

Summerbridge Math Curriculum 2018

What is Project Based Learning? What is its Purpose?	Goals																					
<ul style="list-style-type: none"> • Project Based Learning is “a teaching method in which students gain knowledge and skills by working for an extended period of time to investigate and respond to an authentic, engaging and complex question, problem, or challenge” Retrieved from: https://www.bie.org/about/what_pbl • This kind of learning is all about engaging students in real world problem solving and in challenging students to make choices, reflect on their efforts, and work as a team. • Project Based Learning does rely on the content area utilized; however, in this style of learning, the content becomes a vehicle for teaching other kinds of skills, like: <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">✓ A love of learning</td> <td style="width: 33%;">✓ Planning</td> <td style="width: 33%;">✓ Reflection</td> </tr> <tr> <td>✓ Independence</td> <td>✓ Follow Through</td> <td>✓ Critique</td> </tr> <tr> <td>✓ Curiosity</td> <td>✓ Risk Taking</td> <td>✓ Persistence</td> </tr> <tr> <td>✓ Accountability</td> <td>✓ Adaptability</td> <td>✓ Planning</td> </tr> <tr> <td>✓ Teamwork</td> <td>✓ Communication</td> <td>✓ Questioning</td> </tr> <tr> <td>✓ Organization</td> <td>✓ Asking for help</td> <td>✓ Time Management</td> </tr> <tr> <td>✓ Negotiation</td> <td>✓ Creative Solutions</td> <td>✓ Pride of Self</td> </tr> </table> • In project based learning, the end product is important, but even more important is the process. When doing this kind of project, every activity you do provides a foundation for the final product. Every activity builds student knowledge and skills. Every activity, assessment, practice problem, and homework assignment is an important piece of the larger whole. • When doing this kind of project, remember, the teacher is a guide. You provide the structure, the resources, the supplies, and the problem to solve. The students do the rest. • During this process, it is important to continually remind students of and reflect on students’ progress toward the larger goal/problem/challenge/question. 	✓ A love of learning	✓ Planning	✓ Reflection	✓ Independence	✓ Follow Through	✓ Critique	✓ Curiosity	✓ Risk Taking	✓ Persistence	✓ Accountability	✓ Adaptability	✓ Planning	✓ Teamwork	✓ Communication	✓ Questioning	✓ Organization	✓ Asking for help	✓ Time Management	✓ Negotiation	✓ Creative Solutions	✓ Pride of Self	<ul style="list-style-type: none"> • Moving from instruction to inquiry <ul style="list-style-type: none"> ○ Utilizing an essential or driving question to frame a challenge/the project ○ Building that question/project on knowledge of the discipline ○ Bringing students back to the driving question on a regular basis • Establishing a classroom environment that is inquiry based <ul style="list-style-type: none"> ○ Teaching students to be problem solvers ○ Teaching students to be self-directed learners ○ Teaching students to pose well thought out and meaningful questions ○ Teaching students to seek the answers to those questions in thoughtful and organized ways. • Rethinking student mastery and assessments <ul style="list-style-type: none"> ○ Creating a well thought out unit plan ○ Establishing a series of minor and major checkpoints throughout the project ○ Assessing non-math skills: presenting, collaborating, time management, organization, etc. ○ Establishing goals for individual students – each student will have different abilities and mastery will look different for each of them. • Building individual and team skills <ul style="list-style-type: none"> ○ Developing well-rounded students who can collaborate well by expressing ideas coherently, listening to others, compromising, and respecting deadlines. ○ Helping students to persevere through difficult tasks and to follow through on goals. ○ Helping students to be accountable and take ownership over their work.
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Teacher Checklist

Teacher planning is integral to the successful implementation and completion of Project Based Learning. You need to:

- Have a clear question, challenge, or problem for students to solve.
- Have a clear idea of the final product you want students to produce.
- Have a model(s) or example(s) of the final product so students can see what your expectations are.
- Work backwards from the final product
 - What goals do you have for the unit
 - What content-based knowledge do you want students to know?
 - What other skills do you want them to acquire?
 - What steps with students need to take in order to complete the larger project?
 - What skills and knowledge will students need in order to complete the larger project?
 - In what order will students need to complete these steps in order to complete the larger project?
 - Where and how will you build in time for students to explore, research, practice, create, analyze, and discover?
 - When will students reflect individually, with others, and with you on their progress and choices?
 - When and how will students publish or present the pieces of their project and the completed project?
- Establish a system of organization to help students follow a clear path and utilize previously completed and created materials at later stages.
 - Students should create a portfolio of their work – how should it be organized and when will students add to it?
- Consistently provide clear instructions and expectations.
- Understand that every single thing you and the students do in your classroom leading up to the final product IS the project based learning. The final outcome is important, but the entire process is the whole point.

What We Want To See

- Partner and group work
- Providing students with opportunities to select specific jobs within a group and perform certain roles for that group
- Instruction and activities that help students learn how to communicate with, listen to, and negotiate with other students
- Hands on and discovery style activities
- Use of visuals, models, examples, and manipulatives
- Extension activities available for students moving at a quicker rate than classmates
- Note taking guides that help students to learn the process of organizing their thoughts
- Useful takehomes/handouts that students can refer back to during other activities
- Incorporation of cross over skills like talking to the text, writing, science terms, etc.
- Homework that extends learning and can be used in the next day's lessons
- A well thought out and scaffolded project with clear end goals.
- Emphasis on communication skills, teamwork, problem solving, perseverance, accountability, and follow through
- Meaningful (limited) direct instruction
- Meaningful practice of skills
- Lots of real world problems, examples and applications of math
- Field trips and guest speakers
- Opportunities for students to share out and reflect on progress
- Opportunities for students to “officially” present their findings/project
- Helping students to craft meaningful questions and find answers to those questions.
- Attention to academic math skills that are useful in the context of your project.

Keystone Exam - Anchors	Keystone Exam - Key Terms		Skills You Might Address In Your Unit
<ul style="list-style-type: none"> • Represent and/or use numbers in equivalent forms (e.g., integers, fractions, decimals, percents, square roots, and exponents). • Apply number theory concepts to show relationships between real numbers in problem solving settings. • Use exponents, roots, and/or absolute values to solve problems. • Use estimation strategies in problem-solving situations. • Simplify expressions involving polynomials. • Write, solve, and/or graph linear equations using various methods. • Analyze and/or use patterns or relations • Interpret and/or use linear functions and their equations, graphs, or tables. • Describe, compute, and/or use the rate of change (slope) of a line. • Analyze and/or interpret data on a scatter plot. • Use measures of dispersion to describe a set of data • Use data displays in problem-solving settings and/or to make predictions. • Apply probability to practical situations. 	<ul style="list-style-type: none"> • Absolute value • Acute triangle • Adjacent angles • Alternate exterior angles • Alternate interior angles • Area • Circumference • Coefficient • Conversions • Coordinate plane • Corresponding angles • Denominator • Distributive property • Domain • Equilateral triangle • Equation • Exponents • Expression • Fraction • Integers • Irrational numbers • Isosceles triangle • Like terms • Linear function • Mean • Median • Mode • Number line 	<ul style="list-style-type: none"> • Numerator • Obtuse triangle • Order of operations • Percent • Perfect square • Perimeter • Pi • Polygon • Prime number • Prism • Pythagorean theorem • Radius • Range • Ratio • Rational numbers • Real numbers • Scalene triangle • Scatterplot • Scientific notation • Slope • Square root • Supplementary angles • Table of values • Term • Variable • Vertical angles • Volume • X and Y axis 	<ul style="list-style-type: none"> • Add/subtract/multiply/divide • Positive and negative numbers • Budgeting • Discounts, markups, unit price • Translating and ordering fractions, percentages, and decimals • Substitution – algebra • Equations and formulas • Linear functions $y=mx+b$ • Rate of change • Word problems – translating into an equation • Converting data to an appropriate graph • Reading and analyzing graphs • Collecting and recording data – sample size and results • Calculating distances • Geometry • Surface area, perimeter, volume • Angles • Measurement • Probability and statistics • Communication and presentation skills • Managerial skills • Like skills • Math vocab – Keystone vocab • Calculator use - using calculators effectively • Test prep - strategies for math test taking (both classroom and standardized) • Calculate gas usage and mileage for trips • How math is used in other subjects and areas like science, engineering, medicine, architecture, etc. • Researching real world math jobs • Organizational strategies • Planning and follow through

Project Examples

Possible Project Ideas	Toothpick Bridge Example	Build your own School Example	Product Design Example
<p>Feel free to use an idea from the list below. The following 3 columns are examples of how a project might play out and demonstrate a driving question and possible activities.</p>	<p>Driving Question: How can we design and build a toothpick bridge that will be able to support a 20lb weight for 5 minutes?</p>	<p>Driving Question: How can we design a functional, effective, and creative learning space that will meet all of the needs of a fully functioning middle school?</p>	<p>Driving Question: How can we identify a gap in the current market, design a product to fill that gap, create that product, and finance production?</p>
<ul style="list-style-type: none"> • Toothpick Bridge • Build your own house/school • Toy/product design • Plan a vacation • College planning • Apartment hunt • Start your own business • Green your home/school • Open a café/restaurant • Cater a party • Space mission • Investment banking • Create a math book for children • Create a new sport, venue, rules, teams, etc. • Rescue a failing business • Create a charity • Math in art • Build a large structure (as a class) • Egg drop • Run a farm • Build a park • Start a garden and vegetable stand • Start a band and create music • Design an amusement park 	<p style="text-align: center;"><i>Possible Activities/Skills/Deliverables</i></p> <ul style="list-style-type: none"> • Designing and maintaining a budget • Bridge structures – geometry • Basic principles of engineering • Analyzing pros and cons of different bridge structures • Blueprint drawing • Purchasing inventory • Comparing and contrasting prices and sizes of products for best deal • Buying items in bulk • Calculating supply and labor costs • Add/subtract/multiply/divide • Positive and negative numbers • Translating and ordering fractions, percentages, and decimals • Managerial skills • Teamwork and individual job assignments: designer, engineer, business manager, investor, construction worker, etc. 	<p style="text-align: center;"><i>Possible Activities/Skills/Deliverables</i></p> <ul style="list-style-type: none"> • Designing and maintaining a budget • Purchasing inventory • Utilizing coupons • Comparing and contrasting prices and sizes of products for best deal • Buying items in bulk • Calculating flooring costs based on surface area • Calculating storage costs and space • Hiring and payment of employees • Leases/rent • Calculating quantity • Add/subtract/multiply/divide • Positive and negative numbers • Discounts and markups • Unit price • Translating and ordering fractions, percentages, and decimals • Designing floor plans and blueprints 	<p style="text-align: center;"><i>Possible Activities/Skills/Deliverables</i></p> <ul style="list-style-type: none"> • Classroom economy • Analyzing the current market • Stock market and investing • Create a business model • Create a budget • Present business model to potential investors • Calculating sales and potential sales • Producing marketing and advertising materials • Calculating storage costs and space • Hiring and payment of employees • Leases/rent • Calculating quantity • Graphing • Translating and ordering fractions, percentages, and decimals • Geometry • Surface area, perimeter, volume, angles • Package design

Students must produce:

1. A Final Project

Driving Question	<ul style="list-style-type: none"> • Develop one driving question for the entire project <ul style="list-style-type: none"> ○ What is the problem or challenge at hand? ○ What do you want students to know or be able to do by the end of this project?
Tangible Final Deliverable	<ul style="list-style-type: none"> • Students should be working toward a final goal and should be producing something tangible, which may include any of /a combination of the following: <ul style="list-style-type: none"> • A sales pitch/presentation • A product/packaging • A structure/model • A business plan/model • Blueprints/designs • A working prototype

2. Portfolio

Table of Contents	<ul style="list-style-type: none"> • Use the template below, which includes: <ul style="list-style-type: none"> ○ Page number ○ Item title ○ Key words ○ Date completed 	
Driving Question	<ul style="list-style-type: none"> • Create a page for students to record the driving question for the project • Allow time and space for students to reflect back on this question throughout the unit <ul style="list-style-type: none"> ○ Help students to connect the deliverables in their portfolio to this question ○ Help students to identify how the deliverables they create will help them to complete this challenge. 	
5 Major Checkpoints/ Deliverables	<ul style="list-style-type: none"> • Each week, students should be progressing toward the larger goal of completing the project. • You should have students completing at least 1 major checkpoint/deliverable per week (Weeks 1-5) • It will be helpful to show students a projection – what will the steps look like along the way to the final goal 	Deliverables might include: <ul style="list-style-type: none"> • Charts/Graphs • Calculations • Formula sheets • Illustrations • Research • Written items
10 minor checkpoints/ Deliverables	<ul style="list-style-type: none"> • Throughout the course of this unit, your students will be completing a variety of activities. • Each activity should have some purpose in terms of the larger project goal. • Part of your job is to help students to break down a large project into smaller parts and to understand how all of those parts work toward the larger whole. 	<ul style="list-style-type: none"> • Summaries of deliverables • Classroom economy forms • Web diagrams • Brainstorming • Models • Contracts • Budgets • Inventory
Organization	<ul style="list-style-type: none"> • All entries must include date worked on/completed • Students must keep their own portfolio organized • Prioritize the skill of organization and take time to make sure each student organizes his or her portfolio appropriately • Build in time for students to complete portfolio entries as a class 	

