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Samantha Hines

University of Montana - Missoula, samhines@gmail.com

Eric H. Hines

University of Montana - Missoula, eric.hines@umontana.edu

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Article

Faculty and Librarian Collaboration on Problem-Based Learning

Eric Hines
University of Montana

Samantha Hines
University of Montana

Abstract

This report describes a case study using a collaborative model of problem-based learning in library instruction as an innovative alternative to traditional methods. The authors examine the use of problem-based library instruction in three courses, including an examination of the results of the assignment students were given as part of the exercise. The authors found that the problem-based learning model increased student engagement with library resources and provided a mechanism for identifying and correcting deficiencies in students' information literacy knowledge and skills. If a specific session of library instruction is intended to provide guidance on the use of the library for a particular assignment or project, then using a problem-based learning approach in collaboration with teaching faculty is a simple way to improve library instruction.

It is a commonly held opinion among teaching faculty that the average college student lacks sufficient skill and training in critical thinking and information literacy. The skills needed to master information literacy can vary considerably between both individual students and between disciplines and even specific courses. In the authors' experience, due to time constraints, traditional one-shot library instruction frequently focuses on either introducing basic information literacy skills to reduce discrepancies between students or introducing discipline-specific knowledge needed for a specific course. This emphasis means library instruction often either inadequately addresses disciplinary standards of information literacy or introduces knowledge to students that they do not yet recognize as important for their success. For decades, librarians have recommended integrated library instruction as a way of resolving this conflict, but few course instructors have been willing to cede even more class time to library instruction to make integration feasible. However, the growing use of problem-based learning (PBL) in higher education offers an opportunity to integrate library instruction into courses without consuming more time than traditional one-shot instruction (Macklin, 2001; Enger et al., 2002; Munro, 2006). In this report, we discuss collaboration between a subject librarian and a course instructor in using PBL to enhance both library and course instruction and to evaluate success. While our results are limited, we believe that PBL offers an effective alternative to traditional one-shot library instruction.

Problem-Based Learning: A Literature Review

Problem-based learning (PBL) refers to a set of pedagogical techniques designed to structure courses so that the starting point for learning is a problem or puzzle (Boud, 1985). PBL advocates believe students learn more effectively while searching for solutions to problems in the context in which the knowledge will be used. By reversing the traditional instruction model, which introduces disciplinary knowledge before a problem, the PBL approach of presenting students with the problem at the start of instruction helps students to understand why they are learning course content (Gallagher et. al., 1995).

While there are many variations on PBL instruction including case studies, Webquests, and simple real-world problems like "How long will it take to fill this jug with water," they share three core characteristics (Chin & Chia, 2005). First, PBL uses ill-structured problems to guide students learning. An ill-structured problem is one where students do not initially have all the information necessary to solve it and there is no one correct way to solve the problem. Second, PBL requires that instructors act as facilitators or tutors who guide students towards an answer without providing one themselves, giving students a scaffold they can use to construct their own solutions (Vygotsky, 1978). Finally, PBL techniques generally involve students working in collaborative groups. This reflects the PBL's foundation in the theory of social constructivism. Social constructivism views learning as process mediated by the use of language and social practice, and knowledge as being socially constructed (Hodson & Hodson, 1998).

Pioneered by the health sciences faculty at Canada's McMaster University in the 1970s, PBL has been called "the most significant innovation in education for the professions ...

since the move of professional training into educational institutions” (Boud & Feletti, 1997, p. 1). PBL is now used extensively in the health sciences, especially in medicine and nursing. Over 80 percent of US medical schools use some form of PBL in their courses (Hoffman et. al., 2006). Because of its extensive use in the health sciences, there is a very well developed literature about PBL as it relates to health science education. There is considerable evidence and a wide consensus among health science educators that it has improved the outcome of health sciences education (Vernon & Blake, 1993; Albanese & Mitchell, 1993; Polyzois, Claffey & Mattheos, 2010). However, the literature on problem-based learning in non-professional contexts is less developed and less conclusive about the benefits of using PBL in the classroom.

In a recent meta-analysis of 201 outcomes from 82 different studies on the effect of PBL across a range disciplines, Walker & Leary (2009) found that PBL held its own compared to lecture-based approaches when measured by standardized test scores and was superior to traditional lecture-based instruction in assessments measuring the application of knowledge (p. 27). Walker and Leary concluded the kind of assessment used in a course strongly influenced the outcomes of PBL, and that PBL is most effective for clinical knowledge or skills. They also concluded that PBL shows promise outside of health sciences education especially in teacher education, the social sciences, and business. However, these conclusions are not universally shared in the curriculum and pedagogical literature.

In one of the most widely cited and debated criticisms of PBL, Kirschner, Sweller, & Clark (2006) argue vehemently that PBL is a pedagogical failure due to the inherent deficiencies of minimal guidance and that there is no credible research supporting its use. Their critique centers on three pieces of evidence for the superiority of guided instruction. First, evidence on how the human brain processes information suggests expert problem solvers derive their skill by drawing on past experiences stored in their long-term memory. Novice students who have little to no experience to draw upon will be unable to efficiently resolve problems. Second, PBL makes no distinction between the behaviors and methods of an expert researcher practicing his or her profession and those novices who are new to the discipline and do not know its normative behaviors and methods. Finally, reiterating the most consistent criticism of PBL, the limitations of how much “cognitive load” the mind can handle results in students focusing on solving the immediate problem rather than developing the long-term schemata experts use to solve problems. This is especially true in novice students who cannot rely on their past experiential learning in developing a solution. In other words, the mind is so busy trying to complete the assignment that it cannot learn the skills needed to solve the problem more efficiently.

In one of the many responses to Kirschner, Sweller, & Clark (2006), Strobel & van Barneveld (2009) offer an informative challenge to the specific claim that PBL is unsuccessful and ineffective for learning. Noting that at least six meta-analyses have quantified the effectiveness of PBL compared to traditional instruction, they advocate moving beyond the false dichotomy between PBL and traditional instruction. They suggest instead focusing on identifying the contexts when PBL is helpful, the specific

forms of PBL that are helpful, how best to facilitate PBL, and even the role lectures should have in PBL. Conducting their own meta-analysis, Strobel and van Barneveld concluded PBL was better for long-term retention and skill development, while traditional approaches were more effective for short-term retention as measured by standardized exams.

Librarians and libraries have published examinations of PBL in library education and its effects for medical students (Ngcobo & Hoskins, 2009; Khalil & Saeed, 2008), veterinary students (Dodd, 2007), and engineering students (Hsieh & Knight, 2008). Librarians, similar to academic teaching faculty, tend to adopt PBL for use in professional programs.

In addition, some reports have examined PBL as an approach for information literacy instruction. Kenney (2008) presents an excellent overview of renovating the typical one-shot library session based on PBL, stating that this approach will better align learning outcomes with ACRL's Information Literacy Standards (p. 386). Munro (2006) says adopting a PBL approach to library sessions will increase engagement and participation on the part of students in attendance (p. 56).

The Problem From the Teaching Faculty's Perspective

Like many instructors who turn to PBL in their courses, the traditional lecture model in higher education increasingly discouraged the co-author who instructs in political science. In an experience shared by many college educators, he invariably found that most students who took an introductory lecture-style course from him or his colleagues as a prerequisite for his upper-division courses could not recall more than the most basic information about key concepts. The majority of his students also lacked key critical thinking skills and he found the traditional lecture model provided no incentive for students to eschew rote learning and move beyond their cognitive comfort zones. As a corrective, he slowly began to include more and more non-traditional methods of instruction and assessment in his courses including using case studies and frequent writing assignments. Eventually, in an effort to more systematically address concerns, he investigated these methods and discovered the literature on problem-based learning. He found PBL's emphasis on problem solving and skill development more in line with his aspirations as an instructor and the learning outcomes he was developing for his courses.

The main instrument of problem-based learning in his courses is small group writing assignments. Students are presented with a scenario involving a particular problem (e.g., US-Iran relations) and asked to formulate a policy in response to the problem. They then present their policy and an evaluation of possible alternatives to real world decision-makers in the form of a short policy memo. While it is difficult to assess whether the shift towards PBL has been effective, his initial efforts did reveal some significant deficiencies in the skills students possessed that he felt were vital to success in his courses. These included information literacy and basic research skills. Students seemed unable to implement a research strategy appropriate to their research needs or

compare and contrast research from various sources to create a holistic analysis of a topic.

Previously confronted with this deficiency in information literacy and basic research skills before his transition to PBL, he has always included a library instruction session in his courses. Unfortunately, the traditional model of library instruction did not seem to have a significant impact on the quality of research undertaken by his students. Most importantly, he did not feel like he was able to connect the information from the library instruction session to the writing assignments in a meaningful way. Students were learning to use the library, but they were still choosing not to use it when conducting research for their policy memos or research papers. In the fall of 2009, he decided to work with the subject librarian to develop a PBL approach to library instruction as well. His goal was to provide the information about the library in the context in which it would be used for the course, which was the writing of a final research paper. He expanded the effort to two additional courses in the spring of 2010.

Our Approach to PBL in the Library

Students in our initial experiment of using PBL in the library in Fall 2009 were expected to write a 10-page research paper explaining variations in policy outcomes among European democracies. This required students to develop a research question, choose a method of analysis, conduct research in the library and apply their method, and report their findings. To provide some scaffolding to the ill-structured problem of library research, the course instructor and the librarian collaborated on the design for a library assignment in a PBL format students would complete during the library instruction session (see Appendices I and II). The assignment required students to simulate different steps of the research process the instructor expected them to use when completing their final research assignments.

For the library session, the course instructor began the presentation with a short introduction to the assignment, followed by five minutes for students to formulate a problem statement (research question) based on a simulated topic. Students were able to work individually or in groups of two or three. After students formulated their problem statements, the librarian provided a brief 15-minute orientation to library resources. Through a show of hands, the majority of students claimed library experience; we thought this meant they had a foundational knowledge. Therefore, the librarian bypassed a more traditional discussion of how to access library resources generally or the advantages of using the library over a more general Web search. The librarian focused on the mechanics of using three resources: Worldwide Political Science Abstracts, Academic Search Premier, and JSTOR. She also discussed the strengths and weaknesses of each resource with regard to the assignment at hand and the specific materials covered in each. The intended outcome was to refresh students' minds to the use of these three resources that they had presumably used in the past, and to quickly launch them into practical use of the resources in solving the problem presented in the class session.

After the library demonstration, students had about twenty minutes to work on the rest of the exercise while the instructor and librarian circulated through the room. Students had to develop appropriate keywords to locate relevant resources, compare the credibility and relevancy of sources between the library's resources and a Google search, develop a research design, and correctly format a source citation. Students were given a week to complete the assignment and hand it in to the instructor for credit.

In Spring 2010, the instructor and librarian planned to repeat this approach. The assignment was revised jointly but illness prevented the librarian from participating in the library instruction session. The instructor managed the library resources demonstration on his own, as he had worked frequently with the librarian on various iterations of the library resource presentation for the past four years for this and other classes, and all other interactions were the same as before.

Evaluation of Results

Before presenting the results from the PBL-based library instruction, we must acknowledge the limitations of our evaluations. The difficulty of evaluating the effectiveness of traditional library instruction for helping students master information literacy due to its focus on both functional and cognitive skills, its ability to be targeted at a diverse set of objectives (e.g., user behavior, knowledge, or solving a specific problem), and application to both present and future activities is well known (Hovde, 2000). The same caveats apply to PBL library instruction. We also had measurement issues in our study because we did not design our assessment to be compared between courses and we have no baseline or control to compare our results to. However, we can draw some basic conclusions about this method of instruction.

While we cannot conclude anything from the individual scores students earned on the assignment, we can compare how students did on different parts of the assignment. For example, in Fall 2009 only 58% of students (N=35) could formulate a problem statement or research question correctly. However, in Spring 2009 (N=25) this number increased to 66%. While not a statistically significant improvement, it suggests changes to the design of the assignment may have increased students' ability to complete this important task. The most significant improvement between the two semesters was on the final question asking students to correctly formulate a citation. In Fall 2009, only one student (3%) could correctly cite a source using the required format. Greater emphasis on citation formatting during the library instruction session in Spring 2010 raised the number to six (22%), which was a statistically significant improvement. The area of least improvement was the number of students who could correctly apply the concepts of relevance and credibility, which was 23% and 25% respectively. Given the centrality of these concepts to information literacy, greater emphasis will be placed on developing these skills in future iterations of the assignment.

Another useful comparison is to examine the content of the assignments. In the keyword question, the top four keywords selected by students overall were "European Union" (EU) (appearing 51 times or 85% of the time), "Iceland" (35 mentions or 58% of

the time), “membership” (22 mentions or 37% of the time), and “accession” (11 mentions or 18% of the time). Interestingly, the keywords varied by semester, probably due to both small changes in the wording of the assignment and the content of the courses themselves. Fall 2009’s top keywords were: “EU” (31), “Iceland” (12), “membership” (9), and “join” (6). Spring 2010’s top keywords were: “Iceland” (23), “EU” (20), “membership” (13), and “accession” (11). Important to note is that students were taking a course specifically covering the EU in Spring 2009 and were aware the technical name for the process of joining the EU was “accession.” Students taking the more general European politics course in Fall 2009 were not aware of this terminology and used the more generic term “join.”

Although not measured quantitatively, both the instructor and librarian observed increased engagement in the library lesson on the part of the students compared to previous sessions. Students listened more attentively to the library resources demonstration than in past years and asked more questions. We surmise that since the students were asked to put the library knowledge to practical use right away, in a way that was both evaluated by their instructor as part of their grade and would be relevant to future research assignments, the students understood the stakes of the library session better than some do in the traditional one-shot library session. The librarian has since adapted the PBL approach to other library sessions with some success; convincing instructors to add a graded library assignment has proven difficult but the PBL approach overall does improve student attention and interest in the library lesson.

Conclusion and Areas of Future Focus

Our evaluation of the results showed distinct patterns in the information literacy skills possessed by the students. Most students were able to develop problem statements and assign appropriate keywords. However, the assignment showed a lack of understanding of the concepts of credibility and relevance. While the spring semester results showed a dramatic increase in some areas, most students still lacked the ability to format citations correctly. These areas will receive more attention from the instructor and librarian in future semesters.

A second area of future focus will be on the design and assessment of the effectiveness of the assignment, which leads to several considerations. First, without a control group with which to compare the outcomes or a stricter rubric for grading the assignment between classes, analysis of the assignment will remain speculative. Second, given the emphasis of PBL on ill-structured problems, we will have to more closely consider just how much information to make available on the assignment sheet. For example, the biggest barriers to students formatting a correct citation seemed to be an inability to identify the correct style and to correct formatting errors in citations provided by electronic databases. If we highlight this in the directions or the library instruction itself it is possible the assignment will become an exercise rather than a problem, negating the purpose of the assignment. Conversely, students might possess the ability to format citations correctly but are lead astray by the multiplicity of citation formats available.

Problem based learning has provided revitalization to how both the instructor and librarian present information and instruct students. While improvements need to be made to address specific problems found in this collaboration, generally we have found PBL to provide structure and guidance to instruction of information literacy concepts across disciplines. Building a relationship between instructor and librarian to the level where a graded library assignment would be permitted may make PBL even more effective.

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Eric Hines is Adjunct Assistant Professor, Department of Political Science, University of Montana. He received his Ph. D. in Political Science in 2006 from the University of Iowa.

Samantha Hines is Associate Professor, Mansfield Library, University of Montana. She received her M.S. in Library and Information Science from the University of Illinois, Urbana-Champaign, in 2003. Her current position is Distance Education Coordinator/Social Science Librarian/Reference Desk Manager.

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Appendix I

Fall 2009 Library Assignment

Name: _____

Library Research Assignment

Directions: You may work with a partner during the time in the library, but answers must be your own. Hand in the completed assignment by the beginning of class, Oct. 27.

Since the epic collapse of their economy in October 2008, you have closely followed political developments in Iceland. You were not surprised by Iceland's application to join the European Union (EU) on July 16, 2009, but it did get you thinking about why some states resist joining the EU. You think this would make an excellent research topic for your final paper in Politics of Europe. You head to the library to get started.

Research Question and Keywords

Your first stop at the library is the Information Center. You ask the reference librarian for material about your topic: states joining the EU. The librarian asks if you have a specific question you are trying to answer to narrow the search to the most relevant information. What are you trying to find out? What is your research question?

You give the librarian your research question. The librarian suggests some keywords to conduct a search. Assume you are the librarian, what are the keywords you gave to the student based on his or her research question? If you enter them into library resources, did you successfully locate relevant information for the student? Why or why not? [Provide a print out of the Search Records]

Source Evaluation

The reference librarian conducted a search using a library resource and found several promising research leads. However, you have always researched using Google and you type your keywords into Google to see what comes up. You get very different results. You wonder which results are better for your paper and which of the sources you have located are appropriate for use in your paper. You decide to compare the first three relevant results from each search. On each print out of results (or on a separate sheet of paper), you start at the top and mark the first three results that are relevant. If you skip over a search result because it is not relevant, indicate the reason. For the six sources you believe are relevant, provide a one sentence explanation why the source is or is not credible and whether you would or would not use it in a research paper.

Politics of Europe

Fall 2009

Research Design

Your final paper requires you to apply one of three methods to test a hypothesis. Your research has revealed four main explanations for Iceland's long refusal to join the European Union: its geographic isolation, its high level of development, its heavy dependence on a single commodity (i.e., fish), and membership in the European Free Trade Association (EFTA). What is your hypothesis? What is an appropriate research design to test it and what would your table look like? What additional cases (i.e., countries) should you research? Why?

Reference List

Your professor is a stickler for proper citations because improperly citing material, intentionally or not, is a serious form of academic misconduct. Just to be on the safe side, you want to demonstrate how you correctly cite a source used in this assignment. What does a correctly cited source look like according to the style required in your assignment?

Appendix II

Spring 2010 Library Assignment

European Union (Spring 2010)

Name: _____

Library Research Assignment

Directions: In this assignment, you simulate parts of the research process for your learning group problems. You may work with your group during the library session, but answers must be your own. Hand in the completed assignment by the beginning of class, March 9, 2010.

Scenario: Your learning group has been assigned a problem for your course on the European Union. Your group's objective is to prepare a policy memo evaluating competing solutions to your assigned problem and recommending one for adoption. Your group must apply the six steps of problem-solving outlined by your professor to accomplish this task. The problem is:

You are members of the cabinet of Stefan Fule, the new Commissioner for Enlargement and European Neighborhood Policy. He has forwarded you the European Council's request to analyze Iceland's preparedness for accession talks following the a formal request by Iceland's new government for membership. Commissioner Fule would like you to evaluate the situation and provide him with appropriate recommendations.

Step 1: Identifying and Selecting a Problem

Problem-based learning uses initially ill-structured problems to focus learning. As members of the Fule Cabinet, you must identify and select the problem(s) associated with Iceland's application you will seek to solve. After considering what you know about the situation, your analysis should yield a problem statement that serves as a starting point for your research, and it may be revised as assumptions are questioned and new information comes to light.

Based on what you already know, try to write a 2-3 sentence problem statement (If you have difficulty identifying a problem, try reading [an introduction on the issue on Wikipedia](#)).

8 pts.

Step 2: Analyze the Problem

Once defined, you have to gather information on the problem to see what the root cause is. If you do not have enough information, you define your learning issues and research it. You must also establish a set of criteria appropriate to the problem to evaluate solutions.

Based on the problem statement, write out 2 learning issues or questions you need to resolve.

8 pts.

1. _____
2. _____

Keywords: You take your problem statement and learning issues to a reference librarian for some help. The librarian suggests some keywords to help locate relevant information.

If you were the librarian, what keywords you would give a student based on his or her learning issues? If entered into a library resource, do they locate relevant information? Why or why not?

5 pts. | Keywords:

Source Evaluation: While the reference librarian searched a library resource and found several promising research leads, you always research using Google. You put your keywords into Google to see what comes up and get very different results. You wonder which are better and which of the sources you have located are appropriate for use in your paper.

15 pts. | *Print out the results of a keyword search using a library resource and Google. Revise your keywords if necessary. On each set of results (or on a separate sheet of paper), mark the first three **relevant** results. If you skip over a search result because it is not relevant, indicate the reason. For the six sources you believe are relevant, provide a one sentence explanation why the source is or is not credible and whether you would or would not use it in your final project. Attach the printouts to your assignment.*

Criteria: To recommend a solution to your selected problem, you need a list of criteria to evaluate alternatives. *What criteria are appropriate for evaluating solutions to your problem?*

8 pts. |

Step 3 and 4: Generate Potential Solutions and Select the Solution

Once analyzed, you generate as many solutions as possible. This may require research to identify possibilities. From this list, you select the best solution using your criteria by ordering solutions from strongest to weakest. If there is not enough information to make a judgement or to show a solution is viable, you define new learning issues and research them.

Step 5: Present the Solution

In the presentation of your solution, you will include both the process and the outcome of your research. This includes correctly citing material you have located and used.

In your policy memo, you cite a source you located while at the library. What does a correctly cited source look like according to the style required in your assignment?

6 pts. |