice. Take as one example the procedural description of PBL offered by Koschmann et al. (1996). By this account, PBL is described as having five basic components: Problem Formulating, Applying Knowledge, Self-Directed Learning, Abstracting, and Reflecting. These components were described as moments or phases within a contingently-organized process rather than as rigidly-fixed sequential steps. A list of the resources (e.g., a specially-formatted whiteboard, a paper-based case simulation) used within tutorial meetings was included with the description.

The description chosen here as an example is obviously a cursory one. More detailed procedural descriptions have been provided elsewhere (Barrows 1988; 1994). The problem, however, with any attempt to specify PBL procedurally. Even if we all agreed on what that procedure was to be (which apparently we do not), any such description will inevitably be incomplete. As a result, what takes place in a PBL tutorial meeting owes as much to "situated improvisation" (Suchman, 1987) as it does to any published description of method. Students and tutors are confronted on every turn with what Suchman [1987] has referred to as "the problem of the instruction follower" (p. 101), that is the problem of how to translate abstract instructions into concrete action. Participants within a PBL meeting, for example, must construct their own interpretations of what it means to "formulate a problem" or to "apply their knowledge." To create such interpretations, they do not begin by asking themselves, how shall we proceed to undertake some particular prescribed action? Instead, their interpretations of the prescribed actions are negotiated interactionally on a moment-to-moment basis. What needs to be explicated, therefore, are not the abstract instructions that tutors and students follow (or fail to follow), but rather what they do when they say they are doing PBL.

This calls for a new type of description, one different from theory-based and procedural descriptions. What is needed is a form of *practice-based* description. Such a shift raises questions, however, about the scope and extent of an adequate description. In observing and describing any practical situation, the list of features that could be described is indefinitely large. To provide a useful account of the relevant practices that make an instructional activity recognizable as PBL, therefore, we need a guiding framework within which to produce useful description. The central claim of the current paper is that some clues for constructing one such framework can be found in the work of the educational philosopher John Dewey. I will begin the development of this argument, therefore, by summarizing some features of Dewey's theory of inquiry.

DEWEY'S THEORY OF INQUIRY²

The notion of inquiry appears in many places in Dewey's work, though he began to refer to it using that term only in his later writings. In *The Quest for Certainty* (1929/1988) Dewey asserted, "Thinking is objectively discoverable as that mode of serial responsive behavior to a problematic situation in which transition to the relatively settled and clear is effected" (p. 181). In *How We Think*, a text written for schoolteachers, Dewey (1933/1989) later elaborated on what he termed "the five phases of reflective thought" (p. 200). Though sometimes understood by readers as a linear process, Dewey made clear that these are "phases" not steps. The overall process is more recursive than sequential and the order in which the phases occur (and reoccur) is thoroughly contingent.

It was in *Logic: The Theory of Inquiry* (1938/1991) that Dewey provided his most extensive description of this process. When introduced, Dewey's theory of inquiry came under attack from several of his contemporaries, most notably Bertrand Russell (viz., Burke, 1994). One of Dewey's most succinct descriptions of his theory of inquiry, in fact, was written in response to Russell's criticisms. Dewey (1941/1991; quoted in Burke, 1994) wrote:

[I]nquiry begins in an *indeterminate* situation, and not only begins in but is controlled by its specific qualitative nature. Inquiry, as the set of operations by which the situation is resolved (settled, or rendered determinate), has to discover and formulate the conditions which describe the problem in hand. For *they* are the conditions to be "satisfied" and [are] the determinants of "success." Since these conditions are existential, they can be determined only by observational operations; the operational character of observation being clearly exhibited in the experimental character of all scientific determination of data. (Upon a non-scientific level of inquiry, it is exhibited in the fact that we *look* and see; *listen* and hear; or, in general terms, that a motor-muscular, as well as sensory, factor is involved in any perceptual experience.) The conditions discovered, accordingly, in and by operational observation, constitute the *conditions of the problem* with which further inquiry is engaged; for data, on this view, are always data of some specific problem and hence are not given ready-made to an inquiry but are determined in and by it. (The point previously stated, that propositions about data are not cases of knowledge but means of attaining it, is so obviously an integral part of this view that I say nothing further about it in this connection.) As the problem progressively assumes definite shape by means of repeated acts of observation, possible solutions suggest themselves. These possible solutions are, truisitically (in terms of the theory), *possible* meanings of the data determined in observation. The process of reasoning is an elaboration of them. When they are checked by reference to observed materials, they constitute the subject matter of *inferential* propositions. The latter are means of attaining the goal of knowledge as warranted assertion, not instances or examples of knowledge. They are also operation[al] in nature since they institute new experimental observations whose subject matter provides both tests for old hypotheses and starting points for new ones or at least for modifying solutions previously entertained. And so on until a determinate situation is instituted.

(p. 181–182)

I wish to highlight four features of this description.

Many theories of learning posit an initial state of breakdown. Piagetian accommodation, for example, is initiated when a conflict occurs between current evidence and previously held belief. Breakdown also plays a key role in other conceptualizations of learning (Koschmann, Kuutti, & Hickman, 1998). Dewey begins the passage above by stating, "Inquiry begins with an indeterminate situation," that is with a situation that is experienced by the learner as problematic or troublesome. The term *situation*, however, should not be misunderstood as referring simply to a material context or environment. Rather, it should be apprehended as a unified matrix of which the learner is an integral component (Burke, 1994, p. 22 and passim). It is the situation understood in this way that becomes problematic. When Dewey says that the situation has become "indeterminate," therefore, he means more than simply that the observed participants experience a psychological state of puzzlement. Inquiry, for Dewey, is an "outdoor fact" (Hickman, 1998, p. 172).

Second, Dewey states "data ... are always data of some specific problem and hence are not given ready-made to an inquiry but are determined in and by it." His point here is that what counts as data cannot be determined in advance, for example by a curricular developer, but is determined within the situation by the learner/inquirer(s). It follows from this that what is to count as the 'problem' itself is indeterminate, that is it is a negotiated and interactional achievement. Dewey wrote elsewhere (1938/1991), "inquiry is a progressive determination of a problem and its possible solution" (p. 113). He elaborated, "A problem is not a task to be performed which a person puts upon himself or that is placed upon him by others" (p. 111).

Not only what is to count as 'the problem' is situationally determined, but, as Dewey wrote, "possible solutions are ... *possible* meanings of the data determined in observation." Underlying Dewey's description of inquiry is an orientation to how meaning is constructed within a socially- and materially-defined situation. In *Logic: The Theory of Inquiry* (1938/1991) Dewey wrote: "the meaning which a conventional symbol has is not itself conventional. For the meaning is established by agreements of different persons in existential activities having reference to existential consequences" (p. 53). He went on, "words mean what they mean in connection with conjoint activities that effect a common, or mutually participated in, consequence" (p. 59). The meanings of words, actions, and observations, for Dewey, therefore, are not fixed, but are instead continuously re-negotiated within the contexture of active inquiry.

This point is closely related to a fourth and final observation concerning Dewey's description of inquiry. He wrote: "[inferential propositions] are the means of attaining the goal of knowledge as warranted assertion, not instances or examples of knowledge." Dewey's notion of warranted assertion arose out of his nonfoundationalist philosophical stance. In other writing (1938/1991) he stressed that, "[t]here is no such thing as a final settlement, because every settlement introduces the conditions of some degree of a new unsettling" (p. 42). His position was stated even more pointedly in *The Quest for Certainty* (1929/1988) when he wrote:

Attainment of the relatively secure and settled takes place, however, only with respect to *specified* problematic situations; quest for certainty that is universal, applying to everything, is a compensatory perversion. One question is disposed of; another offers itself and thought is kept alive. (p. 182).

We have used the expression *termless learning* to refer to learning that never ends and is always subject to reappraisal (Koschmann et al., 1996). 'Termlessness', then, is an ever present feature of Deweyan inquiry (Koschmann, in press).

In *Experience and Education* (1939/1991), Dewey wrote, "the immediate and direct concern of an educator is ... with the situations in which interaction takes place" (p. 26). We turn now, therefore, to an attested example of instructional interaction to demonstrate how Dewey's notion of inquiry, as described here, can be used to provide an analytic lens for observing and describing PBL practice.

WHAT WOULD BE THE RISK?

In the sample of interaction to be described here, a group of second-year medical students and a faculty tutor are discussing the case of an adolescent, female patient with pelvic inflammatory disease. This segment of interaction occurs early in the group's second meeting devoted to discussing this case. There have been several previously published accounts of this of this particular strip of interaction (Koschmann, Glenn, & Conlee, 1997, 2000; Koschmann & LeBaron, submitted).³

In the fragment, a conflict emerges when one student ("Joel") asserts that a CT-scan is standard practice when abdominal abscesses are suspected. A second student ("Patrick"), however, raises concerns about the risks involved in exposing a young (and potentially pregnant) patient to radiation. This clash of two strongly held beliefs (i.e. one should comply with standard clinical practice; radiation exposure should be avoided, especially in potentially pregnant patients) provides the source of breakdown in this situation and is the catalyst for the inquiry that follows. The dispute between Joel and Patrick, then, marks the beginning of an episode representing "the controlled or directed transformation of an indeterminate situation

into one that is so determinate in its constituent distinctions and relations as to convert the elements of the original situation into a unified whole" (Dewey, 1938/1991, p. 108). Dewey's notion of inquiry, therefore, provides both with a frame of analysis and a means of conceptualizing what we see here.

The term *problem* is often used in the PBL literature to refer to the case or task which the tutorial group is directed to perform. This is very different from the sense in which Dewey used the term, however. He used it to refer to situations that were "instances or episodes (or 'fields') of disequilibrium, instability, imbalance, disintegration, disturbance, dysfunction, breakdown, etc." (Burke, 1994, p. 22). Within this fragment, we find a choice example of the "progressive determination of a problem and its possible solution" (Dewey, 1938/1991, p. 113). Careful examination of the transcript reveals that what counts as the problem is continuously being negotiated and re-specified by the participants (Koschmann et al., 2000). There is rich behavioral evidence that the students experience this situation as authentically problematic and uncertain. Their utterances are suffused with restarts, self-repair, and hesitation. As Crowder and Newman (1993) described, learners frequently employ iconic gestures in situations in which their "conceptual glimmerings ... outstrip [their] scientific vocabulary" (p. 371) and we see examples of elaborate gestural ensembles performed by the students within this segment (for a description see Koschmann and Lebaron, in press).

A key piece of information apparently not available to the students at the time of this discussion, is the amount of radiation exposure received during a CT-scan. At a point later in the discussion, one student ("Jackie") states "Why don't we just put that up as a learning issue?", that is as a topic to be researched outside the group meeting. Another student complies by recording "CT vs. Xray risks" on the whiteboard. The string "CT vs. Xray risks" would probably not hold a lot of meaning for someone who had not observed or participated in the discussion that led up to this label being attached to the learning issue. One could argue that the meaning that this label holds for the students in the tutorial was accrued through the observed interaction.

We also see evidence here of the participants treating knowledge as termless (Koschmann, in press) or, in Dewey's terminology, as warranted assertability. Coach's challenge to Joel (line # 92), "How sure are you on a scale of zero to ten?" treats knowledge not as justified true belief, but rather as something more nuanced and defeasible. To better understand how the learners themselves treated their knowledge, we would also have to look beyond this segment to examine how they researched the learning issue and how they incorporated their new understanding in subsequent problem-solving. The segment, therefore, shows the origins of an instance of Deweyan inquiry, but not all aspects of the process are made visible to us here.

I attempted to demonstrate here the ways in which Dewey's notion of inquiry can be helpful in illuminating some features of a situation that might be relevant to a description of PBL practice. In the process, I have partially produced an example of one such description. Much additional work is required, however, to document the practices both of this group and others. The eventual goal would be to produce a large corpus of such descriptions supported with audio and video recordings from different sites and PBL implementations (Koschmann & MacWhinney, in press). Such a collection would provide a basis for an open dialog pertaining to the essential features that make an instructional activity recognizable as PBL. This list of features, in turn, could presumably serve as classifier rules constituting a standard as described by Bowker and Star (1999).

CONCLUSION

The research literature on PBL has largely focused on the instructional effects of PBL as a form of educational innovation (cf., Albanese & Mitchell, 1993; Berkson, 1993; Colliver, 2000; Vernon & Blake, 1993), with a certain amount of controversy as to what should serve as an appropriate dependent variable. Relatively little attention has been paid to the independent variable, namely what participants actually do when they say they are doing PBL. This paper seeks to redirect the efforts of the PBL research community by proposing a new program of research. It joins other recent publications (Hak & Macguire, 2000; Kelson & Distlehorst, 1999) in pressing for the development of a clearer specification of PBL practice.

A proposal for how such a specification could be constructed has been provisionally provided here. It calls for fine-grained descriptions of participants' interactions and the development of carefully warranted interpretations of observed activity. Whether the reader agrees with this proposal or not, however, is of less importance than the recognition that the development of *some* standard of practice is the highest-priority issue facing this research community today. If problem-based learning goes the way of earlier failed efforts to reform instructional practice, it will not be because of its detractors; rather it will be the result of our own failure to adequately articulate what it means to *do* PBL.

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¹ Other treatments of *collaborative learning* can be found in Baker, Hansen, Joiner, and Traum (1999), Koschmann (1996), and in the Kelson and Distlehorst (2000) chapter.

² I would like to acknowledge Jeremy Roschelle's role in first bringing to my attention the importance of Dewey's theory of inquiry to research on collaboration and learning (cf., Roschelle, 1992). Also, see Colella (in press) for a related effort to apply Deweyan theories of learning to CSCL research.

³ A digital copy of the video and a transcript can be found at this URL:
<http://edaff.siumed.edu/dept/studies/risks.html>