Career Pathway Systems: Integrated and Project-Based Learning

Career Pathway Systems aim to provide all students with access to the experiences and conditions they need to be prepared for college and career, as well as for civic life. The distinction between Career and Technical Education (CTE) and college preparation are blurred so that all students are prepared for college *and* career. A career pathway system has the goal of increasing individuals educational and skills attainment and improving their employment outcomes (Career Pathways Toolkit, 2011). Two key components of the Career Pathway System model are:

1) A **rigorous academic** core that is tied to state standards and that prepare students for community colleges and/or Universities, as well as for apprenticeships, certifications, and other "after high-school" opportunities.
2) **Real world learning opportunities** that deliver concrete knowledge and skills through work-based and project-based experiences, which are rooted in authentic learning situations.

Authentic Learning:

Equipping students with the ability to think critically, communicate, collaborate, synthesize and analyze information, as well as giving them specialized skill sets for the jobs of tomorrow all require an expansion beyond and outside of traditional academic approaches. A growing body of research indicates that students learn more deeply and acquire more ability perform complex tasks when they are engaged in learning that is "authentic"; learning that requires them to "employ subject knowledge to solve real-world problems" (Barron and Darling-Hammond, 2008).

Project-based learning (PBL) is based on the pedagogical theory that students learn best by doing, by experiencing and solving real-world problems (Barron and Darling-Hammond, 2008). Research (Thomas, 2000) indicates that project-based learning includes the following characteristics:

1) It is central to the curriculum;
2) It is organized around driving questions that lead students to encounter central concepts or principles;
3) It is focused on an investigation that involves inquiry and knowledge building;
4) It is student-driven, as students are responsible for designing and managing their own work;

5) It is authentic and focuses on problems that occur in the real world and that people care about.

Integrated Learning also begins with these principles, but recognizes a unity between forms of knowledge and specific disciplines, also emphasizing the need for interdisciplinary learning and connections with the real world.

Examples of Project-Based/Integrated Learning

1) Expeditionary learning Outward Bound Models are four-to-twelve week models of personalized, project-based learning. These have been applied in schools across the country, but one excellent example is in King Middle School in Portland, Maine. In this project-based learning model, representational work is emphasized, and the culminating event is a student-designed, representational work which integrates subjects such as art, science, language arts, and computer technology around student designed projects of inquiry.
2) Research & Development STEM Challenges in Illinois offer high schools the opportunity to investigate and solve problems relevant to Illinois industry. The R & D Learning Exchange, which is run by the Illinois Science and Technology Coalition and part of a broader Illinois Pathways strategy for success, works with industry partners to customize each project to reflect a current and authentic research problem and spark student interest in R & D careers. These challenges are designed to teach critical skills inherent in problem solving and STEM concepts by exposing students to R & D applications beyond the classroom. Each project is also interdisciplinary and developed with Next Generation Science Standards, building upon the success and learning of the Illinois Innovation Talent Program (ILIT) and other Problem-Based Learning models.
3) IMaST is a two year integrated mathematics, science, and technology curriculum for the middle grades that also makes connections to languages and social sciences. The program is composed of ten modules that provide the full curriculum for each of these subjects and a team of teachers teaches the program. IMaST promotes experientially based, hands-on learning set in a learning cycle; promotes teaming among teachers from three or more disciplines; provides an opportunity for students to apply the concepts and skills to new situations using problem solving strategies; utilizes authentic assessment; makes frequent use of student group work; fulfills benchmarks, national standards, and state frameworks in mathematics, science, and technology; connects to other disciplines, such as social studies and language arts; and responds to the latest research in teaching/learning as well as to systemic reform initiatives.
4) In the Napa, California New Technology High School (NTHS), students collaborate to create digital portfolios on specific issue areas. The creation of these portfolios include projects and assignments that correlate with each of the eight learning outcomes. NTHS

emphasizes that "real" project-based learning needs to be a lengthy and rigorous process, and requires regular feedback from teachers and administrators. Rather than receiving a class grade, students are given grades for each learning outcome, so that they assess where they are performing well and where they need to improve. The school has seen many positive outcomes for their innovative strategy including that students feel that they are more engaged in their learning environment and they believe they are better prepared for college, careers, and citizenship. There is also higher motivation for post-secondary education, 98% of seniors reported postsecondary enrollment (compared to 67% at the Napa Valley Unified School District reports).

Learning Outcomes

There is strong evidence that shows that inquiry-based, collaborative approaches to learning benefit both individual and collective knowledge growth (Barron and Darling-Hammond, 2008), particularly in the areas of academic persistence and academic achievement, motivation and student attitudes towards learning, 21st Century competencies, and equity.

Academic Achievement:

Goals for 21st Century learning emphasize mastery of significant academic content, which also is the foundation of any well-designed project. Comparisons of learning outcomes in project-based, integrated learning models versus more traditional, textbook-and-lecture driven instruction show that:

- Students in pathways programs showed more progress towards graduation and credit accumulation. Although there was no statistical difference in standardized test scores, student engagement was much higher (evaluated through attendance and school district retention rate) (Taking Stock, California's Linked Learning District Initiative).
- Students engaged in project-based learning perform better at knowledge levels that emphasize principles (understanding the link between concepts) and application knowledge structures (Newman, 2003 cited in Savery 2006).
- Studies have indicated that longer project-based inquiry design also promote deeper content knowledge, where students have performed better after field work and felt comfortable teaching others the material they had learned (Baumgartner and Zabin, 2009).

21st Century Competencies:

Students learn more deeply when they can apply classroom-gathered knowledge to real-world problems, and when they take part in projects that require sustained engagement and collaboration.

- Project-based learning is significantly more effective than traditional instruction to train competent and skilled practitioners and to promote long-term retention of knowledge and skills acquired during the learning experience or training session (Strobel and van Barnevald 2009).
- Students demonstrate better problem-solving skills in project-based learning than in more traditional classes and are able to apply what they learn to real-life situations (Finkelstein et. al., 2012).
- In an examination of test scores in relation to students in a project-based learning classroom, these students tended to score significantly higher as the length of the response increased, which demonstrates that the format of project-based learning instruction encourages students to extend their thinking. Tasks and activities are designed to encourage students to express their ideas in a variety of ways (Schneider et al 2002).

Motivation and Student Attitudes towards Learning

- In project based learning classrooms, students demonstrate improved attitudes towards learning. They exhibit more engagement, are more self-reliant, and have better attendance than in more traditional settings (Thomas 2000; Walker and Leary 2009).
- Research has also indicated that "real" project-based learning needs to be a lengthy and rigorous process, and requires regular feedback from teachers and administrators. Positive outcomes from innovative strategies where this feedback is in the program design are that students feel more engaged in their learning environment and they believe they are better prepared for college, careers, and citizenship. Students may also be more motivated to attempt post-secondary education (Pearlman, Bob 2006).
- Engagement in the curriculum and content is key. Research indicates that weak academic skills are not the primary source of course failure-students' academic behaviors (attendance and completing homework) are eight times more predictive of course failure than their test scores (Allensworth, et al 2009).

Equity:

- Project-based learning can work in different types of schools, serving diverse learners (Hixton, Ravitz, and Whisman, 2012). On average, students that engage in project based learning, including minorities, outscored the national average on more than half of the items on achievement tests (Schneider, et al. 2002).
- Research has also indicated that project-based learning has a positive effect on specific groups of students, such as students with average to low verbal ability. Additionally, students with little previous content knowledge learned more in project-based learning classes than in traditional classes (Mergendoller, et al., 2006; Mioduser & Betzer, 2003).

- An examination of a middle school, urban school district suggest that a systems design approach (a method of integrated learning) was most helpful to low-achieving African American students, although it was as least as good and typically better than traditional methods for all students. By having students begin the learning process from their own needs, the systems design approach to learning tackles the question that students often articulate and that often serves as a barrier to learning, "Why do I need to know this?" (Mehalik, et al., 2008).

Additional Resources:

Integrated Learning:

- What is Integrated STEM curriculum? http://cemast.illinoisstate.edu/educators/stem/index.shtml
- Satchwell, Richard and Franzie Loepp. (2002). Designing and Implementing an Integrated Mathematics, Science, and Technology Curriculum for the Middle School. *Journal of Industrial Teacher Education,* 39(2). http://scholar.lib.vt.edu/ejournals/JITE/v39n3/satchwell.html

Career Pathways

- Career Pathways Toolkit. file:///C:/Users/a131501/Downloads/CareerPathwaysToolkit2011.pdf

CTE:

- Learning to Learn: Why the Supervised Agricultural Experience is Key to Agricultural Education. http://www.nxtbook.com/ygsreprints/ACTE/g36681_acte_techniques_oct2013/#/30

PD on Project Based Learning

- Center for Digital Education. 2012. EdTech Project Spur Illinois Educators to Learn. http://www.centerdigitaled.com/training/Edtech-Projects-Illinois.html?elq=b13c82bc39e1421f8a45b47b649d6dc2

Engagement and models for learning:

- Allensworth, Elaine, Nomi, Takako, Montgomery, Nicholas and Valerie Lee. (2009). College Preparatory Curriculum for All: Academic Consequences of Requiring Algebra and English I for Ninth Graders in Chicago. *Educational Evaluation and Policy Analysis 31*(4), 367-391. http://debdavis.pbworks.com/f/college%2Bprep%2Bfor%2Ball.pdf
- *Policy Brief on same topic (August 2010): http://ccsr.uchicago.edu/sites/default/files/publications/College%20Prep%207x10-10-%20final%20082610.pdf

Project-Based Learning Resources:

- www.bobpearlman.org
- Buck Institute for Education (site for Project-Based Learning Resources): http://bie.org/about
- PBLU (Project-Based Learning University): http://pblu.org/
- Edutopia. 2012. Project-Based Learning Research Review. *Edutopia.* http://www.edutopia.org/pbl-research-learning-outcomes

Project-Based Learning Articles:

- Barron, Brigid and Linda Darling-Hammond. (2008). Teaching for Meaningful Learning: A Review of Research on Inquiry-Based and Cooperative Learning (Book Excerpt). http://www.edutopia.org/pdfs/edutopia-teaching-for-meaningful-learning.pdf
- Baumgartner, Erin and Chela Zabin. (2008). A Case-Study of Project-Based Instruction in the Ninth Grade: A Semester Long Study of Intertidal Biodiversity. *Environmental Education Research 14(2)*, 97-114. http://eric.ed.gov/?id=EJ790119
- Bell, Stephanie. 2010. Project-Based Learning for the 21st Century: Skills for the Future. *The Clearing House: A Journal of Educational Strategies, Issues, and Ideas.* 83:2, 39-43 http://www.tandfonline.com/doi/pdf/10.1080/00098650903505415
- Finkelstein, N., Hanson, T., Huang, C.-W., Hirschman, B., & Huang, M. (2010). Effects of problem based economics on high school economics instruction. (NCEE 2010-4002). Washington, DC: Institute of Education Sciences, U.S. Department of Education. http://ies.ed.gov/ncee/edlabs/regions/west/pdf/REL_20104012.pdf
- Mehalik, Matthew, Doppelt, Yaron, and Christian D. Schunn. (2008). Middle School Science Through Design-Based Learning versus Scripted Inquiry: Better Overall Science Concept Learning and Equity Gap Reduction. *Journal of Engineering Education,* January 2008, 71-85. http://www.lrdc.pitt.edu/Schunn/research/papers/MehaliketalJEE2008.pdf
- Mergendoller, J.R., Maxwell, N.L., & Bellisimo, Y. (2006). The effectiveness of problem-based learning instruction: A comparative study of instructional methods and student characteristics. *The Interdisciplinary Journal of Problem-Based Learning, 1*(2), 46-59. http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1026&context=ijpbl
- Pearlman, Bob. (2006). 21st Century Learning in Schools? A Case Study of New Technology High School in Napa, CA. *New Directions for Youth Development,* Issue 110. http://www.bobpearlman.org/Articles/21stCenturyLearning.htm
- Savery, John. (2006). Overview of Problem-Based Learning: Definitions and Distinctions. *Interdisciplinary Journal of Problem-Based Learning* 1(1), 9-20. http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1002&context=ijpbl&sei-
- Schneider, Rebecca, Krajcik, Joseph, Marx, Ronald, and Elliot Soloway. (2002). Performance of Students in Project-Based Science Classrooms on a National Measure of Science Achievement. *Journal of Research in Science Teaching* 39(5), 410-422. file:///C:/Users/a131501/Downloads/09e4150c674e81f5d3000000%20(1).pdf
- SRI International. (2014). Taking Stock of the California Linked Learning District Initiative. Fourth Year Evaluation Report. http://www.sri.com/sites/default/files/publications/sris_year_4_linked_learning_evaluation_report_february_2014.pdf
- Strobel, Johannes and Angela van Barnevald. (2009). When is PBL More Effective? A Meta-Synthesis of Meta-Analysis Comparing PBL to Conventional Classrooms. *The Interdisciplinary Journal of Problem-Based Learning, 3(4)*, 44-58. http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1046&context=ijpbl
- Summers, Emily and Gail Dikinson. (2012). A Longitudinal Investigation of Project-Based Instruction and Student Achievement in High School Social Studies. *The Interdisciplinary Journal of Problem-Based Learning* 6(1), 82-103. http://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=1313&context=ijpblIn
- Thomas, John. (2000). A Review of Project-Based Learning. http://www.bobpearlman.org/BestPractices/PBL_Research.pdf
- Walker and O'Leary. (2009). A Problem-Based Learning Meta-Analysis: Differences Across Problem Types, Implementation Types, Disciplines, and Assessment Levels. *The Interdisciplinary Journal of Problem-Based Learning* 3(1). http://docs.lib.purdue.edu/ijpbl/vol3/iss1/3/