Project-Based Learning

Kevin Smith

The University of Memphis

February 28, 2015

Overview

Project-based learning (PBL) is an instructional model in which students work collaboratively to solve complex tasks (Thomas, 2010) that stem from "driving questions" (Larmer & Mergendoller, 2010). These complex tasks often times resemble real-world problems that students may encounter (Markham, 2011). They are interdisciplinary, complex and meaningful to learners (Larmer & Mergendoller, 2010). Throughout the process students are given the freedom to use innovative approaches to complete tasks. As students work to complete the tasks, teachers act as facilitators by guiding students towards the learning objectives, providing feedback along the way, and encouraging students to reflect on their progress (Markham, 2011). This instructional model is significantly different from a teacher-centered, direct instruction approach. The model is grounded in constructivist design theory and has roots back to John Dewey and the concept of "learning by doing" (Barron, 1998, p. 272).

A typical PBL experience has students utilizing 21st century skills such as communication, collaboration, creativity, critical thinking, and technology (Larmer & Mergendoller, 2010). Often times technology is a key component of PBL as students utilize a variety of tools to conduct research, analyze findings, and produce multimedia presentations as they work towards preparing materials for a public audience (Markham, 2010).

Although there are multiple ways to implement PBL, John Larmer and Dr. John Mergendoller from the Buck Institute for Education (2010) have identified the following eight key components that should exist in all projects.

Significant Content

The questions that students work to answer as a part of PBL should be closely aligned to standards and course objectives. It is the teacher's responsibility to design the project to ensure

students are learning and progressing towards the identified standards and course objectives. However, it is important to note the ultimate goal of PBL goes beyond simply acquiring knowledge, additionally it should develop the "learner as a whole" (Tamim & Grant, 2013, p. 74). As students engage in the social aspect of PBL they are developing 21st century skills that go beyond simply acquiring knowledge.

Create a Need to Know

PBL often begins with an "entry event" (Larmer & Mergendoller, 2010, p. 2) that gets students thinking and asking questions. "An entry event can be almost anything: a video, a lively discussion, a guest speaker, a field trip, or a piece of mock correspondence that sets up a scenario" (Larmer & Mergendoller, 2010, p. 2). The ultimate goal is to pique students' curiosity about the topic presented.

A Driving Question

A good driving question could arguably be the most important part of PBL (Blumenfeld et al., 1999). Based on questions and conversations from the entry event and the overall learning goals, a driving question is developed that serves to provide purpose and direction for students. A good driving question should force students to struggle with complex tasks that take an extended period of time to answer (Thomas, 2000). The driving question, or possibly questions, is what students are working to answer throughout the entire project.

Student Voice and Choice

Throughout the PBL experience students should be given freedom to make choices about their project. These choices may involve deciding how to conduct research, what tools to use for the final presentation, how to allocate responsibilities within the group, or, simply, how they manage time. Teachers need to provide guidance along the way, but must find a balance between

controlling each step and giving students "voice and choice" (Markham, 2011, p. 1). Students are

more vested in the project when they have the opportunity to make decisions for themselves

(Schwalm & Tylek, 2012).

21st Century Skills

As the work begins to answer the driving question, students begin to develop their 21st

century skills. Students typically work in collaborative groups to brainstorm, research, and make

plans for how they'll accomplish the tasks at hand. Because the projects involve complex tasks

(Thomas, 2010), critical thinking and creativity are essential skills students have the opportunity

to develop. Throughout the entire process the ability to communicate effectively is of critical

importance. Students must be able to communicate with peers, their teacher, possibly with

experts from the field, and finally, as part of presenting the final product. And, as mentioned

previously, technology often plays a central role throughout the process (Markham, 2010).

Inquiry and Innovation

With the driving question providing the overall direction for the project, students

generate a list of additional questions that guide their research. As they explore possible

solutions, they are encouraged to generate new questions, hypothesize, and think about

innovative solutions. The entire process allows students to experience realistic problem solving,

similar to what they may encounter in the real world (Thomas, 2000).

Feedback and Revision

Throughout the process students receive feedback and have the opportunity to make

revisions and edits to their projects. Teachers utilize rubrics, milestones, and formative

assessment strategies to make sure students are progressing towards the learning goals they've

identified (Markham, 2011). By providing continuous feedback and opportunity for revision, students are encouraged to produce high-quality products.

A Publicly Presented Product

The culminating event in PBL is presenting the results of the project to a public audience. Presentations may involve students creating videos, posters, and slides to convey their findings. These presentations are important for helping students reflect on their work and learn what it takes to create an engaging, organized presentation (Barron, 1998). Again, 21st century skills are at the core of this endeavor. Students must use multiple skills to produce high-quality products. Additionally the "public" component of these presentations is of critical importance and should not be overlooked. "When students present their work to a real audience, they care more about its quality" (Larmer & Mergendoller, 2010, p. 4).

History

American psychologist, John Dewey, believed that people learn by doing. His research and beliefs date back to the early 1900s (Dewey, 1910). This idea of "learning by doing" is at the heart of PBL. One of Dewey's students, Dr. William Kilpatrick, is credited as the first to use the term "project learning." In 1918 he wrote an essay for the *Teachers College Record* and described his views on "The Project Method" ("William H. Kilpatrick", 2004). His views on learning align fairly closely with PBL today.

Another notable figure in the history of PBL is Maria Montessori. Montessori was an Italian physician and educator who believed students learned through hands-on exploration and self-directed learning environments (Seldin, 2002). Her work from the early 1900s helped shaped PBL as well.

Swiss developmental psychologist, Jean Piaget, and his constructivist approach to learning, expanded upon the ideas of individuals such as Dewey, Kilpatrick, and Montessori. This constructivist approach and the concept of creating learning environments in which students build upon existing knowledge by exploring, discovering, and investigating gained popularity during the 20th century (Boss, 2011).

The first examples of an instructional model that resembled PBL began to show up in medical schools in the 1950s. Medical students at McMaster University Medical School, under the direction of Dr. Howard Barrows, were presented with realistic, complex medical problems that needed to be solved (Hmelo-Silver, 2011). This particular instructional model was referred to as problem-based learning and although many people still use problem- and project-based learning interchangeably, they are slightly different. Project-based learning evolved from this problem-based learning model.

Over the past 10 to 15 years PBL has continued to gain popularity at the K-12 level. Although adoption has been slower in higher education, it is being used there as well (Lee, 2014). The primary reasons for the increasing interest in PBL are the developments in cognitive science and the desire by teachers to expose students to real-world problem-solving experiences (Markham, et al, 2003).

Cognitive Science

There is a social aspect to learning and people benefit from being active in the learning process. "Research shows that learners not only respond by feeding back information, but they also actively use what they know to explore, negotiate, interpret, and create. They construct solutions, thus shifting the emphasis toward the process of learning" (Markham, et al, 2003, p.

3). Because of these developments in cognitive science, teachers with epistemologies that align with these constructivist views tend to gravitate towards PBL as an instructional model.

Real-World Problem-Solving

Teachers are encouraged to provide authentic, real-world problem-solving experiences for students. PBL provides teachers with an instructional model to meet those needs. A teacher-centered approach that primarily uses direct instruction may not provide opportunities for students to utilize 21st century skills to solve real-world problems. PBL affords students those opportunities (Boss, 2011). Additionally, as technology continues to play an increasing role in education, PBL provides opportunities to integrate a variety of technology tools in meaningful ways.

Key Persons and Organizations

In addition to the work done by John Dewey and Jean Piaget in the areas of cognitive science and learning theory, there have been a number of individuals and organizations that have helped pave the way for PBL. These individuals and organizations have focused on everything from researching the effectiveness of PBL to supporting implementation by teachers.

Buck Institute for Education (BIE)

The Buck Institute for Education (BIE) is a non-profit organization located in northern California. BIE was established twenty-five years ago. The primary focus of the BIE is to provide support for teachers to implement project-based learning in their classrooms. They do this by providing training opportunities, resource materials, and advocating for PBL. BIE initially started by doing PBL in economics. After seeing positive results they expanded into all subject areas and have grown substantially in the past several years ("Buck Institute for Education", 2015).

The George Lucas Educational Foundation/Edutopia

The George Lucas Educational Foundation, which is more commonly known as Edutopia, is an organization that provides resources for K-12 teachers on a variety of educational topics. A primary focus of Edutopia is providing information on PBL. The information provided is designed to help teachers effectively implement PBL in their classrooms. Edutopia has a very popular web site which is the primary vehicle for distributing information.

Researchers & Authors

There are a number of educational researchers and authors who have done work relating to PBL. These individuals have written articles and books, trained teachers, and conducted research projects. This list is not an exhaustive list of the individuals doing work with PBL, but does contain several individuals who have done a significant amount of work in this area.

Dr. Thom Markham

Dr. Markham is a psychologist, educator, and author. He has written multiple articles and books including co-authoring the popular book, *Project Based Learning Handbook* from the Buck Institute for Education. In addition to writing, he works directly with school districts and teachers providing PBL training ("Thom Markham", 2015).

Mr. John Larmer

Mr. Larmer is the Editor in Chief at the Buck Institute for Education. He has written curriculum units for numerous PBL projects and co-authored *Project Based Learning Handbook* with Dr. Markham ("John Larmer", 2015).

Dr. Michael Grant

Dr. Grant is the program coordinator for the Educational Technology program at the University of South Carolina. In addition to having written numerous articles on PBL, he is

currently the Editor of the *Interdisciplinary Journal of Problem-based Learning*. ("Michael M. Grant", 2015).

Differentiation

To help explain the unique characteristics of PBL, I'll contrast it with the direct instruction model. PBL is considerably different from the direct instruction model. While the direct instruction model is grounded in behaviorist learning theories, PBL is grounded in constructivist learning theories. PBL is driven by a student-centered approach to learning, compared to direct instruction that is driven by a teacher-centered approach (Howard, 2015). PBL provides a high level of student engagement that is appealing to teachers and may not exist in the direction instruction model (Markham, 2011). Additionally providing students with opportunities to solve real-world problems is enticing to teachers as they prepare students for the world beyond the classroom (Boss, 2011).

Problem- vs. Project-Based Learning

Another important distinction associated with project-based learning is how it differs from problem-based learning. Larmer (2014) defines problem-based learning as a "subset of project-based learning." Both problem-based learning and project-based learning have many of the same components. In both instructional models students solve open-ended questions using 21st century skills. Where they differ is in the length of the projects, how authentic the tasks are, and what the final deliverables are (Larmer, 2014). In project-based learning the tasks tend to take extended periods of time to complete. Often projects can take weeks or months to complete compared to much shorter periods of time for problem-based learning. The tasks associated with project-based learning are authentic and real-world compared to more contrived tasks that you might see in problem-based learning. Finally, the deliverables or public presentation components

of project-based learning are much more in depth compared to the final deliverables in problem-based learning (Larmer, 2014).

Despite these differences in problem-based vs. project-based learning, people often use the terms interchangeably. As I've explained, there are differences in the two instructional models, but they do have many similarities. In a review of the research on project-based learning, Thomas (2000) looked at both project-based learning and problem-based learning in his work. This serves to demonstrate how similar the instructional models are.

Does it work?

Research indicates students who participate in PBL perform at least as well on standardized tests as their peers in traditional classrooms (Thomas, 2000). Additionally the perceptions of teachers that implement PBL are positive. Teachers report improved learning outcomes and increased student engagement (Tamim & Grant, 2013). However there are challenges with implementing PBL. Teachers must be highly skilled in their ability to guide students towards the ultimate learning goals without directing too much. This can be a challenge for untrained, inexperience teachers who may not be familiar with the PBL instructional model or have a solid understanding of the underlying content (Markham, 2011).

Bibliography

Barron, B. S., Schwartz, D. L., Vye, N. J., Moore, A., Petrosino, A., Zech, L., & Bransford, J. D. (1998). Doing with understanding: lessons from research on problem- and project-based learning. *Journal Of The Learning Sciences*, *7*(3-4), 271-311. Available at: http://www.jstor.org.ezproxy.memphis.edu/stable/pdf/1466789.pdf

A good article that helps define PBL. It provides information on challenges and research data.

Blumenfeld, P. C., Soloway, E., Marx, R. W., Krajcik, J. S., Guzdial, M., & Palincsar, A.

(1991). Motivating project-based learning: sustaining the doing, supporting the learning.

Educational Psychologist, *26*(3-4), 369-398.

This article had information on the steps involved in implementing PBL. It specifically

talked about some of the keys to motivating students in PBL.

De La Paz, S., & Hernández-Ramos, P. (2013). Technology-enhanced project-based

learning: effects on historical thinking. *Journal Of Special Education Technology*, *28*(4),

1-14.

Available at:

http://ezproxy.memphis.edu/login?url=http://search.ebscohost.com/login.aspx?direct=tru

e&db=eft&AN=91911046&site=ehost-live

This article had information on how technology was used in PBL.

Dewey, J. (1910). *How We Think.* Retrieved from

http://books.google.com/books/about/How_We_Think.html?id=WF0AAAAAMAAJ

I skimmed this book because several articles mentioned it. It has many of Dewey's

thoughts on how people learn.

Grant, M. M. (2011). Learning, beliefs, and products: students' perspectives with project-

based learning. *Interdisciplinary Journal Of Problem-Based Learning*, *5*(2), 37-69.

Available at:

http://ezproxy.memphis.edu/login?url=http://search.ebscohost.com/login.aspx?direct=tru

e&db=eft&AN=67407554&site=ehost-live

This article looks at PBL from the students' perspective.

Hmelo-Silver, C.E. (2011). In memoriam: remembering Howard. S. Barrows. *Interdisciplinary Journal Of Problem-Based Learning*, *5*(2), 6-8.

Available at: http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1251&context=ijpbl

This information had information on Dr. Barrows and his work with problem-based learning in medical schools.

Larmer, J., & Mergendoller, J. R. (2010). 8 essentials for project-based learning. *Educational Leadership*, *68*(2), 34-37.

Available at: http://bie.org/object/document/8_essentials_for_project_based_learning

This article contains the eight steps for implementing a PBL project. The article does a really good job of explaining each step and why it's important.

Lee, J. S., Blackwell, S., Drake, J., & Moran, K. A. (2014). Taking a leap of faith: redefining teaching and learning in higher education through project-based learning. *Interdisciplinary Journal Of Problem-Based Learning*, *8*(2), 1-17.

Available at: http://dx.doi.org/10.7771/1541-5015.1426

This article talks about PBL at the higher ed level. Most of the information that I found was targeted at K-12 so this was interesting to learn about what is happening with PBL in higher ed.

Markham, T., Larmer, J., & Ravitz, J. (2003). Introduction to project-based learning. *Project Based Learning Handbook: A Guide to Standards-Focused Project Based Learning for Middle and High School Teachers* (pp. 3-10). Buck Institute for Education.

Available at: http://bie.org/shop/product_detail/6780

This was the first chapter of the book. It had a lot of good background information on PBL.

Markham, T. (2011). Project based learning. *Teacher Librarian*, *39*(2), 38-42.

    Available at:

    http://ezproxy.memphis.edu/login?url=http://search.ebscohost.com/login.aspx?direct=tru

    e&db=eft&AN=69978994&site=ehost-live

    This article has a lot of good information about PBL. It provides information on why it is

    popular and how to implement it.

Mitchell, S., Foulger, T. S., Wetzel, K., & Rathkey, C. (2009). The negotiated project approach:

    Project-based learning without leaving the standards behind. *Early Childhood Education*

    Journal, *36*(4), 339-346. doi:10.1007/s10643-008-0295-7

    Available at:

    http://ezproxy.memphis.edu/login?url=http://search.ebscohost.com/login.aspx?direct=tru

    e&db=eft&AN=508041777&site=ehost-live

    This article looks at how a 1st grade teacher implemented PBL in her classroom. It

    emphasizes the importance of aligning PBL to content standards.

Richey, R.C., Klein, J.D., & Monica, W. T. (2011). Constructivist design theory. *The*

    Instructional Design Knowledge Base (pp. 129-145). New York, New York: Routledge.

    The chapter talks about constructivist design theory which is what PBL is grounded in.

Schwalm, J., & Tylek, K.S. (2012). Systemwide implementation of project-based learning: the

    Philadelphia approach. *Afterschool Matters, 15*(1), 1-8.

    Available at: http://bie.org/object/document/systemwide_implementation_of_pbl

    This article provides information on PBL being implemented in out of school settings in

    Philadelphia.

Tamim, S. R., & Grant, M. M. (2013). Definitions and uses: case study of teachers

implementing project-based learning. *Interdisciplinary Journal Of Problem-Based

Learning*, *7*(2), 71-101.

Available at: http://dx.doi.org/10.7771/1541-5015.1323

This article is based on a research study that looked at how inservice teachers define and

perceive PBL.

Thomas, J. W. (2000). A review of research on pbl. Retrieved February 22, 2015, from

http://www.newtechnetwork.org.590elmp01.blackmesh.com/sites/default/files/dr/pblrese

arch2.pdf

This article has a lot of really good information on the research on PBL. Almost all of the

articles I reviewed referenced this article.

Web Resources

Boss, S. (2011) Project-based learning: A short history. Edutopia. Retrieved from

http://www.edutopia.org/project-based-learning-history

A good overview of the history of PBL.

Boss, S. (2015, February 24). 6 tips for making the most of PBL. ISTE. Retrieved from

https://www.iste.org/explore/articleDetail?articleid=291

This article provides 6 practical tips for teachers that want to get started with PBL.

Buck Institute for Education. (2015, February 24). Retrieved from http://bie.org

This is a great web site for all things PBL. The BIE is a nonprofit organization that

focuses on training teachers on how to implement PBL in their classroom. The site has

professional development information, videos, downloadable forms, and other great

information on PBL.

Center of Excellence in Leadership of Learning. (2015, February 24). Retrieved from

http://cell.uindy.edu/our-work/project-based-learning/indiana-collaborative-for-pbl/

This web site has a lot of resources on PBL. It has background information on PBL as

well as tools for teachers.

Howard, M. (2015, February 24). Direct instruction teaching method: Definition,

examples & strategies. Education Portal. Retrieved from http://education-

portal.com/academy/lesson/direct-instruction-teaching-method-definition-examples-

strategies.html

This web site has information on the direction instruction instructional model.

John Dewey. (2015, February 27). South Dakota Public Broadcasting. Retrieved from

http://www.pbs.org/onlyateacher/john.html

This site has biographical information on John Dewey.

John Larmer. (2015, February 25). Buck Institute for Education. Retrieved from

http://bie.org/people/john_larmer

This information has information about John Larmer from the BIE.

Larmer, J. (2014). Project-based learning vs. problem-based learning vs. X-BL. Edutopia.

Retrieved from http://www.edutopia.org/blog/pbl-vs-pbl-vs-xbl-john-larmer

This is a nice, concise article on the difference between project and problem based

learning.

Michael M. Grant. (2015, February 27). University of South Carolina. Retrieved from

http://www.sc.edu/study/colleges_schools/education/faculty-staff/grant_michael.php

This site has information on Dr. Grant.

Project-Based Learning: Explained - Video. (2015, February 20). Retrieved from

https://www.youtube.com/watch?v=LMCZvGesRz8

This is a great animated explainer video of what PBL is. It was created by the BIE.

Seldin, T. D., (2002). Montessori, Maria (1870–1952). Encyclopedia of Education.

Retrieved February 27, 2015 from Encyclopedia.com:

http://www.encyclopedia.com/doc/1G2-3403200418.html

This site has information on Maria Montessori.

Thom Markham. (2015, February 27). ThomMarkham.com. Retrieved from

http://www.thommarkham.com/index.php/philosophy/1-bio

This site has information on Dr. Thom Markham.

Vega, V. (2012). Project-based learning research review. Edutopia. Retrieved from

http://www.edutopia.org/pbl-research-learning-outcomes

A good overview of the research on PBL.

William H. Kilpatrick. (2004). Encyclopedia of World Biography. Retrieved February 27, 2015

from Encyclopedia.com: http://www.encyclopedia.com/doc/1G2-3404703548.html

This web site has information about Dr. Kilpatrick and the work he did with John Dewey.