

# Mathematics and Quantitative Reasoning

## Prospectus

### Context

Mathematics and quantitative reasoning are challenging areas for many alternative schools, and Big Picture Learning (BPL) currently is undertaking an extended redesign of our curriculum and teaching practices in this area. Our approach is to bring strengthened academics to what is relevant to the student as distinct from prevailing designs that attempt to bring relevance to academics. Ultimately, we believe our work can meld these two approaches.

Our experience indicates that it is important to understand quantitative reasoning within real-world contexts. For example, shortfalls in students' quantitative reasoning are often not errors in mathematical skills but in reasoning in quantitative contexts. Traditional mathematics skills testing often fails to uncover the essential workplace skills of context-based reasoning, skills that high quality facilitation of learning and meaningful performance assessments can address.

### The Work We Propose To Do

Quantitative reasoning is one of the five Big Picture Learning Goals.

*How do I measure or represent it? The goal is to think, learn, and perform like a mathematician: to understand numbers, to analyze uncertainty, to comprehend the properties of shapes and dimension, and to calculate how things change over time.*

BPL proposes to develop *QR Quest*, a highly innovative and interactive web-based portal containing a myriad of engaging resources designed to significantly improve students' quantitative reasoning and mathematics skills and understandings. An accomplished *QR Quest* seeks to extract and make sense of meaningful math applications and understandings from the relevance – running counter to traditional math instruction which strives, many times unsuccessfully, to find relevance in the math.

Big Picture will design and prototype *QR Quest* in selected schools in its network of 60 small high schools located throughout the country. It will then refine and scale the program throughout an expanded network of alternative high schools throughout the country. Big Picture will maintain the program and in order to expand the reach of services beyond the Big Picture network of schools, will explore the possibility of operating it in a fee-for-service model.

### Goals and Objectives

Our goals for this work are to:

1. Create an unparalleled learning environment that creatively connects essential workplace skills with student-led interest and curiosity.
2. Produce an easily replicable template for real-world learning and application that takes full advantage of the very best of available technology tools.

3. Inspire students to engage in learning far beyond the traditional classroom – learning that requires establishing and maintaining relationships with mentors, advisors, and students with similar interests and expertise that continuously advances everyone’s understandings.

In order to accomplish these goals, we will:

1. Develop a set of multi-grade units for learning and applying fundamental math skills and concepts.
2. Develop a mathematics portal for students and teachers that supports student interest-led investigations that use real-world contexts and experiences to draw out essential and relevant mathematical understandings.

## Major Tasks

To accomplish these objectives, BPL will:

**Develop support materials.** We will develop contextually based, integrated units, modules, and guided quests as part of the QR Quest project. These units creatively integrate essential understandings in Number Sense, Algebra & Functions, Measurement & Geometry, Statistics, Data Analysis and Probability, and Mathematical Reasoning – strands included in most state mathematics frameworks and high stakes tests.

**Develop mathematics portal.** A second initiative is QR Quest, Big Picture’s innovative model of student interest-led investigations that move from “life to text” using real-world contexts and experiences to draw out essential and relevant mathematical understandings. QR Quest provides a framework for students to purposively look for mathematical connections to better understand driving questions and problems that interest and engage them while connecting via the Internet to other students, experts, and expert practitioners. Each QR Quest, whether explored individually, with a partner, or in small groups, will effectively integrate students’ intellectual curiosity and tacit knowledge while making the most of available technology tools for researching information, communicating with other learners and advisors, and posting/displaying learning to share with and inspire others. Our intent is for QR Quest to serve as the nucleus of a vibrant global learning community.

**Develop a professional development system.** This will largely consist of familiarizing Big Picture advisors who come to assist their students at portal work of the similarities and differences from other approaches in student-centered, project-based learning. Ideally, the collaborative ideas, technology, “portal” methodology, travel and virtual workshops, and teaming will combine in such a way to induce an initial spark of excitement along the lines of each student’s own interests.

**Develop performance assessment measures.** In keeping with the Big Picture Learning design, assessments would be delivered in an authentic mode, documented in peer and mentor-reviewed exhibitions of skills, discoveries, demonstrations, papers, talks, inventions, and integrations with other Big Picture student work.

## Resources Required

BPL needs additional resources in order to conduct and evaluate the prototype, develop additional projects, and then refine, document, evaluate, and disseminate the entire quantitative reasoning

initiative within its own network as well as to the schools in the Alternative High School Initiative (AHSI), a nationwide network of 11 organizations supporting over 300 alternative schools.

We estimate that this project will require about \$.9 million over two years. We need resources for personnel to develop and implement the units and the QR Quest portal and to prototype those resources in selected schools, develop a comprehensive education, training, and support system for advisors, and develop rigorous and authentic performance assessments.

### **Benefits**

By developing and promulgating innovative approaches to mathematics education, BPL will contribute to its revitalization in our schools and in other traditional and alternative school settings where hands-on learning in out-of-school settings and contexts is practiced. Through our dissemination of this work, we will help to create a generation of youth who can reason well mathematically and are eager and prepared to use well-developed processes for asking and answering questions about the world. Such an accomplishment would benefit our entire economy and society.