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Commentary for the Special Issue: PBL Scholarship: Building on the Educational Vision of Howard Barrows

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Commentary for the Special Issue

PBL Scholarship: Building on the Educational Vision of Howard Barrows

Peggy A. Ertmer

Abstract

In this commentary, I discuss each of the seven articles included in this special issue, which, as a collection, honor the impact of Howard Barrows' vision on the scholarship and practice of problem-based learning (PBL). Collectively, these articles represent a variety of contexts, content areas, delivery formats, and structures in PBL implementations and research. Each article is examined and evaluated for specific information that practitioners and researchers may use in their future PBL efforts.

Keywords: Howard Barrows, commentary, problem based learning, PBL

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Commentary for the Special Issue

PBL Scholarship: Building on the Educational Vision of Howard Barrows

In 2004, when the idea to create a journal dedicated to problem-based learning (PBL) was first formulated, the editors envisioned a journal that would bring together a host of scholars, working in a variety of disciplines, all of whom, in one way or another, were applying ideas initially articulated by Howard Barrows (Ertmer & Macklin, 2006). Now, nearly 10 years later, I am honored and humbled to pay tribute to the man who inspired our efforts. It is truly my privilege to acknowledge the tremendous impact that Howard's vision has had on the use of PBL, not only in my own work but in a growing number of educational settings.

When Howard Barrows suggested that students should be able to do more than pass multiple-choice tests when they graduate from medical school (Olsen, 2011), he pioneered an educational method that transformed not only how medical students learn, but also how educators in many other fields think about teaching, learning, and assessment. Initially proposed by Barrows over 40 years ago, the PBL method has slowly spread across disciplines, institutions, and countries (Hung & Loyens, 2012). Today, PBL is being implemented, not only in medical schools and other health science programs (e.g., schools of dentistry and nursing), but also in law, economics, business, forestry, teacher preparation, engineering, and K–12 education, among others (Camp, 1996). According to Dorsey (cited in Olsen, 2011), Barrows "helped transform how students should learn" (p. 2).

The goal of this special issue of *IJPBL* is to pay tribute to the man who laid the foundation for the use of PBL as a powerful learning strategy. Because of Barrows' expertise in two different domains, neurology and education, he was uniquely positioned to consider how students learn best—especially in applied areas, such as medicine. As noted by Xian and Madhavan (this issue), Barrows' impact on PBL is enormous; he authored or co-authored 26 publications (e.g., books, articles, proceedings) specifically related to PBL, with over 4,500 current citations of these specific works. Moreover, this number shows no sign of tapering off (Hung & Loyens, 2012). Given the current interest in preparing students to be 21st century knowledge workers (Brown, Lawless, & Boyer, this issue), the uses of Barrows' work will undoubtedly continue to grow in both number and scope.

The articles in this special issue are testament to the wide-ranging influence of Barrows' work. Walker, Leary, and Hmelo-Silver, the guest editors for this issue, were purposeful in their call for manuscripts (2011), soliciting articles that represented the diversity of fields in which PBL is used. As a result, the articles included in this special issue provide descriptions of PBL implementations in a variety of contexts (e.g., K–12, undergraduate and graduate education) and content areas (e.g., data literacy, science, medicine, social

studies), while using different delivery formats (e.g., online and face-to-face), and structures (e.g., using both the traditional, as well as modified, approaches). I suspect that Howard would be pleased to see the commonalities, as well as the diversity, among the articles presented here.

For this commentary, I consider each of the seven articles included in the special issue individually, providing both general comments and suggestions. More specifically, I approached each article as if I were hunting for detailed information that practitioners and researchers could use in their PBL practice. As such, I was particularly interested in the implications I could garner—what would I, or other PBL teachers and researchers, do differently given the information or results reported in each paper? With that goal in mind, then, I consider each paper.

McCaughan—Barrows' Integration of Cognitive and Clinical Psychology in PBL Tutor Guidelines

In this conceptual piece, McCaughan helps us understand how Barrows' ideas, specifically those related to how tutors should interact with students during a PBL unit, grew out of his understanding of both cognitive and clinical psychology. As such, this article enables us to see the roots, as well as the theoretical foundations, for one of the hallmarks of the PBL method—the nondirective tutor role. By comparing Barrows' description of the facilitative role of the PBL tutor to 1) Dewey's explanations of the types of teachers' actions required to promote student inquiry (1910) and to 2) Rogers' recommendations for the behaviors of client-centered therapists (1942), McCaughan helps us see the connections among these three approaches. While the relationship between Dewey's ideas and those advocated by PBL scholars has been previously noted (e.g., Koschmann, 2001; Savery, 2006), the link to Roger's client-centered therapy techniques has rarely been articulated (Herman, 1995). However, as noted by McCaughan, techniques advanced by the client-centered approach are readily observed in many of today's classrooms in the form of student-centered strategies (e.g., active listening, questioning skills) — strategies that are considered essential to the PBL process.

It is generally agreed, as McCaughan notes, that the role of a PBL tutor is not an easy one to embrace (Land, 2000; Ertmer & Simons, 2006), especially by faculty who have traditionally used more teacher-centered approaches. This is not surprising. However, it would be interesting to know the specific strategies that Barrows, as well as Dewey and Rogers, recommended for the effective development of PBL tutors, inquiry-oriented teachers, or client-centered therapists. Although the authors do not offer any suggestions as to how to help teachers/tutors make this difficult transition, this is clearly an area in which PBL researchers should engage further. While it is useful to explore the theoreti-

cal bases of our educational practices, and McCaughan has done a great job delineating the recommended actions of a PBL tutor, I encourage her and others to consider how to build on these guidelines to design effective professional development programs that enable novice PBL tutors to adopt and implement these student-centered behaviors in their classrooms.

Hmelo-Silver—Creating a Learning Space in PBL

The success of the PBL approach depends, to a great extent, on the problem or question that anchors the unit (Hung, 2006; Capon & Kuhn, 2004). In this article, Hmelo-Silver analyzes the learning space afforded by a rich PBL medical problem, and then examines the extent to which students engaged with relevant related concepts, that is, those concepts that were not directly needed to solve the problem at hand. As a great companion piece to her 2006 article (Hmelo-Silver & Barrows), it's important to keep in mind that the students Hmelo-Silver observed were engaged in a PBL tutorial facilitated by Barrows. This is both instructive as well as limiting. While it allows us to see the potential of a PBL problem to engage students in content that goes beyond basic knowledge requirements, it's impossible to know how much of this potential would or would not be realized if the PBL lesson were facilitated by a tutor who was less experienced than Barrows. This also leads me to wonder which component is more critical—the problem itself (and the affordances it provides) or the facilitator's ability to guide the students within and across the potential learning space. This provides an interesting question for PBL researchers to pursue in the future.

One thing I found particularly interesting about this piece was the cognitive analysis Hmelo-Silver conducted of the medical problem being discussed. This seems to be a critical component of this research as it enabled the author to determine the extent to which students engaged in the related conceptual space. If the analysis were "off" (delineating too many or too few concepts) then the results, too, would be off. How, then, do we assure that our analyses are *right*? Furthermore, how do we create problems that have the appropriate number and kinds of affordances needed to engage students in the most relevant content, and how can we be sure that students cover the related conceptual space that a problem affords? According to the results reported here, students covered a little more than 50% of the topics in the identified learning space. How do we decide if this a "good" amount? At the very least, this seems to suggest that we need to think of PBL as curriculum, where topics are covered multiple times, in order to assure complete coverage of the learning space.

Given the role of cognitive analysis in addressing these questions, it'd be helpful to have more information about how to actually complete this type of analysis. For example, as noted by Hmelo-Silver, educators and researchers might use this method to estimate the

potential of the PBL problems they use in their own courses and/or research studies. New PBL instructors, also, could use the output of a cognitive analysis as a type of facilitator's road-map, eliminating some of the guess work that tends to accompany initial facilitation efforts. Finally, a cognitive analysis might mitigate many of the fears novice PBL teachers (and administrators) have regarding how to meet the required curricular standards using a PBL approach (Ertmer et al., 2009). Hmelo-Silver also describes additional uses for this type of analysis (e.g., a formative evaluation tool), suggesting great potential for future research efforts.

Leary, Walker, Shelton, and Fitt—Relationships between Tutor Background, Tutor Training, and Student Learning: A PBL Meta-analysis.

The article by Leary, Walker, Shelton, and Fitt is the third in this special issue that addresses the role of the tutor in the PBL process, emphasizing the importance of this component to the entire PBL enterprise. Whereas McCaughan highlighted how a tutor should interact with students during a PBL tutorial, and Hmelo-Silver examined the conceptual space learners engaged in when their discussion was facilitated by an expert tutor, Leary and her colleagues examined, through a meta-analysis, how various tutor characteristics (e.g., experience, training) impact student learning during PBL. Given the acknowledged importance of the tutor to the PBL learning process (Barrows, 1998; Hmelo-Silver & Barrows, 2006; Neufeld & Barrows, 1974), it is surprising that, prior to this publication, there had been no systematic reviews of the relationship between tutor characteristics and student learning outcomes. Fortunately, that gap is narrowed considerably by the work of Leary et al. in this issue.

As noted earlier, the tutor role is not easily enacted, and thus, training is considered critical to preparing tutors to effectively engage with learners during the PBL process. Yet, as noted by Leary et al., the impact of training on student learning outcomes remains unclear, possibly due to the wide variance in training approaches. Furthermore, there is considerable debate over the need for tutors to have content expertise. In fact, one of the strategies used at McMasters to break lecture-prone instructors from reverting back to their traditional teaching approaches is to involve them in the PBL facilitation process as content *novices*, rather than content experts (Barrows, 1996). This suggests, then, that training may be more important for tutors with content expertise, as they are more likely than content novices to revert back to their ingrained methods for teaching the assigned content.

Thus, while training is considered critical (and is supported by the results of this meta-analysis), the need for content expertise is not as clear-cut. In fact, based on the meta-analysis results reported here, content expertise was not significantly related to stu-

dent learning. This suggests, then, that professional developers should invest the majority of their efforts helping novice tutors understand and use effective facilitation strategies, as opposed to helping them develop more content knowledge. In more practical terms, when the teachers in my summer PBL course protest that they are not experts in the content they are expected to teach via a PBL approach, I can mitigate their concerns with evidence from this thoughtful meta-analysis indicating that it is more important that they learn how to become good facilitators.

Interestingly, results showed that tutor experience was inversely related to student learning—that is, learning decreased as years of experience increased. This might be explained by the increasing confidence tutors gain as they facilitate PBL tutorials, leading them to become more complacent regarding the use of best practices. Or perhaps, old habits begin to creep back in as the novelty of the PBL approach wanes. As noted by Leary and her colleagues, additional work is needed to examine this relationship more closely. I echo their call for "revisiting and extending scholarship about the most effective means" for preparing tutors. Without a clearer understanding of what constitutes best practices for training PBL facilitators, we are unlikely to make the kind of inroads desired in achieving sustainable PBL implementations.

Brown, Lawless, and Boyer—Promoting Positive Academic Dispositions using a Web-based PBL Environment

In their article, Brown, Lawless, and Boyer describe selected results (i.e., changes in students' self-efficacy skills related to science and technology use, and science writing skills) from the implementation of a 14-week simulation called GlobalEd 2 (GE2). Although the GE2 project was implemented within a middle school social studies class, the problem-based scenario was designed to address an international science crisis. According to the authors, GE2 expanded the curricular "space" in a typical school day by providing students with opportunities to learn science and the use of educational technology during a time normally reserved for social studies, but without sacrificing the curricular goals of the social studies curriculum.

One of the key tenets of PBL is the interdisciplinary nature of learning (Neufeld & Barrows, 1974; Jonnasen, 2011), and yet many variations ignore or shortchange this aspect, simply because it's quite difficult to achieve in practice (Schwartz & Martin, 2004). The GE2 project, however, exemplifies an effective multi-disciplinary approach, as it immersed students in an authentic problem that integrated economics, human rights issues, as well as health and environmental issues.

The GE2 project was noteworthy, also, for a number of other reasons. First, the GE2 project augmented the face-to-face components of the project (e.g., group work), with

virtual interactions with students located in other classrooms and schools. This provided opportunities for students to engage in simulated international negotiations, with the intent of developing "multi-national" resolutions to real world, socio-political science problems (e.g., global water resources). Second, the project lasted over 14 weeks, a relatively lengthy timeframe that is rarely realized in real-world settings (Jonassen, 2011). Third, the project involved students from both rural and urban schools, with variations in student characteristics (socio-economic status, race/ethnicity, gender) that enabled the authors to compare relative benefits across populations. Finally, the authors describe how the teachers were trained and supported in their efforts to implement the unit. Although details of this training were not provided, it is likely that this contributed to the success of the project. I encourage the authors to share these details in other publications about this project.

Results of the GE2 project demonstrated significant increases on all three measures (science interest, technology self-efficacy, and writing self-efficacy) but with few noted differences among demographic groups, suggesting that the program was equally effective with students at both schools. This is definitely an encouraging finding, as it demonstrates that PBL is not just for the "smart" kids (Pedersen, 2003). However, I would have liked to see more results related to *learning* outcomes (whether these be based on performance, or other embedded, assessments), as it is hard to convince teachers to adopt a 14-week project if students don't show learning gains on the relevant content being covered. This is not to suggest that science interest and self-efficacy are not worthy outcomes, only that content learning, as one of the primary goals of PBL, must be considered *alongside* these other valuable outcomes.

Swan et al.—Problem-based Learning Across the Curriculum: Exploring the Efficacy of a Cross-curricular Application of *Preparation for Future Learning*

Similar to the previous article by Brown et al., Swan and her colleagues examined the implementation of a PBL-like unit in the context of a multi-disciplinary middle school unit. According to the authors, the PBL variant described in this study, *Preparation for Future Learning* (PFL), "reverses the typical PBL modeling, scaffolding, and fading sequence . . . by allowing students to first flounder before solutions are formally introduced and modeled." In reality, this is not a large departure from the typical PBL process, and in many ways actually captures the spirit of a true PBL approach. As noted by Neufeld and Barrows (1974), PBL "challenges the assumption that information is required before problem solving can begin" (p. 1043). Others have described using similar sequences to prepare students for the PBL inquiry process (Ertmer & Simons, 2006). For example, Kolodner et al. (2003) described how middle school learners began exploring a design problem by engaging in a "messing

about" activity in which they interacted with specific objects (variables) without formal guidance. Baumgartner and Reiser (1998) described the use of "staging activities," while Wood, Bruner, and Ross (1976) described the need to "recruit" learners into the project. The goal of all of these approaches appears to be to spark students' interest at the beginning of the project so that they become curious, inquisitive, and motivated to engage. The approach by Swan et al. offers another effective means for accomplishing this goal.

The PFL project, designed to increase students' data literacy skills, provides one of the best examples of a cross-disciplinary unit I've seen, to date. Middle school teachers from four different disciplines—social studies, mathematics, science, and English—coordinated their curricular efforts to implement the goals of this project in a pre-determined, sequential manner. This is not a trivial accomplishment! I find it interesting that the authors did not mention any of the logistical difficulties involved in arranging these collaborations. Neither was there any mention of the training that was needed. What would it take for other schools to implement a similar project? Additional information could help round out the project description included here.

IJPBL readers, particularly those who work in the K–12 arena, will appreciate the manner in which the authors mapped the project activities to the standards in each of the four disciplines. This could go a long ways toward convincing new teachers to get on board. Results, too, are convincing, as the project was found to be effective at two different schools. That is, students who participated in the PBL unit outperformed those who did not on a data literacy assessment. While participating students at one school outperformed their peers at the other school, it's difficult to determine why this occurred, as the authors do not provide any demographic information about the student populations nor the teachers who participated in the project. This information would enable further, insightful interpretation. Still, the intervention appeared effective. According to the authors, preparing students for learning in one context, followed by formal learning in another, helped students transfer their new understandings to applications in new settings.

Gallagher and Gallagher—Using Problem-based Learning to Explore Unseen Academic Potential

The Gallagher and Gallagher article, also based on a middle-school implementation of a cross-disciplinary PBL unit (science and social studies), examines a relatively unique outcome—the ability of the PBL approach to identify students, not previously identified by traditional means, as having advanced academic potential. By combining the results of standardized achievement scores with teachers' ratings of students' engagement in the PBL units, a group of students was identified that was distinct from both the traditionally-identified gifted students as well as the general education students.

Although it is generally acknowledged that most students find PBL engaging (Pedersen, 2003; Simons & Klein, 2007), few have tried to measure that engagement, particularly among low-achieving middle school students. Furthermore, the work reported here was conducted in two schools with high-minority, low-income students—a demographic that has been largely ignored in the PBL literature (Pedersen & Liu, 2003). It was refreshing to read how these teachers and students engaged with, and learned from, the PBL approach.

A useful "take-away" from this article was the Classroom Engagement Rubric (see Table 1) as well as the detailed description of the relevant content area variables assessed in the social studies and science assignments (see Table 2). These provide readily adaptable guidelines for other PBL teachers and researchers who wish to assess students' engagement and content learning during PBL units. In addition, a detailed scoring rubric with benchmark examples (see Table 3) for the social studies assignment, illustrates, for more novice PBL teachers, what student work might look like following engagement in a PBL unit.

The results of this study also highlight the need to use multiple measures when examining the impact of a PBL unit on student learning. Whereas the standardized achievement measures showed little difference between the students with advanced academic potential (AAP) and those designated as general education (GE) students, when viewed through the lens of the PBL assignments, AAP students seemed more similar to the gifted students than the GE students. And in terms of engagement, the AAP students scored the highest of any group. This serves as a strong reminder that, as PBL teachers and researchers, we would do well to incorporate these additional measures into our units.

The results of this study confirmed what many of us already believed: "the benefits of the PBL classroom go beyond content delivery, skill development, and enhanced engagement." In addition to facilitating noticeable changes in students' academic performance, Gallagher and Gallagher demonstrated how the unit impacted teachers' perceptions of their students, creating positive changes in the way they were viewed. Finally, as noted by Gallagher and Gallagher, "students were so engaged by the ill-structured problem they didn't notice that they were working harder and thinking more." I cannot think of a better reason than this for adopting a PBL approach!

Xian and Madhavan—A Scientometric, Large-Scale Data, and Visualization-based Analysis

Although it's hard to quantify the impact of a single man's work, Xian and Madhavan use a combination of tools to help us visualize Barrows' impact. The results of their analysis show the reach and influence of Barrow's work, published over a 30+ year span (from 1974 to 2008). As such, this article provides a fitting summary for this special issue.

To examine Barrows' contributions to the field, Xian and Madhavan employed the techniques of scientometrics, bibliometrics, large-scale data mining, and visualizations. The results of these analyses enabled them to illustrate two distinct aspects of Barrows' work: 1) his own intellectual contributions and 2) his subsequent impact on PBL scholarship (papers that cite Barrows' five most cited publications). Although none of us would have doubted that Barrows has played a key role in the development and use of PBL, these analysis techniques provide additional convincing evidence.

I appreciate both the thoroughness and clarity with which the authors described their analysis methods, which were completely unfamiliar to me. However, one area I'd like to know more about is why the authors examined only those papers that cited one of Barrows' five most cited publications. Was this simply to make the process more manageable or is there a theoretical reason for doing this? A little more explanation about this decision would help clarify the authors' reasoning.

Another question I have relates to the way in which the authors defined Barrows' collaborators. According to Xian and Madhavan, collaborators included only those people with whom Barrows co-authored a publication. If this definition were broadened to include all the people he worked with, even if he did not co-author with them (students, faculty, consultants, etc.), Barrows' reach would be seen as much greater than currently illustrated.

Finally, the authors claim that the wide, seemingly disconnected, distribution of those who cite Barrows' work is indicative of "fragmentation." However, another interpretation (that I prefer) is that Barrows' reach is not bounded by either discipline or field. Even if those who reference Barrows' work do not work together, they still are all united in their efforts to use the PBL method, as envisioned and applied by Barrows. Furthermore, Howard himself did not see these variations as a problem. As noted in his 1986 article, "The increasingly popular term 'problem-based learning' does not refer to a specific educational method. It can have many different meanings depending on the design of the educational method employed and the skills of the teacher" (p. 481).

Xian and Madavan conclude their paper with a call to connect isolated PBL research groups and practitioners. This, of course, is one of the primary objectives of IJPBL and one that we continue to pursue vigorously. Just as Barrows' influence will continue to grow as more and more teachers search for effective ways to meet their students' learning needs, we believe the reach and influence of IJPBL, as a primary outlet for the dissemination of PBL scholarship, will also continue to grow. For that, we owe a world of gratitude to Howard.

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