Project-Based Learning

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Project based learning (hereafter referred to as PBL) is an approach to instruction that is derived from the idea that students should be doing a task to aid in the learning process. More specifically, PBL includes student-centered activities that are inquiry-based and rooted in active learning. While current attitudes in public education favor education approaches with these characteristics (student-centered, inquiry based, and active learning), PBL does not apply well in all disciplines, nor do all educators choose to utilize PBL as an approach when it may be well-suited for their individual disciplines. A description of what constitutes PBL as well as a discussion of arguments for and against PBL will follow.

Origins of Project Based Learning

The origins of PBL can be traced to the American philosopher and educator John Dewey. Dewey stated:

The teacher is not in the school to impose certain ideas or to form certain habits in the child, but is there as a member of the community to select the influences which shall affect the child and assist him in properly responding to these influences (Dewey & Small, 1897, p. 9).

This sentiment expressed by Dewey is sometimes referred to as learning by doing and continues to receive support today. Researchers slowly developed Dewey's ideas of learning by doing into PBL over the last century, although the distinctions (if any) between learning by doing and PBL as well as between PBL and problem based learning are not always clear.

What is Project Based Learning?

Project based learning is thought to have different characteristics depending on who is asked. While it is probably impossible to define PBL in a way that will be universally agreed upon, definitions of PBL generally have a few characteristics in common. The common characteristics that will be described in this paper are the long-term nature of PBL, the interdisciplinary nature of PBL, and the student-centered nature of PBL.

PBL is long-term in nature, meaning that a project based learning experience will continue for days, weeks, months, or even years at a time. This juxtaposes teaching methods that isolate lessons from each other. PBL requires lessons to be interlaced together with each day's lesson requiring students to think back to previous lessons. Consequential to this style of learning is the rise of new problems to solve throughout the course of the project. These problems could delay the progression of the project as a whole. Students may have the real-world experience of lying awake thinking about the project in an attempt to solve a recent problem.

PBL is interdisciplinary. Projects draw from multiple content areas in order to create a full and complete project. This is in

contrast to more typical modes of teaching, in which lessons, questions, and problems may exist entirely independent of each other. This isolation is often found both within a class and in between classes. The interdisciplinary nature of PBL includes working both within and without the course, but not necessarily across multiple courses. For example, in a classic middle school experiment students build a device to protect a raw egg when it is dropped from a high ladder onto a hard surface. If the lessons are designed with PBL in mind, they should be interdisciplinary within the course. Perhaps students discuss not only the design for a low acceleration that (hopefully) protects the egg, but also discuss the moral implications of using animal eggs as part of a science experiment. Additionally, since the lesson should be interdisciplinary outside of the science class, students might also perform a cost-benefit analysis of the protective apparatus and write a short newspaper article about the test.

PBL should be student centered, meaning that students spend the majority of the time working toward a goal and limited time focused on the teacher. Students are often in collaborative groups and manage their own time. The teacher acts to facilitate teamwork and not as a lecturer. In many ways the teacher acts like a coach, encouraging students to think critically and pursue the end goal of the project. Teachers are also responsible to assess learning from student work during the project. When learning is student centered, students play a role in selecting learning goals and approaches to achieving those goals (Hannafin and Hannafin, 2010).

Project Based Learning vs. Problem Based Learning

Project based learning is similar to problem based learning in that students work toward a shared goal, usually as part of a collaborative effort. The key difference between these approaches is that in PBL students usually work toward a solution with no single (or predetermined) solution whereas problem based learning often has a specific answer to a question. An example of PBL might be a group of students who work to design a workflow for managing the treatment schedule of patients in an emergency room. In contrast, an example of problem based learning might be a group of young doctors diagnosing patients under the supervision of an attending physician during medical rounds. The distinction between project based learning and problem based learning is sometimes made unclear in the literature of instructional design, where the abbreviation "PBL" may refer to either teaching method indiscriminately, but they are different ideas and should be treated as such.

Support for Project Based Learning

Many advocates of PBL believe that this mode of teaching is a high-engagement method that improves student learning (Krajcik & Blumenfeld, 2006) although research supporting this position is not highly conclusive. The discussion of the effectiveness of PBL is limited by an inability of practitioners of instructional design to agree on what constitutes evidence of student learning when PBL is implemented. This problem of

defining evidence becomes increasingly difficult when PBL is implemented outside of math and laboratory sciences where learning is less easy to measure (Thomas, 2000).

Many practitioners of science, technology, engineering, and math (STEM) education are especially enthusiastic supporters of PBL, where funding grants for PBL are abundant. Hundreds of grants for secondary STEM classrooms are available to educators (stemgrants.com). The popularity of advocating for funding for STEM classrooms is so high that United States President Barack Obama recently discussed the need to fund STEM in the 2011 State of the Union Address (Obama 2011).

Support for PBL in STEM fields has led to the coining of the term Project Based Science (PBS). PBS is simply the application of PBL in a science classroom. In 2006, Krajcik and Blumenfeld conducted a study in which students in urban Detroit and Chicago public middle schools learned science using curriculum that included one or multiple PBS units during the course of study. Pre- and post-tests as well as performance on the Michigan state standardized assessment showed significant improvement in scores by students who engaged in one PBS unit over students who did not engage in a PBS unit. Students who engaged in multiple PBS units showed significantly better performance than students who engaged in only one PBS unit (Krajcik & Blumenfeld, 2006). Findings like those of Krajcik and Blumenfeld may contribute to the rise in popularity of PBL in STEM classrooms. However, PBL should not be considered as a STEM-centric approach to instruction. PBL can be adapted to fit a variety of curricula due to its ability to holistically address the real-world nature of most projects.

A characteristic of PBL is that it integrates real-world situations into the learning experience. This means that instructors should seek to create an experience that is as authentic as possible for students. For example, an activity that requires students to formulate a business plan for a restaurant should include the requirement to comply with health, fire, and building codes. Some advocates in K-12 education might suggest that the real-world nature of PBL enhances career readiness in students, but research findings do not strongly support this position. This may be in part due to the difficulty of defining career readiness (Jollands, Jolly, & Molyneaux 153).

Obstacles, Limitations, and Considerations for Project Based Learning

Some teachers and administrators may be hesitant to adopt PBL because of a need or desire to closely adhere to state or district teaching standards and curriculum, and while PBL can provide rich learning experiences for students, the problems themselves may not fit very well into curriculum (Blumfield and Krajcik, 2006). For example, in the Utah state curriculum, students in high school US Government and Citizenship are expected to "determine the rights and liberties outlined in the Bill of Rights" (USOE, 2012). If a class of students were to spend two weeks developing arguments for a court hearing and then proceeded to turn the class into a full-scale courtroom, the students would likely have a rich learning experience in PBL. However, depending on the design, the learning experience might not explicitly meet the requirements of the curriculum.

The perceived disconnect between curriculum and PBL may impact assessment techniques when PBL is used. Assessing learning with PBL can be difficult due to the potential for subjectivity and inconsistency when evaluating the outcomes of PBL. Teachers may be tempted to evaluate student learning by using more traditional methods of evaluation like written, end-of-unit tests or quizzes testing small, discrete steps. The potential temptation to evaluate learning with discrete assessments may be increased for some teachers by the knowledge that their students (and to some degree the teacher) will be evaluated using written standardized assessments. This may lead to a dissonance between the way learning takes place in PBL and the way that learning is evaluated. Assessment should instead include an evaluation of the artifact or product that results from PBL (Krajcik & Blumenfeld, 2006).

Some teachers may be hesitant to adopt PBL because of the difficulties associated with classroom management. Because PBL requires high level thinking, teachers may experience lower completion rates and higher failure rates than other methods of instruction. The complexity of projects may slow lesson momentum, increase student need for help, and increase classroom disorder. Teachers may feel pressure from students, parents, administrators, or peers to reduce the complexity of the project in order to deal with these negative potential aspects of PBL. If teachers do reduce the complexity of projects in order to simplify management, then they may inadvertently attenuate the effectiveness of PBL (Blumenfeld et al., 2011)

PBL may also have negative social effects in the interaction of student groups. Social loafing may become prevalent in PBL groups. Social loafing is seen when students exert less effort

toward their projects when working in groups than they do when working alone. This is seen in the Free-rider effect, where students do not put in their full effort under the assumption that other group members will compensate for the unperformed work. Social loafing is also manifest in the Sucker effect--a consequence of the Free-riders--high performing students lower their effort standards in response to the attitude of Free-riders (Salomon & Globerson, 1989). Instructors may have difficulty in combating social loafing because of the high degree of effort required to provide meaningful student feedback during PBL. Peer evaluations may help combat social loafing in PBL, but many instructors are hesitant to do so because of a perception that student evaluations are not reliable and will address different criteria than desired by the teacher (Lee & Lim, 2012). Actual research on the effectiveness of peer evaluation in combating social loafing is not abundant.

Conclusion

PBL continues to be a popular approach to instruction, especially in public schools. In PBL, students are generally engaged in active, inquiry-based learning, and the instruction is student-centered. PBL is especially popular in STEM instruction, but its application should not be considered to be STEM-centric but rather an approach with applications across curricula. PBL may increase student engagement and scores on standardized tests, but further study is required to conclusively support these findings. PBL may also increase the difficulty of classroom management if students begin to engage in social loafing, but peer assessment strategies may help reduce such potential negative social effects.

Keywords

inquiry, authentic learning, project based learning, PBL

References

Anderson, K. (2016). Grants resources in science, math and integrated STEM. CESA2. Retrieved from http://www.cesa2.org/programs/stem/STEMgrants.cfm

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.

Dewey, J., & Small, A. W. (1897). My pedagogic creed (No. 25). New York: EL Kellogg & Company.

Hannafin, M. J., & Hannafin, K. M. (2010). Cognition and student-centered, web-based learning: Issues and implications for research and theory. In Spector, M., Ifenthaler, D., & Kinshuk (Eds.), Learning and instruction in the digital age (pp. 11-23). US: Springer.

Jollands, M., Jolly, L., & Molyneaux, T. (2012). Project-based learning as a contributing factor to graduates' work readiness. European Journal of Engineering Education, 37(2), 143-154.

Krajcik, J. S. & Blumenfeld, P. C. (2006). Project based learning. In R. K. Sawyer (Ed), The Cambridge handbook of learning sciences (pp. 317-334). New York, New York: Cambridge

University Press.

Lee, H. J., & Lim, C. (2012). Peer evaluation in blended team project-based learning: what do students find important?. Educational Technology & Society, 15(4), 214-224.

Obama, B. (2011). Remarks by the president in state of the union address. The White House. Retrieved from https://www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-union-address

Salomon, G., & Globerson, T. (1989). When teams do not function the way they ought to. International Journal of Educational Research, 13(1), 89-99.

Savery, J. R. (2015). Overview of problem-based learning: Definitions and distinctions. In A. Walker, H Leary, C. E. Hmelo-Silver, & P. A. Ertmer (Eds.), Essential readings in problem-based learning: Exploring and extending the legacy of Howard S. Barrows (pp. 5-15).

STEMgrants (2016). Stemgrants.com. Retrieved from www.stemgrants.com

Thomas, J. W. (2000). A review of research on project-based learning. Retrieved from Buck Institute for Education. website: http://www.bie.org/object/document/a_review_of_research_on_project_based_learning

Utah State Office of Education (USOE), Utah State Office of Core Standards for Social Studies. (2012). Core Standards for Social Studies. Retrieved from http://www.schools.utah.gov/CURR/socialstudies/Core.aspx

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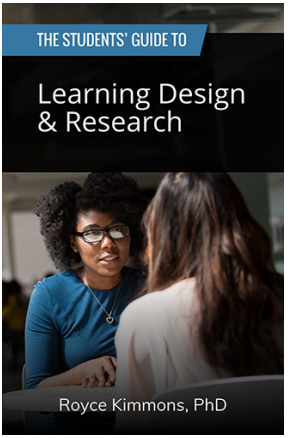

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