# Project-Based Learning in Kindergarten to Grade 12 Online Environments

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# Introduction

Project-based learning (PBL), while not a new instructional strategy, has become increasingly popular in education. More and more classrooms in Kindergarten to Grade 12 education are incorporating PBL as a way to promote deeper understandings of course material and as a means of developing students' critical thinking and problem-solving skills. PBL allows students to connect what they learn in school with real-world situations. In addition, PBL encourages students to take active responsibility for the material and skills they learn, as well as to develop collaborative problem-solving skills, practiced as part of the PBL project, that will serve them in their everyday lives.

Online learning is also assuming an increasingly important role in Kindergarten to Grade 12 course content delivery. Some schools and school systems are turning to virtual learning solutions in response to teacher and classroom shortages, but more schools look to incorporate online learning to take advantage of innovative ways to teach complex concepts.

A few progressive schools are incorporating PBL with online learning in efforts to ensure that students gain the maximum benefit from their educational experiences. Florida Virtual School® (FLVS®) is among this group which recognizes the effectiveness of PBL and has been working to incorporate this transformative teaching strategy in its online courses. This paper endeavors to frame a discussion about the following: PBL; online learning; how FLVS is implementing PBL in its Kindergarten to Grade 12 online learning programs; and how the use of these strategies and approaches might inform future educational programs and practices.

# About This White Paper

FLVS commissioned Hezel Associates, LLC (Syracuse, NY) to develop this white paper to explore how PBL is implemented in virtual classrooms in Kindergarten to Grade 12. Hezel Associates used interviews as the principle information source for this document, and conducted semi-structured interviews with the following four individuals, each of whom have national reputations relating to the theory and practice of both project-based and online learning:

> **Dr. John Mergendoller**, Executive Director of the Buck Institute for Education (www.bie.org), an organization that teaches best practices in project-based learning.
> **Dr. Kerry Rice**, Associate Professor in the Department of Educational Technology at Boise State University, and author of Making the Move to K-12 Online Teaching: Research-Based Strategies and Practices.
> **Jeff Robin**, an Art & Media teacher with over 12 years of experience in project-based learning at High Tech High, a charter school located in San Diego, CA (www.hightechhigh.org and www.JeffRobin.com).
> **Heather Staker**, a Senior Research Fellow for Education Practice at Innosight Institute (www.innosightinstitute.org), and co-author of three publications that discuss blended learning in elementary and secondary classrooms.

To understand how PBL is currently being implemented in wholly online Kindergarten to Grade 12 classrooms, Hezel Associates also interviewed five individuals—teachers, curriculum specialists, and curriculum designers—with firsthand knowledge and experience with online PBL at FLVS, a unique, Florida-based virtual school whose instructors teach accredited courses online to students in Florida, the United States, and overseas. The interview protocol was informed by initial reviews of online publications affiliated with both FLVS and national substantive informants.

# What Is Project-Based Learning (PBL)?

Because there are many working definitions of PBL, it is necessary to frame a definition for the purpose of this discussion. The definition adhered to by the Buck Institute, as expressed by Institute Executive Director, Dr. John Mergendoller, is:

> A systematic teaching method that engages students in learning essential knowledge and life enhancing skills, through an extended inquiry process that is structured around complex authentic questions and carefully designed products and tasks. (J. Mergendoller, personal communication, May 21, 2012)

The definition provided by the Buck Institute for Education describes PBL as

> […] an extended process of inquiry in response to a complex question, problem, or challenge. While allowing for some degree of student "voice and choice," rigorous projects are carefully planned, managed, and assessed to help students learn key academic content, practice 21st Century Skills (such as collaboration, communication & critical thinking), and create high-quality, authentic products & presentations. (What is PBL?, 2012)

No matter the working definition used, PBL in its ideal form has a number of characteristics thought to be central to its effectiveness. PBL uses a provocative real-world question or problem to encourage learners to apply their learning to develop a solution. There is no single correct answer or outcome to the question posited for the "project"—the work in which learners engage and the product that they produce. The creation process requires that learners not only apply existing knowledge to the project, but also respond to questions and challenges that compel them to learn new content and skills. The process is iterative, as students present stages of their work to their instructors (and/or others) for feedback on improving their final product. Students are often encouraged to work collaboratively with their peers or with others outside of the immediate learning setting. At the end of the project, students are typically given the chance to share the product of their efforts with an audience—classmates, the school, or members of the community—to make the entire experience "real." This chance to shine is believed to engage and motivate learners to work hard to create the best possible product.

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Educators are choosing to implement project-based learning on the understanding that PBL and its related processes: develop students' critical thinking and problem-solving skills; encourage greater student interest and engagement in learning materials and activities; develop students' ability to self-monitor their learning progress; result in learners' deeper understanding of the course content; and develop students' 21st Century Skills to drive their success in the real world. It is important to note that the traditional roles of instructors and learners change dramatically with PBL. The strategy is student-centered. It requires students to take control of what they learn and how they do it. Students choose what their solution will be. This responsibility for choice encourages students to apply what they already know and to determine what they need to learn in order to complete the project creation process. PBL also engages students to think critically about content so that

they craft their best possible solution. Students actively apply related new concepts, principles, and skills in a meaningful context, which results in a more comprehensive understanding of the new material.

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Instructors take on a radically new role in PBL, as they become facilitators or project managers and are no longer in direct control of what students learn or how they learn it. Educators transition away from giving lectures and prescribing how the student will learn or demonstrate mastery of a topic (e.g., take an exam or write a five-page paper) to providing the resources, feedback, practice, and examples that students require to be successful. Instructors continually monitor student progress to ensure that the learners finish their work according to the course schedule.

Educators have always used "projects" as part of their coursework, but it is possible to do so while falling short of the standards of "project-based learning." Jeff Robin (personal communication, May 29, 2012) frames this as the difference between project-based learning and project-oriented learning. Learning may be defined as project-oriented if, for example, the teacher maintains maximum control over content, process, and demonstration of mastery, leaving students with little control, such as what may be the case if the project serves purely as a summative activity. Further distinctions are illustrated in the following table.

| | Project-Based Learning | Project-Oriented Learning |
|---|---|---|
| **Role of the Teacher** | The teacher becomes a facilitator and project manager. Lectures are kept to a minimum, if used at all. The teacher plans the project, introduces the scenario to the students, and then steps back to allow the students to determine what to create and what process to follow. | The teacher delivers the entire content first, typically in some combination of lecture, readings, and demonstration of mastery. |
| **Role of the Student** | The student becomes responsible for his or her learning. The student has choice and control over what the solution will be, what content is relevant, what their process will be, and how to present their solution. | The teacher decides what content is relevant. The student's only responsibility is to learn what is presented, and to demonstrate mastery as prescribed by the teacher. The teacher determines the topic, the media, and the process used. The student has limited control or choice. |
| **The Project** | A single project may last the length of the course, or the length of a single unit. The goal of the project is to allow the student to use course content to address real-world concerns, and by doing so engage more deeply with course content in a meaningful context. | A short-term assignment that requires the students to apply the content that was previously delivered. The teacher predetermines the form of the final product. |
| **The Creation Process** | The process is iterative. The student presents versions of the project for teacher or class feedback. The student uses the feedback to improve the project, and can use several iterations to "get it right." | The student does not present versions of the project for teacher or class feedback. The student has one attempt to "get it right" with no "do-overs." |
| **Examples** | • How would you teach the students and the administration in your school about how to make better food choices?<br>• How would you eliminate bullying in your school?<br>• Create a game that teaches some aspect of financial literacy to your peers. | • Create a healthy cafeteria lunch menu for one week.<br>• Write a two-page paper about the effects of bullying at school.<br>• Use the Internet to find an example of a good financial literacy game, and create a two-slide critique. |

Distilled to its purest form, there are four elements that might be thought of as crucial to making PBL experiences successful. Dr. Kerry Rice, a proponent of PBL in online learning environments, describes "four cornerstones" that must be in place in order to make the experience powerfully effective:

## Four Cornerstones of Project-Based Learning

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|---|---|
| 1 | Self-directed learning, student choice, and autonomy |
| 2 | Active student participation |
| 3 | Collaboration, ideally with others outside of class, but perhaps with classmates, which contributes to the development of the project solution |
| 4 | Authentic assessment, which includes real-world application and presentation to an external audience |

(K. Rice, personal communication, May 30, 2012)

# Project-Based Learning in Online Settings—Florida Virtual School

Given the rise of affordable and available computer technology, the ubiquity of the Internet, and the rapid appearance of excellent online content and collaboration technology, the number of schools that have chosen to incorporate online content and online learning into their curricula is growing. Schools and school districts are looking to online education as a way to address teacher and classroom shortages resulting from education budget cuts, to expand their course offerings, and as a way to take advantage of online educators who teach complex topics in innovative ways.

Heather Staker, Senior Research Fellow at Innosight Institute, offers a working definition of online learning developed in collaboration with the Evergreen Education Group and national online education leader iNACOL—the International Association for K-12 Online Learning—as "education where content and instruction are delivered primarily over the Internet. The term online learning is used interchangeably with virtual learning, cyberlearning, and e-learning." This definition stipulates that learning has "some element of student control over time, place, path, and/or pace" in order to distinguish online (or "blended" learning, incorporating both online learning and an actual brick-and-mortar school) from instruction that may be technology-rich but not truly "online" (Staker & Horn, 2012).

FLVS is an established leader in online learning, curriculum development, and course implementation. It is an accredited public school district that has been offering online education solutions to elementary and secondary students since 1997. As the first statewide, Internet-based public high school in the country, it now serves students throughout Florida, the United States, and the world. (Florida Virtual School, 2012)

Virtual learning may be imagined by some as taking place in an isolated environment, in which a lone student is pictured interacting with content on a computer and with little human interaction. Isolation can be a concern among parents, educators, and some learners themselves when they consider online instruction. Even in online learning settings where students realize the "emotional benefit from contact between teachers and other students," Dr. Kerry Rice (personal communication, May 30, 2012) proposes that in some cases more collaboration is better:

> Even though there may be asynchronous contact between teachers and students [online]—opportunities to work collaboratively and a strong virtual community—there is a feeling that students should still have the opportunity to interact in real time with other human beings.

FLVS courses are delivered wholly online. While this means that students have the flexibility to study at the pace and schedule of their own choosing, their coursework often requires them to interact through online synchronous lessons, but does not require face-to-face physical meetings with their teachers or other classmates. However, it is important to note that while students typically only interact with their teachers and fellow students online, they do not necessarily study in isolation. Students may take their courses in the comfort of their home, but are just as likely to learn in a public setting where wireless Internet access is available, or in a virtual learning computer lab located at a school or community center (one of the blended learning models described by Heather Staker), surrounded by other students engaged in online study.

Furthermore, most FLVS courses require that students attend at least one collaboration session per course term. These collaboration sessions can take place face-to-face or by means of online conference technology. In addition, FLVS teachers hold regular telephone conversations with each student to review his or her progress, assess content mastery, and address areas of concern.

FLVS started incorporating PBL in middle and high school courses in 2008. This paper considers two examples of 100% project-based learning courses at these levels: *Health Opportunities through Physical Education* (or HOPE) and *Sociology*.

HOPE combines health and physical education. This innovative course enables students to experience firsthand the life-changing benefits of regular physical activity, proper nutrition, and healthy decision-making. Students begin the course with an assessment of their current physical fitness levels. They then define personal goals and maintain workout logs to track their activity and progress. Lessons encourage students to build self-image and self-esteem, while projects challenge students to seek solutions for teen issues in today's culture.

HOPE is a two-semester online course that is offered to students in grades 8-12. Each semester includes four modules that can be completed in 10 to 16 weeks during the school year, or in as few as 6 weeks during the summer semester. Each of the eight total modules has multiple milestone "mini-projects" that lead up to the main project for the module. Content and projects focus on real-life topics and skills. Consistent with the PBL precepts of self-directed learning and choice, students can use whatever media they desire to create and deliver the product of their project activities. Students are not required to work with other students on their projects, but they are encouraged to develop collaborations with people in their community to complete their work. Teachers conduct weekly or biweekly telephone calls with students as they are progressing through these projects. Students are also required to participate in collaboration opportunities at least once each semester. They are also required to engage in a peer review process in which they swap and critique projects with an online classmate or, in the case of Virtual Learning Labs (VLLs)—hundreds of computer facilities where students work in the same physical space with a lab facilitator—students have the opportunity to work face-to-face with classmates to complete the peer review. This affords students the opportunity to get feedback and update their work before the formal submission for a grade. It also offers students a chance to see how other learners approach the project.

HOPE teachers use an online conference tool to host events for students where they come to hear a short presentation from a speaker on topics affecting teens. Students then break into virtual discussion rooms with a facilitating teacher. In these rooms, students are given a mission "to get the word out" about the topic discussed. Students work together to come up with ways to convey the information to peers and/or their community about their topic, decide what images to use in their campaign, and write slogans. Students use the brainstorming sessions to complete their individual projects for submission.

Students are not, however, explicitly required to collaborate with others in order to complete all of their projects. The reasons cited by FLVS staff members for not requiring such collaboration include the use of rolling admission and students' abilities to set their own pace for completion, which all but assure that few students share common schedules. Therefore, peer review was chosen as a solution that allowed some level of student collaboration to occur in this unique learning environment, while collaboration with others (e.g., community members) remains an option.

In Sociology, students examine social issues in their increasingly connected world and learn how group behavior impacts both the individual and society. Students investigate problems that plague societies, such as crime, poverty, discrimination, racism, and sexism. This course implements PBL in a two-semester offering, available to students in Grades 9-12. Each semester includes four modules that can be completed over 2 to 18 weeks. Each module is made up of three projects, each of which requires students to use course content to solve real-world issues in their community.

Sociology requires that students complete one collaboration assignment per semester. A collaboration assignment is a one- to two-hour synchronous online session with a group of other students, facilitated by the teacher. During the session, students work together to complete an assignment. The collaboration assignment allows students to discuss their assignment and complete an assessment of the collaboration experience. For example, students might investigate and debate the topic of nature versus nurture. They would look at a set of twins who were separated at birth and work as a group to create a description of each twin's personality traits, behaviors, and characteristics. They would complete a mock interview of the twins and then pull together their findings to conclude how the twin study demonstrates nature versus nurture. Students turn in their final project along with an evaluation of each group member who contributed to the project.

The current state-of-the-art status in online implementation of PBL at FLVS can be determined by examining these two courses and by considering Dr. Rice's four cornerstones for effective project-based learning:

1. ***Self-directed learning, student choice, and autonomy*** – FLVS excels here, given their standard course management practices. Students control the speed with which they complete courses. They choose the real-life issue that will allow them to address the mini-project question, and they select the media and method to present their project work. While some learning activities frame problems in a relative narrow manner (e.g., the Sociology twins collaboration assignment), PBL appears to integrate seamlessly into FLVS online learning where this attribute is concerned, giving students what the Buck Institute for Education calls "voice and choice."

2. ***Active student participation*** – FLVS students control the rate at which they complete these courses, and they are empowered to select the specific issues they address in order to complete the mini-projects. This is consistent with understandings of how students become highly engaged and active in their studies, applying what the Buck Institute calls "inquiry as part of the process of learning and creating something new" (What is PBL?, 2012). This is another way the precepts of PBL are well-aligned with online learning in these FLVS examples.

3. ***Collaboration, ideally with others outside of class but perhaps with classmates, which contributes to the development of the project solution*** – Projects in both courses may be completed with collaboration—a key 21st Century Skill, alongside critical thinking, problem solving, and communication (What is PBL?, 2012). The FLVS courses examined require students to participate in collaborative activities, but the fruit of this interaction does not necessarily contribute to the solutions developed for students' projects. Students may elect to collaborate on their project-based learning with other classmates or people in their community, but may complete their projects without doing so. While collaborative activities are being thoughtfully integrated into FLVS courses, room still exists to get closer to the PBL ideal of collaboration being a substantive part of project development. To be fair, collaboration at a distance is a challenge for any project, whether in education, business, or other human endeavors. FLVS faces challenges associated with rolling enrollment and student-controlled study pace, on top of the reality that students from around the world enroll in FLVS courses. Traditional brick-and-mortar PBL classrooms do not have these constraints; it is demonstrably easier for students located in the same classroom or school to work collaboratively on class projects. FLVS's VLL approach takes advantage of this to increase opportunities for students to collaborate face-to-face—an opportunity of which students in both of the above courses have availed themselves in the past.

4. ***Authentic assessment, which includes real-world application and presentation to an external audience*** – Both courses encourage students to address real-world issues with their projects. The HOPE course uses peer review as mechanism to share student work, but only to an audience of one member of the student's peer group. In the Sociology course, students present their finished projects to their teacher. Teachers of both courses may select and share exceptional student work as exemplars with class members. However, neither course currently requires that student work be presented to an audience "beyond their classmates and teachers – in person or online" (What is PBL?, 2012). Each of the national informants interviewed for this paper stressed that presentation of student work to such an audience is a critical step to promote authenticity in PBL. Understanding this, FLVS is launching a new portal website, which will allow student work to be posted and shared with the broader FLVS community. This opportunity for projects to be presented to a wider, more public audience is a substantial step toward achieving this PBL model ideal.

To this point, FLVS has done an excellent job at applying PBL in their online world, and they have gained valuable insight into the challenges and opportunities of doing so. FLVS appears interested in continuing to explore ways to improve its already strong implementation of this challenging and powerful instructional method.

# Next Steps in the Evolution of PBL in Online Learning

FLVS is definitely in the forefront of efforts to offer PBL in purely online courses to middle and high school students. Effective PBL, while not necessarily simple to implement face-to-face with students in brick-and-mortar classrooms, becomes additionally challenging in virtual settings. FLVS is currently maintaining a high standard of fidelity to key elements of high-quality PBL in their online courses. However, the perspective afforded by the contributors to the interview study underpinning this paper suggests that opportunities still exist for educators to improve the state-of-the-art of PBL where these two educational approaches meet.

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Higher education and business—both of which present arguably more "authentic" learning opportunities than does Kindergarten to Grade 12 education—may provide examples for ways to improve collaboration and sharing of student work with real-world audiences in online PBL activities. New technologies (e.g., three-dimensional virtual workspaces) can be expected to become more affordable and accessible, perhaps reaching a point in the not-too-distant future where they become appropriate solutions for these learning models. Blended learning may hold additional promise for the implementation of project-based approaches, or perhaps aspects of the various blended models that complement elements of PBL might be adapted to purely online courses. Advances in online collaboration technology may afford new opportunities for students to more easily present their work in authentic ways to audiences outside of their courses—parents, the public, policy makers, the media, or even prospective FLVS students.

Finally, additional research into the efficacy of online PBL would almost certainly contribute to collective theoretical and practical understandings of how to optimize these approaches, and the relative importance of the various factors that bear on their effectiveness. The lack of overlap between PBL and online learning "best practices" shared by the experts interviewed for this paper strongly suggests that there exists room for innovation and progress where project-based and online learning meet.

# About Hezel Associates, LLC

Founded in 1987, Hezel Associates is a research and evaluation firm in Syracuse, NY, specializing in the study of education innovations.

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# About FLVS

Florida Virtual School (FLVS) is an established leader in developing and providing virtual Kindergarten through grade 12 education solutions to students nationwide. A nationally recognized e-Learning model, FLVS, founded in 1997, was the country's first state-wide Internet-based public high school. In 2000, the Florida Legislature established FLVS as an independent educational entity with a gubernatorial appointed board. FLVS is the only public school with funding tied directly to student performance.

If you are interested in learning more about the Project-based learning courses offered through Florida Virtual School, please visit **www.FLVS.net**.

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