# Creating a 21st Century Classroom

# Contents



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# Combine the 3R's and the 4C's

*Steps you can take to address the 4C's and shift instructional processes to create your 21st century classroom.*

*The illiterate of the 21st century will not be those who cannot read and write, but those who cannot learn, unlearn, and relearn.—Alvin Toffler*

The pace of change in our world is accelerating and designing classroom instruction with a 20th-century mindset no longer prepares students for future success. While not everyone agrees on a single solution, sitting in rows and listening to content delivered through a lecture is slowly being replaced with active learning environments where students are prompted to ask questions, seek out relevant information, and apply information, not just remember it.

In 2002, the Partnership for 21st Century Skills (P21.org) began looking at the skills students need to be successful citizens beyond school. After interviewing leaders in a range of fields and working with schools to implement the P21 framework, they identified a set of four essential skills they call the 4 C's: critical thinking, creativity, collaboration and communication.

The rest of this article describes steps you can take to reinforce the 4 C's in your classroom and provides ideas you can use to change instruction to make the 4 C's an integral part of the learning process.

## Critical Thinking

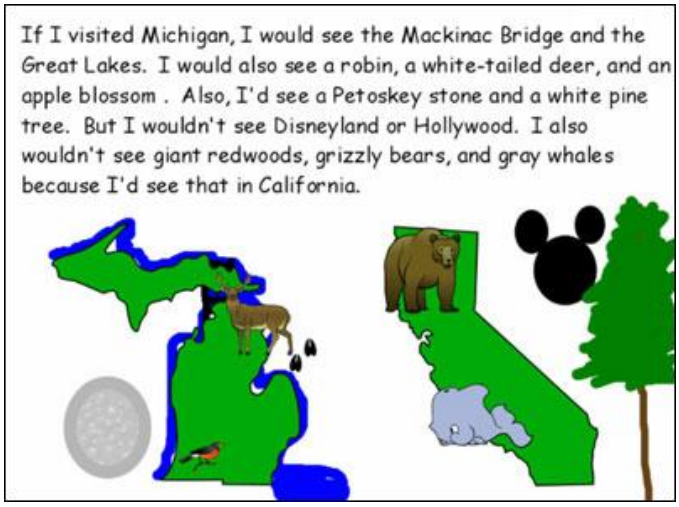
The often-cited, but nevertheless accurate, reality is that today's wealth of information makes it essential that every student must be able to compare and evaluate facts and opinions and make decisions based on that analysis. We need citizens who know more than "about" something, we need citizens who can take information and apply it to solve problems and create solutions.

Developing student's thinking skills is not a revolutionary concept. Benjamin Bloom and colleagues

first published his eponymous Bloom's Taxonomy, the ubiquitous methodology for classifying educational learning objectives, in 1956! You're likely also familiar with Webb's Depth of Knowledge, which was released back almost 30 years ago and the revised Bloom's Taxonomy from 2001. No matter which system you use, educational models like these can help you plan instruction that promotes higher levels of thinking.

Today's presentation tools make it easy for students to generate flashy presentations. Student's can simply mine data during a brief web search and copy and paste it into a presentation with lots of animation and movement. We can be so enamored by design and production value that we overlook the fact that the content was simply a dump of facts and information and shows no evidence of thought and understanding.

It is easy — and essential — to move beyond "about" projects; simply ask students to demonstrate knowledge AND thinking with end products that require both. Educator Elizabeth Allen has a list of fun products students can create that push them beyond copying and pasting, requiring them to think, internalize, and contextualize.




We need to create classroom cultures that value questions more than answers. If we want students to analyze, evaluate, and work with challenging ideas and problems, we need to equip them with skills for categorizing, deconstructing big ideas into component parts, identifying relationships, and asking more questions. Great thinking starts with effective inquiry.

## Creativity

The US Patent office evaluates new ideas using the criteria of 1) originality, 2) usefulness, and 3) novelty. This sort of innovation is a result of creativity in practice. If we are going to be able to address the needs and issues in our highly complex and rapidly changing world, we need to stop thinking about creativity as just art, or as a unique character trait.

To promote creativity in our students, we need to create a learning culture that values and promotes creative behaviors. One of the biggest predictors of person's creative capacity is their openness to experience. Ensuring that the classroom culture values risk-taking and difference can help students overcome their reluctance to try new things, especially those things at which they might not initially excel. Make it clear that creativity is a positive, valued attribute of EVERY student. "*Expect that your students can do it.*"

To promote student creativity, require students to create work that is uniquely theirs. This sounds easy, but making it happen requires you to change as well. Let go of giving students exact instructions that, when followed, are guaranteed to meet your expectation of success. Let students take control of project design; let them define what, where, when, and how during ongoing discussions about why.

Student work, whether done individually or in teams, should not look like work done by other students on the same topic. Sameness is a symptom…when the processes and the resulting product(s) all look the same, there is too little control in students' hands and too many instructions being followed. Create an environment where student creativity can flourish by transferring responsibility for learning and demonstrations of that learning to students.

## Collaboration

Students often dislike working in groups because they do not know how to collaborate productively. Take the time to develop norms for group work and discuss behaviors and actions that result in successful team projects.

Learning to build on one another's knowledge and expertise involves respect, listening, and contributing. You might scaffold the learning process by assigning roles, allowing students to see the different tasks needed to complete a project and understand how their strengths can contribute to the overall success of their group. Make sure students have time and opportunities to reflect on their own strengths and weakness, as well as how to utilize the strengths of their team members for maximum effect.

While building skills for successful teamwork is important, it is just the beginning of collaboration in a 21st century classroom. If we want to prepare students for high-level thinking and work, we need to give them access to real work with experts and colleagues in a field of study. They need to work alongside professionals on tasks for a real audience who values that work.

## Communication

Including communication as one of the 4 C's underscores the changing nature of literacy. Powerful literacy skills have always included the ability to read and to share thoughts, questions, ideas, and solutions in ways others can understand. Literacy includes traditional speaking and writing as well as well as new modes of communication made possible by widespread, affordable availability of video and multimedia tools.

Regardless of the medium, students must still be capable of clear, concise writing and the correct use of topic-specific vocabulary. Today's students must also build skills with multimedia forms of communication, requiring the ability to "show rather than tell" using pictures, music, intonation, and more.

Technology has changed how we communicate. PEW Research Center findings suggest that students prefer writing on the computer to writing on paper and that they will write and edit more when writing on a device rather than writing by hand.

If we want students to work hard, we need to give them audiences for their work that value the content and delivery for more than academic purposes. Technology makes it easy to connect students to the world around them, providing an authentic audience for their communication. The Web makes it easy to connect to a specific audience, allowing students to share an idea or solution that make a real difference in the lives of real people.

## 21st Century Skills in the Classroom

A 21st century classroom provides students with the dispositions and skills to meet both the 3 R's and the 4 C's. Don't worry…this isn't yet another requirement you'll need another teacher to cover.. To help students gain these essential 21st century skills, you can adapt the process of learning, not the content they learn. By adding in both maker movement ideals and elements of project-based learning, you can provide learning opportunities that require students to learn and apply these skills.

| Creativity | Critical Thinking | Communication | Collaboration |
|---|---|---|---|
| create | inquire | present | listen |
| design | predict | justify | share |
| enhance | analyze | articulate | clarify |
| imagine | find relationships | discuss | participate |
| change | evaluate | convince | motivate |
| invent | investigate | summarize | organize |
| improve | experiment | propose | empathize |

## Get Making!

Students want to be producers, not consumers. If you have the budget and the space, you could create a Maker Space in your classroom where students can use paper and other recycled materials to build prototypes of their ideas as well as products that solve real problems.

If you don't, you can take advantage of technology tools that start with a blank page and let students develop their own curriculum products that show their knowledge and passion. Open-ended tools like Frames and Wixie require students to think creatively as they develop, implement, and effectively communicate new ideas to others.

Having students create with video, audio, text, and images provides an opportunity to exercise higher-order thinking skills. Students must critically evaluate both content and media as they frame, analyze, and synthesize information to solve problems and answer questions.

## Implement Project-Based Learning

Project-based learning (PBL) connects students to real world issues and problems with an authentic audience. A project-based approach to teaching and learning requires students to question, think, and work together to apply learning. As they apply knowledge, explore relationships between ideas, and develop solutions, they engage deeply with and make personal connections to the curriculum.

*"Creating authentic learning tasks... prompts this important process of meaning-making, because they establish relevance; the question, 'why is this important to me?' does not go unanswered." Virginia Padilla*

This type of project work requires students to employ flexibility and adaptability as they reevaluate their work throughout the project process, becoming self-directed learners as they produce quality results. Working in diverse teams to complete a project on time and meeting assessment requirements helps to build leadership, responsibility, social skills, collaboration skills, and cultural awareness.

## Get Started

Whether you start with small steps for each of the 4 C's or tackle a large instructional shift to move toward a 21st century classroom, the important thing is to embrace the goal of provide students with the content and skills they need to succeed in our complex and changing world.

## Further Reading

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# Get Started with Project-Based Learning

*Move from projects to Project-based Learning by focusing on ideas, work, and effort.*


At a time when there is a lot of shallow, on-demand information, we need to encourage deep thinking and creative problem solving. Project-based learning provides an effective model to engage students in deep thinking, while connecting their learning to the real world.

## Is This Project Project-Based?

In a project-based approach to teaching and learning, students work to apply what they know to solve a real-world problem. Students explore the curriculum in depth as they apply knowledge to resolve questions, determine connections, and assess relationships. During the project-based learning process, students also engage and hone thinking, communication, leadership, collaboration, and other essential 21st century skills.

Lillian Katz shares that project work "provides children with the opportunity to apply skills; (2) addresses children's proficiencies; (3) stresses intrinsic motivation; and (4) encourages children to determine what to work on and accepts them as experts about their needs." (Katz, 1994).

There is widespread use the terms "project" and "project-based learning." While there are benefits to both, they are not the same thing.

## Why PBL and Not Just Projects?

While we may not yet be agreement about what exactly education today should look like, talking at students and stuffing their heads with facts is not longer enough. We may want every student to go to college and get a degree, but the reality is that many of them do not.

Project-based learning helps us engage learners today, keeping them in school and providing opportunities to learn skills that will help them meet the challenges of the world to come, regardless of whether they go to college or not.

On the continuum of teaching and learning, where instruction is on one end and construction the other, project-based learning falls at the constructivist end. Projects can be applied in a wider range of areas, depending on their requirements and organization.


We can push the learning in our classrooms from projects to project-based learning by focusing on ideas, work, and effort that matters.

## Ideas that Matter

For the most part, the "what" we teach in classrooms seems pretty straightforward. We have textbooks, standards, and elaborate scope and sequences that tell us what to cover ... but the goal of project-based learning isn't to cover. It's to uncover.

A project-based approach focuses on depth over breadth. It is as much about thinking as it is about knowing. It recognizes the importance of internalizing and contextualizing information in meaningful ways.

If we want students to uncover, we have to give them time. Time to explore, time to wonder, time to question ... and that's before the uncovering even begins! Time is likely to be a resource you do not have in abundant supply, so the ideas explored through a project-based approach need to address the most important questions in your discipline.

We have all heard a student say, "Why do I have to learn this?" Since project-based learning requires students to know and use knowledge to develop their ideas or determine potential solutions, it helps students see clearly why the content is important.

If we want to move toward project-based learning, we must identify what learning is truly essential in our class or course. What is worth exploring deeply? What isn't? Be prepared to back up your choices, as you will (and should) be asked by administrators, parents, students, and teachers.

Great questions for project-based learning do not lead to answers - they beget even more questions and inquiry. Truly important questions also require students to utilize knowledge of many subjects. What questions can you ask your students that will help drive them toward deep thinking?

Share your big ideas and essential questions with other teachers to see where you can find intersections and commonalities. Working together yields additional ideas and perspectives and often helps you clarify your thinking. Collaboration makes it easier to form instructional teams for project-based learning.

## Work that Matters

In the project-based classroom, the traditional roles of teacher and student are blurred. Students, whether exploring on their own or in a group, are likely to investigate and study beyond the knowledge of their teacher.

This need to know is driven by work that matters. In a project-based approach, student work centers around real problems and issues; things people face beyond an academic setting. If the problems are real, students need to become content experts in order to solve them.

A project-based approach asks students to apply knowledge in situations where there is a lot at stake. A meaningful PBL project requires students to solve important problems and create products that are important to someone beyond the walls of the classroom. Teaching or developing academic content for other students at other ages in not project-based learning. Student work needs to matter beyond the academic community.

We often think about expanding the audience for student work, and technology certainly makes it easy to post student products for a global audience. PBL requires that we consider not just the audience's distance from the classroom, but to consider how they feel about the value of student work.

Presenting to parents is almost always rewarding, but many of them will show up in support regardless of the level of students' deliverables. Parents can be a highly focused audience if students' work is beneficial or valuable to them. For example, as part of a nutrition and physical activity project, students might work to find solutions to healthier eating and exercise that work for their own families. You could even hold a health fair where interested families could learn lots of new ideas.


In a project-based approach that is student-driven, the audience for each student or group may not be the same. Some students could work to improve the nutrition of the school lunch program, collaborating with the cafeteria manager and food service organization to find healthier options students will actually eat and meet budgetary realities. Other students might work to find ways for students and teachers at their site to be more active during the school day.

In a project-based approach, we need to consider the specific person, organization, or group that benefits from the work students are doing. Student work is most authentic when it arises naturally to address an obvious need or a cause they have identified and are inspired to join.

In the same way we ask 'who cares?" about the ideas we are exploring, we can ask "who does this?" to get a better sense of the connection beyond the classroom.

This is also the perfect opportunity to connect with experts who can share important content and process as students begin work as well as form part of the evaluation team at the culmination of the project.

## Effort that Matters

Project-based learning is hard. Sure, it's hard for teachers, but it's hard for students too. By "hard," I don't mean it's just intellectually difficult ... it truly is hard work!

Expending a great deal of time and effort demands that the process is meaningful. We can make this hard work a lot more enjoyable for our students if we make sure it includes learner choice, learner control, and learning together.

Choice is crucial to getting students engaged, involved, and responsible for project work. The earlier we can involve them in the process, the better.

Giving a list of options to students for project topics isn't really choice. Ideas and content that matter are still going to drive the focus of what we choose for project-based learning. That doesn't make it easy to involve students. Taking the time to listen to their comments and discussions can help us determine ways to make choice less artificial.

The PBL process is perfect place for giving choice. If the problem or task is suitably real, you alone can't envision exactly what it should look like. What a solution or product should look like and how to share it with the world should be wide open for students.

Love making movies? Then share your solution through an advertisement, or public service announcement, or movie short. Love to draw? Create a diagram. When students choose how they will showcase their work, they naturally differentiate based on interest, ability, and experience. It becomes your job to coach them.

As long as the medium conveys the message, it doesn't matter what medium they choose. Latitude in medium provides additional opportunities to build communication, creativity, and critical thinking skills as they decide. Because so much of project-based learning is organic, leading us where questions and needs

demand, it is almost impossible to plan out exactly what is going to happen each day. This forces teachers to become facilitators and naturally moves both control and responsibility to students.

Because PBL asks students to solve real problems and challenges them with real tasks, it is difficult to implement true project-based learning without incorporating collaboration. Giving students opportunities to work together is another way to make learning fun and to build skills that are essential both in higher education and in the workplace.

While choosing your friends as your collaborators may not yield the best results, we need to give students opportunities to work together to build collaboration skills. The process of working together helps students reflect on their own strengths and weaknesses and learn how to utilize the strengths of others to reach shared goals. Working with others opens us up. We see firsthand how individuals can view things differently, and we learn to take risks, try new things, and grow together.

Finally, students need to realize that the project is theirs. Where they took the ideas, what they chose to work on, and the effort they put into the process should be a reflection of the individuals who worked together on the project. All the thinking, hard work, and effort are worthwhile when it is easy to see and when every learner can say, "This is mine!"

## Putting It Together

Consider a typical elementary state report. Once just a handwritten or typed report, state projects today may be fancy videos or involve students presenting to the entire school ... but the content hasn't evolved the way the delivery medium has. These reports are often a collection of facts and little more - the capital, the state bird, the state flower, and facts and figures about agriculture and population. When a student's work is about something, it is just a project.

Students' artifacts and performances in project-based learning may contain information and facts about a topic, but a mere fact dump is never the goal of PBL.

*A local travel agency would like to see more people travel for spring break. Apply what you know about the state of [Insert name here] to create a spring break itinerary for a family of four that includes at least one unique geographic feature, one historical highlight, and one current point of interest.*

This has more promise as a project-based approach. It involves higher-level thinking and applying knowledge (ideas that matter). It crosses the boundary between social studies and language arts, and could even include math if you include a budget requirement. It also seems to have real-world connections to tourism and family.

But is the work students are doing work that matters? To move beyond just a project, there should be a real travel agency that needs this help, or tourism board that needs help with marketing. Yes, students can present to their families, but the audience is still artificial, the task is fictitious, and the value of the work is low if the audience that sees these projects isn't really going to use the information to make an informed decision about an upcoming trip.

The process isn't overly specified so it also the potential for effort that matters. With an obvious focus on learning about locations in the United States, choice remains somewhat limited as far as content. But with open parameters requiring students to research and choose which geographic and historical content to include, there are no "canned" answers.

While everyone may create an itinerary that addresses the predefined set of expectations, each learner or group has latitude to showcase their work as a presentation, a video advertisement, a print brochure, and more.

The goal of this article isn't merely to provide a checklist to gauge whether an activity is a project or is project-based learning. Rather, the goal is to remind you to focus on ideas that matter, work that matters, and effort that matters to help you keep classroom learning headed in the right direction.

# Connect Curricula for Deeper Understanding

*Break out of the separate-discipline mentality and move to STEM and STEAM as you develop more holistic and problem/project-based approaches.*


If we were going to build a house, we would expect that all its various parts would work together. We would assume that the architect shared the building plans with the plumbing, electrical, and general contractors. If these contractors did their part without regard to how their work fit in with what others were doing, the house would be inhabitable. But in a similar manner, school curricula are often disconnected; that is, we categorize subjects by disciplines and teach them separately. Why aren't we concerned in schools when the content of one subject does not relate to other subjects?

Instead of studying motion across the subject areas: what is it, where we see it, and how it affects us in our daily lives, we study the principles of motion only in a science class. In most schools, the only connection between a topic like motion taught in science to other subjects is in the minds of students. This is often by chance rather than by design.

## Reasons for Separate Subjects

Most schools will say that they want students to have an understanding of their world as a whole, but they seldom look at topics with an interdisciplinary focus. Why? It is easy to find reasons why this disjointed approach to learning happens:

- Some argue that there is so much content and so many skills to be learned in each discipline that they don't have time to integrate subjects.
- Others say that the each discipline has a body of knowledge and skills that should stand on its own and not be muddied by the intrusion of other disciplines.
- Secondary educators say that there is insufficient common planning time to combine their efforts to teach an interdisciplinary course.

- Still others say that the whole system is geared toward separate subjects and to break out of this would require a monumental effort.
- Others are guided by "the tests," which are presented by separate disciplines.

Despite the norm, there are many schools that practice cross-curricular teaching. They organize students into interdisciplinary teams and coordinate lessons so that what happens in math, science, language arts, and social studies all tie to a common theme. Many times these teachers team-teach during larger blocks of time.

Advocates of this more holistic approach to curriculum argue that it helps students:

1. see how content of one subject is interconnected with content from other disciplines.
2. delve deeper into fewer topics rather than skimming across the surface of many topics.
3. connect learning more easily with the experiences in their lives.

## STEM, STEAM, and More

In recent years, curriculum developers have begun putting money and effort behind the notion of connecting allied disciplines. Linking the disciplines of science, technology, engineering, and math has been given the acronym STEM.

These disciplines have a lot in common, so their interconnection seems logical. We can find applications for each of these disciplines in the other. For example, we use science, technology, and math in the field of engineering. Similarly, we might use technology, engineering, and math in the study of a science such as genetics.

Some educators say that the arts are an integral part of STEM and they shouldn't be excluded from an interdisciplinary mix, calling their approach STEAM. For example, if students are studying the transfer of energy, art could be a means to show it through music, dance, or poetry.

Still others feel that it is hard to exclude any discipline from a unified study. Everything, they say, is interconnected. One program at Spigot Science uses the large acronym STEAM GLASS + to characterize this all-inclusive approach. It incorporates more subjects than STEAM, such as geography, language arts, and social studies.

The one thing that all these acronym-labeled programs have in common is the recognition that the ways we divide subjects is artificial and is something that occurs mainly in schools for the convenience of the education system. The way schools work and the way scientists and others work is quite different. When scientists are studying a problem, there are often scientific, mathematical, artistic, or social elements involved. They seldom think about which discipline is at play when solving a problem.

This discipline separation in schools does not meld well with a problem or project-based approach. Nor does it help students learn to think deeply about solutions to problems that cross discipline lines.

**Consider a student's day in each type of curriculum structure:**

| Subject Area | Separate subjects | Intradisciplinary by subject | Intradisciplinary by blended subjects |
|---|---|---|---|
| **Science** | Newton's First Law (An object at rest stays at rest and an object in motion stays in motion with the same speed and in the same direction **unless acted upon by an unbalanced force**). | Newton's First Law | How do we know how much force is applied to cause objects to move? Force experiments and calculations |
| **Math** | Area of a trapezoid | Force equation: F = m x a force = (mass) (acceleration) | |
| **Social Studies** | The Civil War-Battle of Gettysburg | Who was Isaac Newton? | What was happening in the world when Newton developed his laws? Research and multimedia project |
| **Language Arts** | Writing prompt: My favorite holiday | Writing prompt: Forces in our lives | |
| **Art** | Watercolor: Spring | The Art of Force: Newton Mobiles | How do forces affect us? Illustrate the effects with an art project. |
| **Health** | Avoiding disease | Forces that affect our bodies – the roller coaster | |

## Digging Deeper

The ultimate goal for the study of any subject is to develop a deeper understanding of its content and skills so that students can engage in higher-level thinking and higher- level application of its principles. When students dig deeper and understand content across several disciplines, they will be better equipped to engage in substantive discussion and application of the topic. They will also be better able to see relationships across disciplines.

Suppose upper elementary or middle school students were studying ecosystems. If they were studying this in science class, they might learn about how the habitats of plants or animals are interrelated. This is fine, but it doesn't push the topic as far as it could go. Students could collect and analyze data about ecosystems in the math portion of the study. They might use technology to find and represent information. They could learn what ecological engineers do and try their hand at designing a balanced ecosystem. Students could represent their findings using multimedia applications. And this study could go on to touch all the other school subjects.

Engaging in a thorough study of ecosystems would involve reading, writing, planning, designing, interacting, producing, and more. When students learn though an interdisciplinary approach, they are acting as they will in the real world—solving a problem rather than studying a subject. They are using many methods to gather, analyze, and process data.

Of course, digging deeper doesn't fit well in the time frame that most schools use. It takes time to link content across several disciplines, and it may be difficult to squeeze a learning activity into a 40-minute period. To change the method of learning will mean changing more than the curricula. The school structure, including the schedule and methodology will also need to change. The measurement of interdisciplinary approaches does not fit well in a traditional testing format. Just as test developers have found it hard to create science tests that include hands-on experiences, they would find it very challenging to test understanding when the content crosses several disciplines. Indeed, to measure the results of an interdisciplinary, problem-based approach, we must often use rubrics and other measures that some test makers feel are "soft measurement" due to the difficulty of getting quantifiable data.

One ray of hope comes from the support offered by the Common Core State Standards initiative. This effort is embraced by 45 states and it supports digging deeper though cross-curricular teaching and its associated problem-based and project-based approaches. It supports using a variety of methods and incorporating technology to help all students learn. This initiative seeks to prepare students for college and their careers.

## Our Challenge

To prepare our students for an integrated world, we need to break out of the separate-discipline mentality and develop more holistic and problem/project-based approaches. Many have tried to do this, and it isn't easy. Our separate-disciplinary structure is deeply ingrained in the culture of schools.

If we can ever reach the point where we view education as more than separate subjects and can begin to replicate the way problems are solved in teams in the working world, perhaps we will then be able to think outside the separate boxes that we our curriculum is squeezed into now. When we achieve this, our students will be the winners. After all, they are what this effort is all about.

# Develop a 21st Century Learning Environment

*Effective 21st century education is not limited to time or space, and considers the ways we learn best and our individual learning needs.*

Our traditional notion of learning environments has centered mainly on places and spaces. It's natural to associate the quality of our learning with the quality of our learning environments, but a fancy building with big LCD monitors and gigabit Ethernet may not be a 21st century school at all. In fact, an effective learning environment doesn't have to be a particular place or space. Effective learning environments do not limit themselves to time or space, but comprise a variety of support systems that take into consideration the ways in which we learn best as well as the unique learning needs of each student.

Today's classrooms look very different from those of the past. Students do not necessarily sit in rows of desks; teachers are as often working alongside students as lecturing in front of them. In many schools, students enjoy the luxury of a laptop for every learner. Learning environments today need to embrace the variety of places, ideas, and people that the modern world demands and reflect a flexibility of space, time, people, and technology.

Physical learning environments need to sustain and promote multiple modes of students learning, supporting both individual and group work, providing space for presentation and exploration, promoting interaction and a sense of community, and fostering both formal and informal learning.

Expanding our notion of learning environments to encompass more than physical space allows us to provide students with more opportunities for meaningful learning. Whether students are working in their communities to tackle problems through internships and service projects, or networking with peers using social networking tools to gather and share data on global issues, our learners are acquiring knowledge in a context that is meaningful and taking responsibility for their own learning. We are finding out that powerful learning is happening outside of schools through online learning, community service, and internships.

Technology can help seamlessly support a 21st century learning environment by blending physical and digital arrangements. This often includes online course work, access to outside experts, and the wealth of information in the online community. One-to-one technology, ubiquitous networking, and exciting new tools like Wixie allow students to turn ANY environment into a learning environment.

Many schools are also looking toward creative ways to expand time for learning. One common approach has been the block schedule, which creates bigger and more flexible time slots for student learning, as well as professional development and planning for educators. Some schools have extended school year calendars and the length of the school day to provide additional opportunities for learning and create a stronger link between schools, families, and the community.

Expanding the where and when of learning, however, does not guarantee the results yearned for by many administrators. Effectively using the time available to us is more important than ever before. Schools will need to move away from the idea of measuring accomplishments by the amount of time spent on a topic, focusing instead on the demonstration of what students have learned.

To be prepared for the world of the 21st century, students need to be inspired. Peers, teachers, educators, parents, entrepreneurs, and civic leaders can all provide the human component necessary to encourage students to become intellectual risk-takers and creative problem solvers. We need to praise students for generating ideas and encourage innovative thinking, and we must challenge students to push further to refine their most unique ideas into high-quality projects.

Each school is a unique amalgamation of leadership, instructional strategies, and teaching talents that meets the learning needs of its community. The belief that every child deserves and wants to learn, and the commitment to achieve that goal, is shared throughout all effective school communities.

There is no single right answer to developing a 21st century learning environment, but expanding our notions beyond the spatial and temporal restraints of our school building and school day will help us truly provide environments that support anytime, anywhere learning.

# Become a Classroom Coach

*Five ways to take on the role of a coach in a project-based learning classroom.*


In a student-centered, project-based classroom, the teacher roams the classroom, guiding students as they explore, plan, think, and create. We often hear the terms facilitate and "guide on the side" to describe this role, but I think it more useful to think of this role as coaching.

Coaches are more than facilitators; they share a common goal with their players. In sports, the team's shared goal is to win. Winning occurs in education when students become strong thinkers who can find, analyze, and apply information to solve problems, persuade others, and create something that is useful and/or remarkable.

Coaches always have an outcome in mind and work to help team members reach that goal. Coaches don't do the playing. They figure out how to get each player to develop and apply the skills and abilities they need to excel.

Coaches do not spend most of their time lecturing or even "front-loading." Coaches give players opportunities to practice and apply skills in a contextually appropriate situation, providing just-in-time feedback, asking targeted and specific questions, clarifying what is happening, and providing information relevant to what is happening at specific moments.

The project building process minimizes how much of the teacher's time is spent directing the class from the front of the room. During project building, student learning happens in a functional context… "just in time." Rather than providing information before the project that may or may not actually be required during the project, content is provided at the moment its need is realized. Students see the relevance of information they are learning because it addresses an immediate need, making it much more likely that they will internalize the content. As the project develops, students evolve into the role of coach for other students, sharing knowledge and information they have already learned.

A classroom coach needs to assist students rather than working and thinking for them. Coaches remove obstacles to learning or help students overcome them. The purpose of this is not to make the process easy, but rather to shift the focus on the learning rather than the obstacles.

The best coaching involves:

- drawing solutions out of the group.
- helping the group achieve results.
- helping the group succeed on their own.

Again, good coaches don't do the work for the group! The best coaches also believe that their team has tremendous potential.

## Effective Coaching Habits

### 1. Ask Open-Ended Questions

Questions requiring a "correct" answer can be intimidating and do not welcome a variety of responses or discussion. You need to ask questions that solicit ideas, feelings, and opinion, such as *"What if...?"* or *"Why do you suppose…?"*

When students aren't looking for a "correct" answer, there is less stress. They are free to share ideas in a risk-free environment. In this situation, discussion ends only when a solution is found or a new direction is taken.

Closed questions make it easier to evidence short-term success, like better scores on a multiple-choice test, but these isolated bits of content knowledge do not contribute to your shared goal of developing strong thinkers and learners.

### 2. Listen

When you listen, you are less likely to direct the group and lead them toward preconceived solutions. When the group asks a question of you, listen to their concerns and reply using an open-ended question that provides just enough information to to keep the discussion moving, allowing students to continue problem-solving on their own.

Learning and growth occur during the process of project-building. Listening helps you ensure that students do not focus solely on the task, product, or end-point. Listen to ensure that students do not miss out on fantastic opportunities for learning.

### 3. Foster Partnerships

When students look to another member of their group for insight, support, and information, they learn to appreciate the diversity within their group and realize that collaboration can lead to greater results. Refer to actions and suggestions already made by a team member, or ask the group leading questions like, "What ideas have you already come up with?" to ensure they are trying to solve problems on their own before coming to you.

### 4. Promote Student Self-direction

When students are self-directed, they become responsible for their own learning. As invested learners, they must identify what needs to be learned, identify how they can learn it, and determine how they can best share their knowledge and understanding. Yes, you may need to scaffold as they learn how to manage a project, but it is very easy to over-engineer a project trying to guarantee its success.

Good coaches support personal growth and are available to help students find answers. The best coaches know when to stay back. Floundering isn't fun, but solving all of your students' problems for them, and even being the one who always helps a team find the solution, doesn't build students' abilities.

### 5. Believe in Your Players

Push your students to produce the best possible project and solution, and have faith that they can do this without you doing it for them. Be clear on your expectations and trust that they can do the work. If you don't trust them, you indicate that do not believe in their potential for greatness.

Provide students with opportunities to learn skills and think on their own, but remember to step back. When your students see that you believe in them and that you are willing to let them stand on their own, they want to meet your expectations.

Classroom coaching can help you and your students reached a shared goal of powerful learning. Coaching can help you form strong partnerships with the learners in your classroom, developing trusting relationships that will help your classroom "team" achieve your shared goals.

# Create, Not Consume: Making in Language Arts

*Engage struggling readers by giving them authentic opportunities to practice, reading, writing, and illustrating.*


Technological innovations continue to make the world a smaller place, changing the nature of work and communication. In order to fully participate and thrive in a world steeped in information, students must be able to effectively locate and qualify information, apply it to solve problems, and effectively communicate ideas and solutions.

While today's classrooms may be full of digital natives, we still face the challenge of engaging those students who are not prepared for work at grade level and who are not interested in traditional activities.

The instructional response to at-risk students is often the application of more drilling, which further depletes their interest in school. Rote practice may seem like the fastest way to improve students' reading scores, but this tactic does nothing to foster an essential lifelong love of learning.

Like all students, at-risk learners yearn to express themselves creatively, to do things in non-traditional ways, and to demonstrate successes. Students who are struggling with literacy are rarely asked to create literacy products, eliminating important opportunities for them to demonstrate their abilities and mastery.

Creative multimedia tools allow for multiple forms of representation, providing an opportunity for students to demonstrate understanding while practicing literacy skills through writing (text), reading (audio), and illustration (picture walks and visualization). "When students publish their own books, you tap into their innate desire for recognition as they learn to connect to literature, play with language, and beam with pride at their accomplishments," shares California educator Linda Oaks.

## Publish student-created eBooks

Younger students are often asked to retell stories. We can use the same strategy for struggling readers and writers. Instead of requiring students to complete a fistful of worksheets or to order the scenes of a story in a workbook, have students publish their retellings as electronic books. Once students are masters of basic comprehension, push them to develop storytelling and linguistic skills by creating new endings or developing completely different variations of the same story.

Students can use tools like Wixie to create their own version of books like Mary Wore Her Red Dress by Merle Peek. Such adaptations give students an opportunity to include themselves in the story as well as practice new vocabulary or descriptive writing. Publishing an eBook motivates them not only to work hard during the process, but encourages them to practice when they revisit their very own eBooks at home.


Combining visuals with text gives students an opportunity to demonstrate learning without struggling to tell their story solely using words. Recording student narration provides an opportunity for nonthreatening practice as they record, listen, record again, listen, and finally save. The recordings also provide performances you can use to assess fluency.

## Have students "flip" the classroom with their own how-to tutorials

In a flipped classroom, students explore a variety of resources such as videos, web sites, and simulations at home and return to class to address misconceptions and explore additional questions with their teacher. Having students create flipped class resource videos helps them grapple with the content they are learning while providing an opportunity to for expository writing in a format they most likely have seen or used before, such as Khan Academy-style videos in school or how-to online videos about Minecraft or making rubber band bracelets.

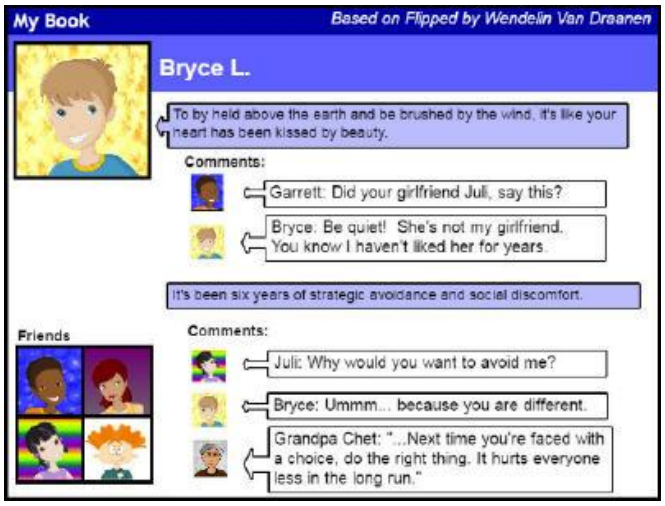

Second-grade teacher Katy Hammack found that after innumerable worksheets and countless review activities, many of her Title I students still lacked mastery over grade-level grammar and language skills. After creating her own grammar tutorials for student review, she began to ask her students to create them instead. She immediately noticed her students more quickly internalize grammar concepts and found that they were also "so proud when they saw their work being used by other students!"

## Create as a response to literature

There are lots of ways to evaluate student comprehension beyond character trait charts, plot summary worksheets, and stereotypical book reports.

Students can show what they know by creating scrapbooks or developing social media-style profiles for characters they are reading about. These projects can include plot summaries as well as direct quotes. Regardless of the exact format, students' deliverables are intended to demonstrate their understanding of point-of-view in ways that go beyond a simple copy and paste.

You can also ask students to design covers for books they have read or create book trailers to encourage other students to try a title in the school library. To connect to a potential reader, students need to understand the book and connect the story to their own experiences, helping them see how the content is relevant to them and the people who will view their projects.




The visual nature of these products allows students who struggle to read and write to demonstrate understanding by utilizing pictures and music as well as text. As they learn to think about audience and utilize the tools of propaganda and methods of persuasion, they build powerful skills in argument and media literacy.

## The Big Picture

The final Regardless of the activities you choose to do with your students, keep the following ideas in mind.

### Read and write in authentic ways

Students need (and want) to practice reading and writing in real-world situations. Technology helps us make this connection by asking students to use tools to create the types of products they see in the world around them.

Try to make sure every day includes time to apply literacy skills in projects that also have value and meaning beyond a specific learning goal.

### Publish for a real-world audience

At the very least, make sure students are doing work that is similar to work done by people outside of the classroom or would have value to someone outside of the classroom. Even better, ask students to do work that will actually seen by, evaluated by, and used by someone outside of the classroom.

All of these things indicate to students that their work has value and meaning. Technology makes it easy to share student work with a wider audience, whether they are creating eBooks, comics, cartoons, or public service announcements.

### Give students a voice

Student work should be a reflection of the creator, not the instructor. One student's final work should not look the same as another student's. Sure, we can scaffold early work with templates, but too much structure focuses student work solely on "correct" content, not representation or meaning. If our projects assume there is only one right answer for content and delivery, we aren't asking the right questions.

Take some time with a process like Understanding by Design to ensure you are clear on the goals for student learning. Many district lesson plan templates include great questions like: What will students know as a result of completing this lesson? Also include questions like: What will students be able to do as a result of completing this project? Sometimes this is simply a matter of remembering to focus on process learning as well content learning.

Asking open-ended questions and using open-ended and creative technologies can help you engage your students in important reading and writing practice as well as help them develop powerful literacies that will serve them in our rapidly changing world.

# Create, Not Consume: Making in Mathematics

*Build number sense and problem-solving with virtual manipulatives, art, play, and creative technology tools.*

*"Limiting the use of creativity in the classroom reduces mathematics to a set of skills to master and rules to memorize. Doing so causes many children's natural curiosity and enthusiasm for mathematics to disappear as they get older, creating a tremendous problem for mathematics educators who are trying to instill these very qualities."* - Hartwig Meissner

Most adults remember math instruction as listening to a teacher's explanation followed by lots of rote practice. This focus on memorizing procedures without context and deep understanding resulted in an adult population that largely feels they are "bad at math." This negative memory has resulted in a profound cultural dislike of math, contributing to our current situation of too few students choosing to become much-needed mathematicians and engineers.

Changes elicited by the Common Core State Standards and the growing popularity of the Singapore Math approach have generated significant change to math instruction in the elementary classroom. Rather than an approach that focused on finding the answer to 4+4, students are now asked to share many ways they can make the value 8.

While 4+4 will likely be the first option shared, it won't take long for students to come up with other factors like 2+6, 1+7, and 3+5. Students may not be able to define the commutative property of addition, but they will realize that 6+2, 7+1, and 5+3 are also valid responses.

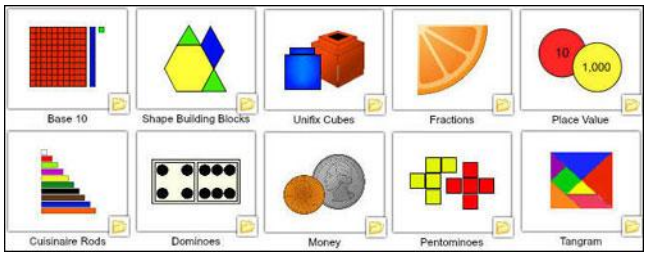
More time is required for students to begin producing responses like 12-4, but instead of telling students what to think, teachers now give them the opportunity to reason. As soon as an alternative to simple addition is suggested, the wave of new solutions grows almost exponentially.

A renewed focus on students explaining their work helps teachers determine whether learners understand concepts. Time that used to be spent on rote repetition

of a procedure is now spent on arranging, rearranging, and thinking about a problem. The implicit message of "what's another way" is accepted so long as students can demonstrate the mathematical thinking behind their suggestions.

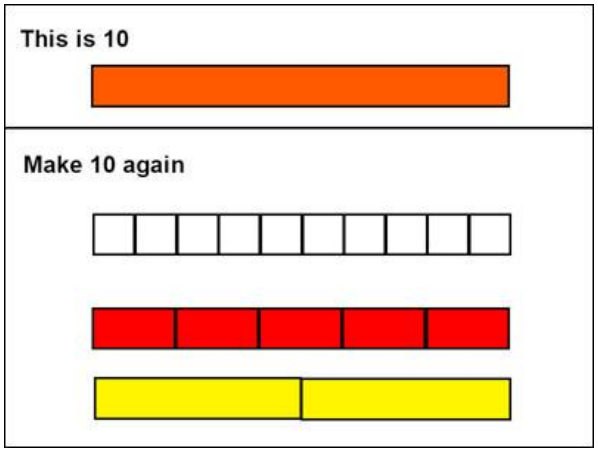
## Exploring Value with Virtual Manipulatives

The use of base-ten blocks and Cuisinaire rods, created in the 1920's, are not new. Their use in modern classrooms provides students a way to conceptualize numbers in a variety of ways. These tangible objects are called manipulatives.




If you are unfamiliar with the term, think about counting money. With money, each physical coin represents a value. Manipulatives like these provide a way for students to see and feel a mathematical concept by manipulating it. This hands-on, visual approach has been show to have a positive effect on student achievement. (Ruzic & O'Connell , 2001)

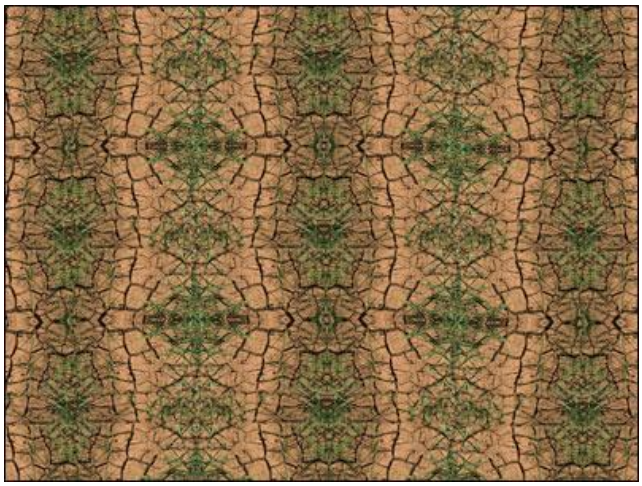
The prevalence of technology in the classroom introduces the concept of virtual manipulatives. Although they are not tangible, digital manipulatives can still be grouped and regrouped to create models that help students see and internalize mathematical concepts. Following is a sampling of the virtual manipulatives found in Wixie.




In the same way that student can move Cuisenaire rods on a table to form equal values; students can arrange representations to achieve the same effect using a computer. As they see and play with different ways to formulate the same value, they build stronger number sense and a better conceptual understanding of factors. As students play with virtual manipulatives, they build cognitive models that teachers can actually see, allowing them to quickly perform formative assessments and identify misconceptions.

## Pattern play with Virtual Manipulatives

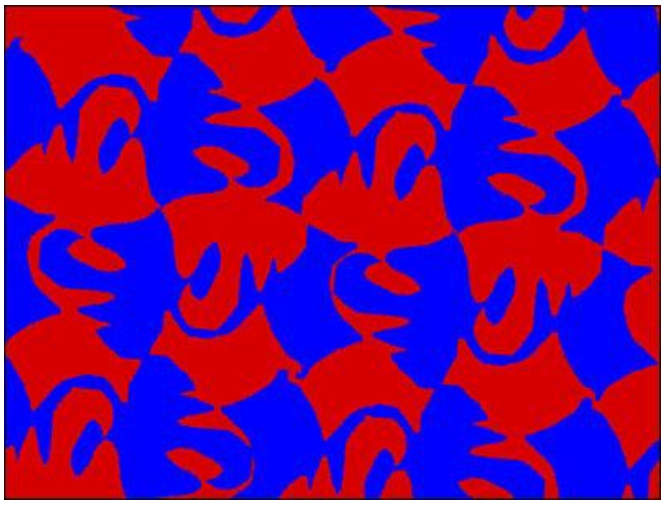
Virtual manipulatives offer easy opportunities for constructing with shapes. As students participate in this type of play , they naturally sort, compare, match, and begin to create patterns, exactly the sort of mathematical thinking outlined in the Common Core State Standard for Mathematical Practice: 7. Look for and make use of structure.



Dr. Walter Drew and Dr. Henry Olds found benefits to building mathematical thinking as students first build patterns with physical shapes and then continue their work with the resulting patterns on the computer where they experimented further "in an environment where the risk factor is substantially reduced. Trying out ideas is faster and easier and mistakes or wrong turns are easily undone" when students work with virtual manipulatives. The resulting iconic pattern play helps students begin to understand how to apply elements of geometric patterns like rotation and reflection in a way that is both engaging and beautiful.

## Connecting math to art

Using art is a great way to help students see the beauty of math as well as help them connect math to the world around them. Most students have seen tessellations in tiled bathrooms, kitchens, or courtyards. Many are also familiar with the work of M.C. Escher. Students can use the paint tools in programs like Wixie to create tiling patterns as well as their own original tessellations.



Wixie's paint tools also let students play with symmetry in photos and even paint using linear and radial symmetry.

As they play with math on the computer through art and virtual manipulatives, students begin to create and solve their own problems. Creative digital tools provide a safe place they can experiment and easily undo mistakes. This environment encourages learners to try new approaches and "fail forward" as they work to solve problems they create.

Creative technology tools can help us foster and support a classroom culture that values multiple approaches, questions more than answers, process more than product. Encouraging creativity in math instruction can help us develop mathematical thinkers who have the "resourcefulness, persistence, and desire to explore alternative methods of solution." (Mann, 2005) In other words, we can create a generation of students who love to play with math.

## References and Further Reading


Mann, E. L. (2005). **Mathematical Creativity and School Mathematics: Indicators of Mathematical Creativity in Middle School Students.** University of Connecticut.

Meissner, H. (2000, July-August). Creativity in mathematics education. Paper presented at the meeting of the International Congress on Mathematical Education, Tokyo.

Ruzic, R. & O'Conell, K. (2001). "Manipulatives." Enhancement literature review.

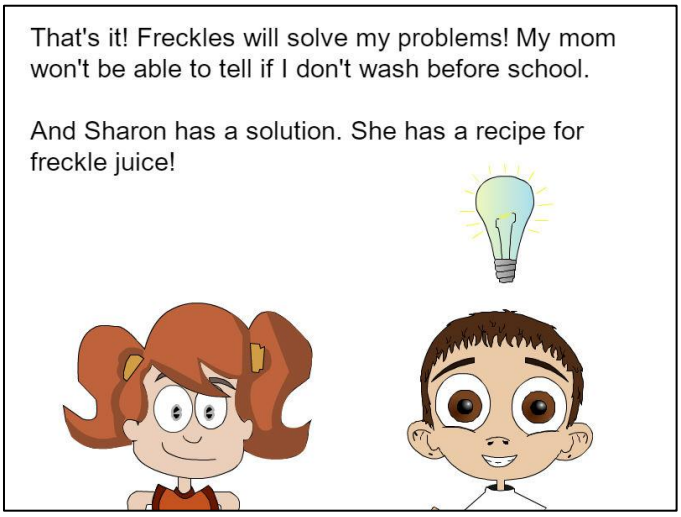
Piggott, J. (2011). "Cultivating Creativity." University of Cambridge. Accessed from: https://nrich.maths.org/5784

# Additional ideas from real classrooms

## Informational Texts

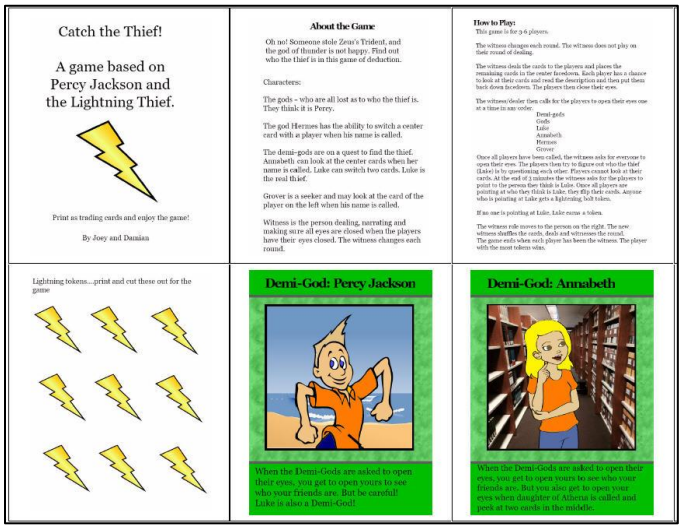

Younger students can retell an event from school or home. View sample online.

## Book Trailers




Tell the story of your favorite book and why you would want to read it. Movie-trailer style. View sample online.

## Create a Game




Students can create their own card games to teach a skill or engage with characters from history or literature. View sample online.

## Animal or Artifact Interviews


Students can share understanding and perspectives as they create an interview with an animal or artifact. View sample online.