

Work that matters

The teacher's guide to project-based learning



"This guide is an unusually thoughtful and valuable resource for teachers. It is distinguished by a powerful focus on the integrity and quality of projects – not just doing them, but doing them well."

RON BERGER
CHIEF PROGRAM OFFICER – EXPEDITIONARY LEARNING SCHOOLS

"There are always those adventurers in education who are wanting to push the frontiers of what is possible and are driven by a passionate belief in what schooling should and could be like. Here is a guide that can help and inspire others to try too. It is such people who have always found ways to unlock the future for many youngsters who would otherwise spend their lives realising only a fraction of their potential."

PROFESSOR TIM BRIGHOUSE
EX-CHIEF ADVISOR TO LONDON SCHOOLS

This guide has grown out of the partnership between the High Tech High schools in San Diego, California, and the Learning Futures project, in England.

High Tech High

High Tech High is a group of 11 public charter schools in San Diego. It is non-selective: applicants are chosen by lottery according to postcode, using an algorithm to ensure that the school populations mirror the demographics of San Diego County.

When High Tech High began in 2000, its founders decided that rather than focusing on a range of metrics and test scores, they would measure their success by how many of their graduates went on to university. Since then, 99% of High Tech High students have gone on to two-year colleges or universities. 35% of these are the first generation of their family to do so.

High Tech High has achieved this remarkable success by building the entire school culture around a carefully designed project-based curriculum.

For more information about High Tech High, visit: www.hightechhigh.org

Learning Futures

In 2008, the Paul Hamlyn Foundation (a charity) and the Innovation Unit (a social enterprise) launched the Learning Futures project in order to find ways to improve educational outcomes in secondary school by increasing young peoples' engagement in learning.

The project has worked with over 40 schools on developing innovative methods of teaching and learning aimed at increasing students' engagement in learning.

Learning Futures has found that well-designed project-based and enquiry-based learning gets young people engaged, and leads to positive learning outcomes. As a result of this finding, Learning Futures formed close links to High Tech High – this guide is one of the results of that relationship.

For more information about Learning Futures, visit: www.learningfutures.org

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Published by the Paul Hamlyn Foundation
February 2012

ISBN: 978-1-905500-07-9



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How to use this guide

This guide is for teachers. It explains how to design and run projects for students that begin with an enquiry and end with a tangible, publicly exhibited product.

There are six main sections:

Section 1: Introduction

Explains what project-based learning is, and why more and more teachers are doing it.

Section 2: Inspiration

Shows the work that students created in five real life projects, with some information about how the projects worked.

Section 3: Foundations

Introduces the three keys to successful project-based learning: multiple drafts, critique, and exhibition.

Section 4: Execution

A guide to planning and running projects.

Section 5: Integration

Explains how to build a 'culture of excellence', which will encourage students to do great work of lasting value.

Section 6: Conclusion

The final section wraps it all up.

In the back of the guide you can find recommended further reading, advice on connecting with like-minded teachers around the world, examples of project documents, and protocols for critique.

In project-based learning, teachers design the curriculum, rather than just 'delivering it'. In that spirit, we hope you will treat this guide as a toolkit that you can draw on, rather than as a prescription.

SECTION 1: INTRODUCTION

Understanding the icons

This guide is marked with a set of icons that will help you find what you are looking for.

QUESTIONS: Questions, concerns, and anxieties from teachers about project-based learning

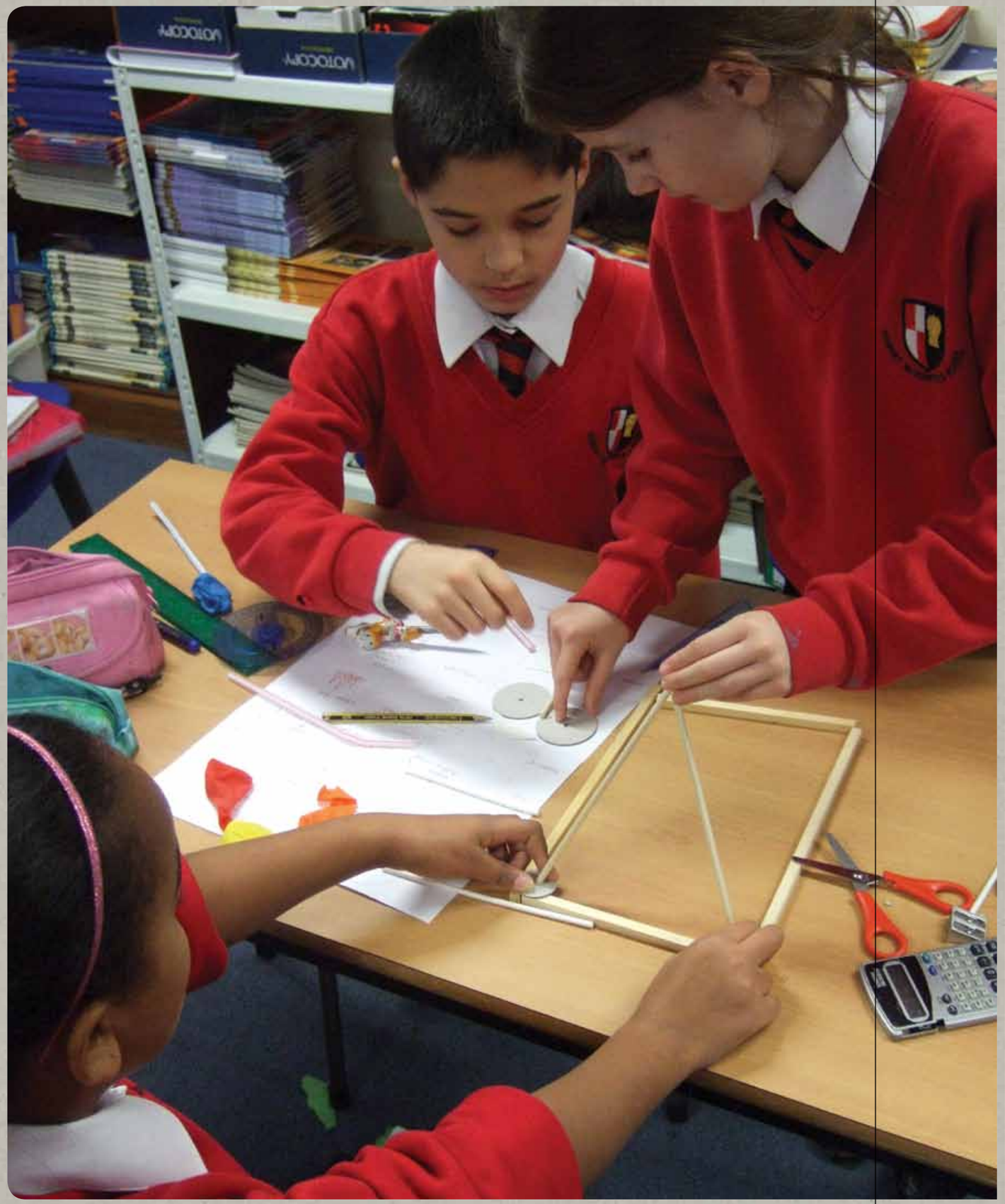
STORIES: Stories of project-based learning in schools

TIPS: Tips and strategies that other teachers have found useful

PROTOCOLS: Protocols for conducting workshops and activities

"**QUOTES: Comments** from students and teachers"

LEARN MORE: Where to find extra resources to learn more



SECTION 1

Introduction

Introduction

It's Saturday morning, and Cramlington Learning Village, in Northeast England, is buzzing with activity. In the courtyard, students stand proudly beside an enormous birdhouse that they built themselves, and submitted to the Guinness Book of World Records for consideration. In a tent nearby, more young people are performing music that they spent the week perfecting in impromptu gigs on the streets of Newcastle.

Inside, students offer samples of food cooked to recipes developed with help from professional chefs, using seasonal produce grown in the school's own garden. The students have tested and refined their recipes all week, until they reached a professional standard. They have also self-published a combined gardening guide and cookbook. Another group shows off their guide to birdwatching in the local area, complete with meticulously hand-drawn maps and pictures of local birds.

Today is Cramlington's annual Festival of Learning, and the school's halls are packed with students, parents, siblings, teachers, volunteers, local historians, musicians, amateur birdwatchers – all the people who have helped make the students' projects possible.

In one room, the audience climbs into a boat to experience a multimedia tour of the River Tyne's history. Another room is full of the picture books that students wrote, illustrated, and then read aloud to pupils in a local primary school.

The work on display today has not been specially-selected: the whole school is putting their accomplishments on show. Some students have produced work that exceeds everyone's expectations. Some are only now becoming conscious of the disparity between the quality of their work and that of their peers. Nobody is thinking about the marks they hope to receive – they are all worrying about how the audience will respond.

In preparation for today, students have been conducting research both online and throughout their town. They have produced draft after draft of their work, had it critiqued by their classmates, and refined it until it was ready for presentation. Their work with local people and local businesses has broadened their horizons at the same time that it deepened their understanding of the place they come from.

Teachers are no longer their students' primary sources of information. Instead, they are the designers of learning who created the conditions for the students to conduct their own enquiries, and advisers to whom learners can come as they create their product.

For both students and teachers, this is work that matters.

What project-based learning is, and why more and more teachers are using it

'Project-based learning' refers to students designing, planning, and carrying out an extended project that produces a publicly-exhibited output such as a product, publication, or presentation.

It is related to enquiry-based learning (also known as inquiry-based learning), and problem-based learning. The distinctive feature of project-based learning is the publicly-exhibited output. We have chosen to focus on project-based learning because it incorporates enquiry, and because, in our experience, public exhibition is a tremendously powerful motivator for both students and staff.

The Recent Resurgence of Project-based Learning

Project-based learning isn't a new phenomenon – it was popular at the beginning of the 20th century (most notably championed by John Dewey) and again in the 1970s. During the 1970s, it picked up a bad reputation (in some circles) for being unstructured and lacking rigour.

However, since then there have been two key shifts that have reignited teachers' interest in project-based learning and helped it to shake off its stigma.

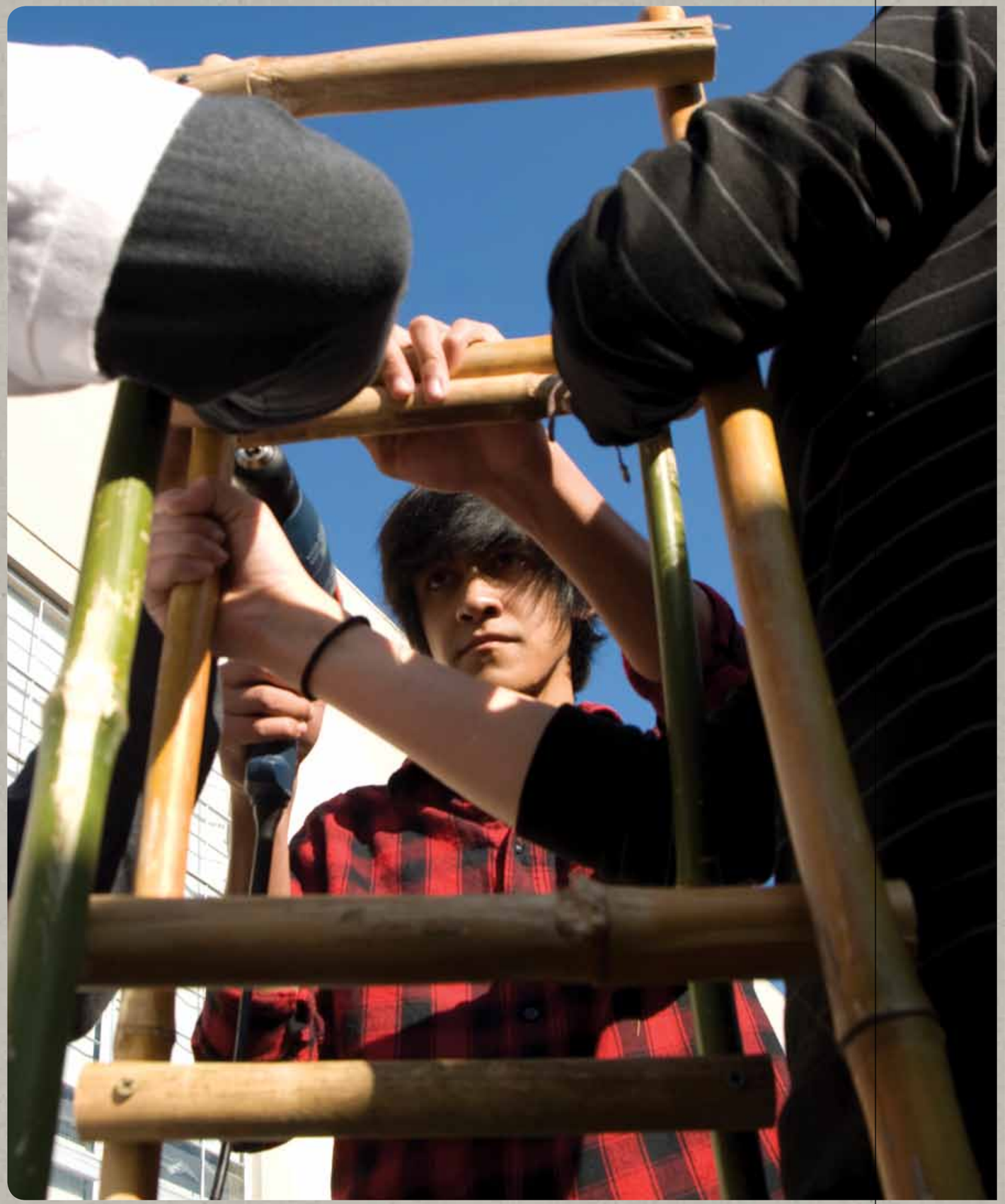
Firstly, and most obviously, digital technology makes it easier than ever before for students to conduct serious research, produce high-quality work, keep a record of the entire process, and share their creations with the world.

Secondly, we now know much more about how to do good, rigorous project-based learning, and we can evaluate its effectiveness. This guide draws upon a substantial (and growing) body of knowledge, bringing together tried-and-tested strategies and protocols that all teachers can use.

Today, teachers around the world are designing projects for their students because they ignite a shared passion for learning in both students and staff; they foster a wide range of skills (such as time management, collaboration, and problem solving) that students will need at college, university, and in the workplace; and they can be tailored to suit students with a wide range of abilities and learning needs.

In addition, teachers who are frustrated by narrow standardised tests are finding that students can acquire the curriculum content they need through projects, without letting the test dictate the curriculum.

This is a very exciting time to begin doing projects with your students – and this guide will give you everything you need to get started!



SECTION 2

Inspiration

The Blood Bank Project

The Blood Bank Project came about when the San Diego Blood Bank commissioned High Tech High students to create video installations for San Diego's JETT gallery, in order to educate the public about blood diseases and the importance of blood banking. The students also sold the work in order to raise money for the blood bank.

Working in pairs, students began the project by researching 'bloody' topics such as leukemia, sickle cell anemia, the role of blood in religion, and the difference between how blood responds to injuries in real life and in films. This entailed gaining a detailed understanding of blood on a chemical, anatomical, and cellular level.

The students produced an animated video illustrating the key information about their topic, and made a painting on plywood, which housed the video.

See more examples here (click on the paintings to watch the videos): bit.ly/xuH9Fm

HIGH TECH HIGH, SAN DIEGO, CALIFORNIA

Designers:
Jeff Robin (art teacher) and Blair Hatch (biology and multimedia teacher)

Students:
50 students, 17–18 years old

Time:
15 weeks (15–20 hours per week)

Exhibition venue:
JETT Art Gallery, San Diego

Examples of content covered:
human anatomy, cellular biology, diseases and treatment, history of medicine, history of art, history of cinema, world religions

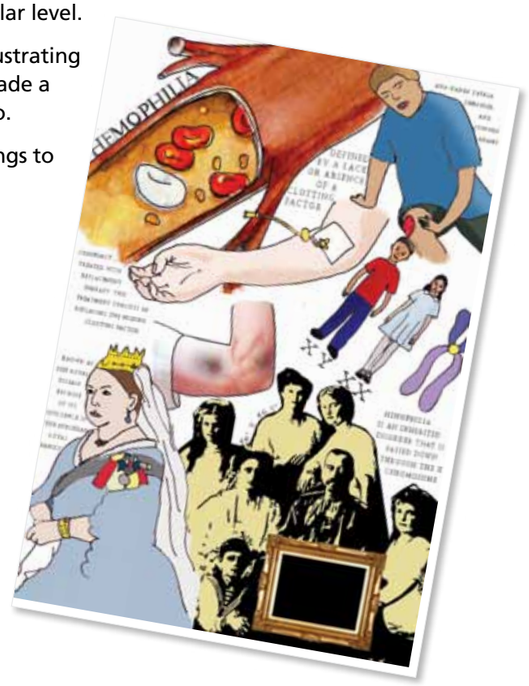


Image: Design Poster for 'Haemophilia', by Ana-Karen Zavala Zimmerer and Stephen Adams

Should the US government apologise for the 'genocide' of the Native Americans?

This project happens every year as part of a unit on the American West in preparation for national examinations.

Students work in groups to create an answer to the big question 'Should the US Government apologise for the "genocide" of the Native Americans?' They work with local historians and learn from experts online in order to develop a thoroughly-researched, persuasive argument to be presented at a local university.

The first incarnation of this project involved creating imaginary emails to send to the American Embassy, but in recent years students have instead split into two 'teams' (for and against the US apologising) and travelled to a local university to publicly debate the issue with academics who hold the opposing view.

COPLESTON HIGH SCHOOL IPSWICH, UNITED KINGDOM

Designer:
Neal Watkin (history teacher), with help from academics at University Campus Suffolk and University of East Anglia

Students:
Approximately 160 students each year, 14–15 years old

Time:
5 weeks (approximately 2 hours per week)

Exhibition venue:
Lecture Hall at local university

Examples of content covered:
overview of American West 1830–1900, nature of change on the plains, roles of US government and army in destruction of plains tribes



Photo: Copleston students have their work critiqued by a Holocaust survivor

Wild About Cramlington

Wild About Cramlington took place during 'sustainability week', when the regular timetable is suspended for five days so that students can pursue intensive projects.

Students worked with local birdwatchers and learned map-making techniques in order to make a guide to the wildlife in green spaces near the school (including a section about the school grounds).

Darren Mead, who designed this project, originally intended to use photographs in the guides, but after students started doing sketches, the group decided that it would be better to use drawings.

See the full 'Wild About Cramlington' guide here:
bit.ly/wIPiWA

CRAMLINGTON LEARNING VILLAGE
NORTHUMBERLAND,
UNITED KINGDOM

Designer:
Darren Mead (science teacher), with help from birdwatchers Phil Allott and Cain Scrimegour

Students:
28 students, 13–14 years old

Time:
1 week (working full time on the project)

Exhibition venue:
Whole-school exhibition day (on a Saturday)

Examples of content covered:
zoology, ecology, mapmaking, desktop publishing, nature drawing



Image: 'Wild about Cramlington' guide

Field guide to San Diego Bay

Students conducted an environmental assessment of the fauna along the intertidal zone of San Diego Bay, which included analysing species' abundance and diversity, and assessing human impact upon different sites within the Bay.

To provide a complete picture of their fieldwork, the students produced a Field Guide, which included scientific studies, creative writing, photographs, histories of human development, and maps of human impact on the bay.

Since the project was carried out in 2004, the students' research has been used by organizations including the City of San Diego and the State of California in order to evaluate the health of the Bay and seek solutions to improve its ecology.

Read more about this project here:
www.sdbayguide.com

HIGH TECH HIGH
SAN DIEGO, CALIFORNIA

Designer:
Jay Vavra (science teacher) and Tom Fehrenbacher (humanities and sociology teacher)

Students:
50 students, 16–17 years old

Time:
16 weeks (15–20 hours per week)

Exhibition venue:
book-signing events at the Scripps Institution of Oceanography, San Diego Natural History Museum, and San Diego Maritime Museum

Examples of content covered:
biology, US history, American literature, pre-calculus

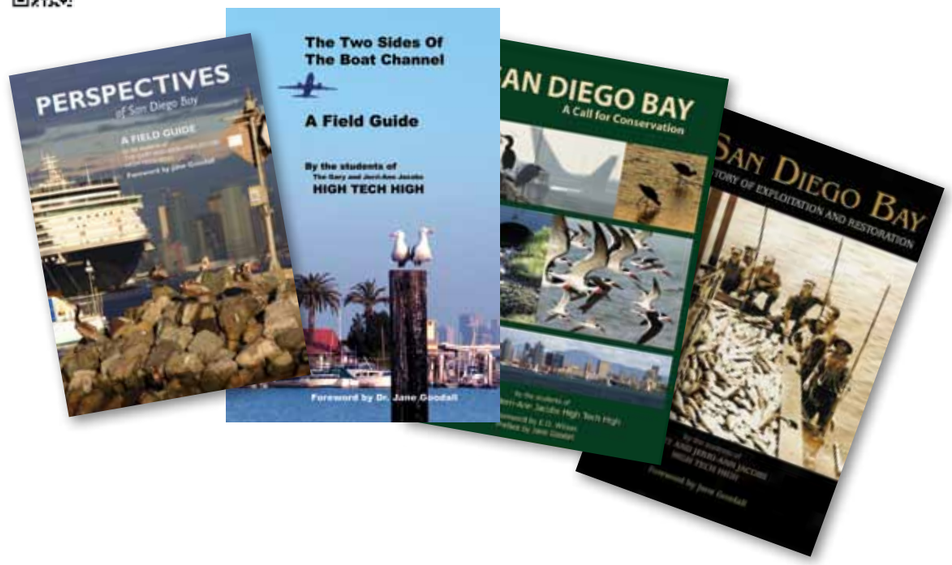


Image: Field Guides produced by students of High Tech High

Kindergarten tools

Each student in Kelly Flahive's kindergarten class became an expert in a carpentry tool of their choice, and produced a drawing and a written description of their tool for a book on tools produced by the class.

This project took place within an extended unit on tools, in which students interviewed adults from within and beyond the school about the tools that they used in their jobs, engaged in fieldwork research to interview workers about their tools, learned woodworking techniques, and designed, built, and painted their own wood sculptures. For the students, tools became a way of connecting to the adult world. The tools also gave them a way to understand their new school – by taking tours in which teachers, secretaries and janitors showed them the tools that they use in their work.

ALICE B. BEAL ELEMENTARY MAGNET SCHOOL, SPRINGFIELD, MASSACHUSETTS

Designer:
Kelly Flahive (kindergarten teacher), with support from Expeditionary Learning

Students:
21 students, 5–6 years old

Time:
Three weeks

Exhibition venue:
School exhibition night

Examples of content covered:
descriptive writing, identifying and using titles and tables of contents, interviewing, critiquing, public speaking, identifying and drawing two-dimensional shapes, sorting and categorizing objects

Read more about the project here: bit.ly/pb1NH0

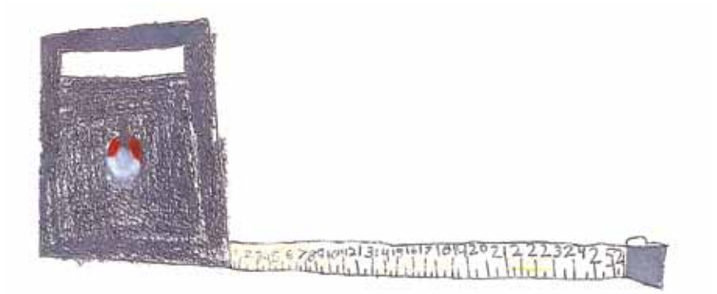


Image: 'Measuring Tape', by Breanna

SECTION 2: INSPIRATION



SECTION 3

Foundations

The three keys to successful projects: exhibition, multiple drafts, critique

The five projects in the previous section were done with different age groups, for different lengths of time, in different subjects – the ages range from five to eighteen, the lengths vary from one week to 15 weeks, and the subjects span the curriculum. But there are three components that all five projects share: they culminate in a public exhibition or presentation, they require students to produce multiple drafts, and they incorporate frequent peer critique. These are the three keys to a successful project.

If you're new to project-based learning, it's probably tempting to regard multiple drafts, peer critique, and public exhibition as 'advanced' project methods – stuff to move on to once you've got the basics right. But these are the basics.

Certain things can be jettisoned when you plan your first project – perhaps don't go off-site, keep it single-subject, and make it last less than a week. But if your students get a taste of multiple-draft working and peer critique early on, it will make a huge difference later, when you are doing big projects. Public exhibition will also have a big impact: it drives up the standards of student work, gets teachers talking to each other, and creates a sense of healthy competition between both teachers and students.

Even if you decide never to do big projects, these three 'keys' will have a huge impact on the culture, and particularly the work ethic, within your classroom – and your students will take this ethic with them when they leave at the end of the year.

This section will address each of these 'keys' in turn:

1. Exhibition
2. Multiple drafts
3. Critique

Because critique is the most complicated of the three keys, we've included a special section on how to do it (see page 28)

Key 1: Exhibition

When students know that the work they are creating in a project will be displayed publicly, this changes the nature of the project from the moment they start working – because they know they will need to literally 'stand by' their work, under scrutiny and questioning from family, friends, and total strangers.

This inspires a level of ambition and commitment much greater than is fuelled by the incentive of 'getting good marks'. In addition, students' families, as well as other people from the local community, get to see what is going on in the school, providing an opportunity to strengthen the relationship between the school and community.

You can read more about exhibition on page 66.



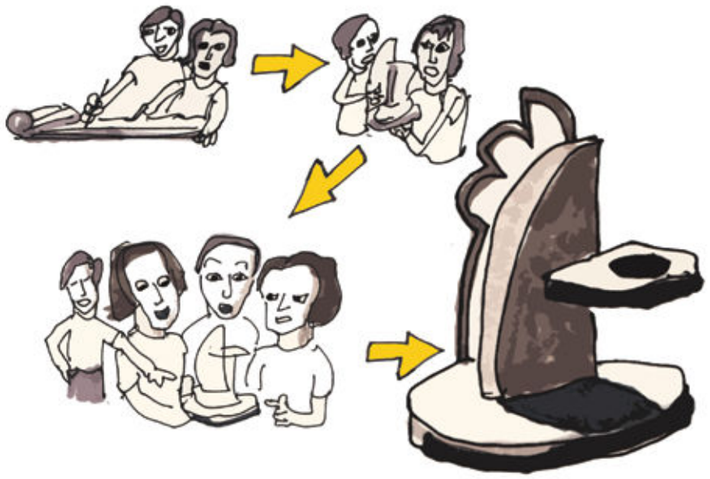
Key 2: Multiple drafts

Ron Berger, Chief Programme Officer at Expeditionary Learning, gives an eloquent explanation of the value of multiple drafts:

> *"In most schools, students turn in first drafts – work that doesn't represent their best effort and that is typically discarded after it has been graded and returned. In life, when the quality of one's work really matters, one almost never submits a first draft. An ethic of excellence requires revision."*
>
> RON BERGER, CHIEF PROGRAMME OFFICER AT EXPEDITIONARY LEARNING

The case for giving students time to make multiple drafts of their work is hard to refute – the trouble is that it's difficult to make time for more than one draft, which is one reason why it is so important to produce a realistic project timeline when you are designing your project.

Multiple drafts are also valuable for personalising assessment, because they provide you with the means to assess, not only a student's final product, but also the extent to which they have improved their work since the first draft. This can be valuable for all students, but it is particularly helpful for students with special educational needs, and students for whom English is not a first language.



Key 3: Critique

Getting into the habit of creating multiple drafts of work has a huge impact on how students regard their assignments, their learning, and themselves. It is especially effective when students are critiquing each other's drafts, rather than just handing in drafts to a teacher.

Formal critique sessions give students the opportunity to learn from each other's work and from each other's feedback in a structured, safe context – this can include critique of the process ('how I made this thing') as well as product ('the thing I made'). Critique sessions can become lessons in their own right, because they provide the opportunity for teachers to introduce concepts and skills at a point when students will be eager to learn them. Equally importantly, they bring students' misconceptions about the project to the surface, so that the group can respond to them.

On the following pages, you can find some more information about how to run critique sessions.



Critique: How to do it

The three ground rules of critique

These are the basic rules that students at High Tech High follow when they are holding critique sessions (teachers also use them when they are tuning a project). They were developed by Ron Berger:

1. Be kind

Presenting your work for critique puts you in an incredibly vulnerable position. For the critic, on the other hand, it's easy to get carried away when you're critiquing work, especially when you feel like you know exactly what a piece of work would benefit from, and inadvertently say very hurtful things. Thus, this ground rule cannot be stressed enough.

2. Be specific

Even if you are being kind, you are not doing anybody any favours if you are vague. 'I think Melanie's writing is really good' does not cut it in a critique. 'I like the way Melanie uses lots of different verbs in her writing so that you feel like you're a part of the action' is much better.

3. Be helpful

Critique is not just about naming what is strong and weak in a piece of work, it is also about working out how to go about improving that work.

The first critique session: introducing the model

Whatever students are making for a project, they are likely to be making it for the first time, so it will be difficult for them to know what they are aiming for.

Thus, before they start a project, students should be shown what Ron Berger calls 'examples of excellence' – high-quality work made by previous students, by professionals, or by you. The whole class can then discuss the attributes that make the 'model' so good. This way, students not only know what they are aiming for, they understand its characteristics.

It's important to stress to students that their task is not to replicate this model, but to use what they learn from their discussion of its attributes in order to make something unique of their own.

There is another reason that models are important: if you aren't sure what a model of a successful project would look like, you probably haven't thought the project through well enough!

For more about introducing and critiquing the model, see page 62.

TIPS: Suggest to students that they use the following questions in their critique

- What strikes you about this piece?
- What strengths do you see?
- If you didn't know the topic, what extra information would you need to fully understand the topic from this piece?
- How do the visuals/graphics/sounds help you understand the concept? If parts are unclear, what could be changed to help you understand the concept better?
- What questions do you have for the presenter?
  — Clarification: What do you mean?
  — Elaboration: Tell me more about…
- What suggestions would you offer as the work moves to the next draft?

When to hold critique sessions

The best rule of thumb is to hold critiques whenever you want students to revise a draft. It is valuable to hold a few 'formal' critique sessions, but it's good to also have informal critique sessions that feel like less of a 'big deal', because it is this informal critique that will embed the rhythm of critique and revision into your class's culture.

If you are working with experts from outside the school, it can be very rewarding to invite one of them to take part in a critique session. For an example of this, see the text box entitled Working with local experts (below).

STORIES: Working with local experts

Copleston High School, in Ipswich (UK), took on the challenge of staging the Remembrance Day Service at their Church. In recent years attendance at the service had fallen, so Copleston's students were asked to create a unique exhibition and experience to be held on 11 November at the church.

The vicar and community youth worker from the church were invited to offer advice and to critique the developing work of the students. After visiting the church, grand ideas involving light shows and dry ice machines began to flow and thoughts of troops of actors playing out the Christmas Truce were conjured up.

Once the students had formed relatively tight drafts, the vicar was invited in. He was able to stimulate thinking on the congregation's expectations, and how to deal with space limitations. He had the expertise of building a coherent church service and was able to help students move closer to shaping their event around keywords (something he does every Sunday). From this, students were able to gain a stronger sense of what tone they wanted to achieve.

Once exposed to authentic expertise, the students asked for more. A professional art curator was invited to critique the design of the space and the exhibition; professional photographers, contemporary dancers and computer programmers all helped them realise their visions of commemoration. They all worked within the local community and were generous with their time. National expert historians, from the National Army Museum, Imperial War Museum and local archivists also assisted in gathering the necessary background information.

Involving experts from the local community has transformed the way Copleston operates: it is not only a dynamic and exciting way to teach, but is raising standards to levels we would never have anticipated. Experts expect work of a professional standard, and students are now starting to aspire to meet this expectation.

NEAL WATKIN, COPLESTON TEACHER

Instructional critique and peer critique

There are two basic types of critique session: instructional critique, and peer critique.

PROTOCOLS: Instructional critique

Instructional critique is led by the teacher, and usually involves the entire class. You will conduct an instructional critique when you introduce the model at the start of a project (see page 62).

You can find an instructional critique protocol on page 98.

Peer critique

Peer critique is what students use in order to get feedback on their drafts. Peer critiques are usually carried out in pairs or small groups, though they can also be carried out by a full class. Types of peer critique include the following:

Gallery walk: Students display their drafts around the classroom. The class then wanders the room taking notes on the drafts and affixing post-its offering general impressions and suggestions. Allow about 20 minutes. Monitor to make sure every product is being critiqued.

You can find a full gallery critique protocol on page 99.

Dilemma protocol: Students are placed in groups of four (five can work too if necessary). Students share something they're struggling with on their product, share their draft, answer clarifying questions, and then allow remaining students to discuss possible solutions while the sharer remains silent (only taking notes) for about 6–7 minutes. The sharer then rejoins the group's conversation, restates helpful suggestions, and asks for clarification. The next student does the same until all students have had a chance to pose a dilemma and get feedback.

Workshop-style critique: Students are in groups of three with specific teacher-generated questions about the product in hand. Students take turns presenting their product to the two other students and then discussing the questions as a way to improve product quality. Each student spends about 10–15 minutes on presenting and receiving feedback/critique.

Pair critique: This allows for deeper critique with critical friends really digging into the product, evaluating the work, and pushing each other. 15–20 minutes per student usually works well for this. This is often a good final critique to do before the product is to be turned in for final assessment.



SECTION 4

Execution

1. Get an idea
2. Design the project
3. Tune the project
4. Do the project
5. Exhibit the project

1. Get an idea

Look for project ideas everywhere

"I started thinking about projects while doing all sorts of things I love to do. Checking out music at local venues, I thought about starting a music magazine to teach writing, photojournalism, editing and advertising. On hikes, I thought about nature reflections, the history of parks and the history of nature conservation. It seemed that every time I was doing something I truly enjoyed, a new idea for a potential project sprang into my head. Some of the project ideas had been done before, but somehow, this new revelation made them feel fresh, pristine."

ANGELA GUERRERO, TEACHER

Different professions have different ways of seeing the world: writers see a world full of stories, architects see a world of structures to be imitated and spaces to be built on, and teachers who do project-based learning see a world full of projects.

This is where the initial spark for a project comes from: from your passions, or from a colleague's passion, or, indeed, from a student's passion. The important thing is that somebody is very excited about the idea, and that person's excitement is infectious. Of course, there is much more to projects than excitement, but if you don't start with something that you feel passionate about, the project won't be much fun, and the quality of the work will suffer.

A project's initial spark may take many forms: it could be a question, such as 'why don't more people like contemporary art?', or it could be a product that you'd like students to make, or it could even be an exhibition venue that you want to take advantage of (for example, a local museum that would be interested in displaying student work).

TIPS: Find project ideas online

Not all successful projects grow out of a teacher's moment of inspiration. It can be a good idea to try out a project that a colleague has done in the past that you find interesting.

You can find a list of websites with project examples on page 82.

The importance of products

The final outcome of a project, which might be a product (such as a machine or an artwork), a performance (such as a theatre piece or a debate), or a service (such as giving a lesson to younger students), creates a focus for the project that gives it a feeling of purpose from day one. Think about your own work – you probably carry out tasks with much more confidence when you have a clear idea of what you are meant to produce at the end of it than you do when the final output is vaguely defined.

It is also important that the outcome be something that students (as well as other people) value. A good test for this is whether students' work is being kept at the end of a project, or thrown away.

Designing a project based on curriculum content

Wherever you are in the world, whatever age you teach, chances are there is specific content that that your students are required to learn each year.

Fortunately, you can design projects so that they help students to master the content that they are required to learn. The best way to do this is by using 'backwards planning'. To find out how to do this, see page 42.

Looking further afield for project ideas

You can also talk to local businesses, charities, and government, and find out what your students could do to help them. Or there may be an area of the curriculum that you want to address with a project based in the community.

Three big questions to ask yourself

Once you have your idea, there are three important questions you should ask yourself, because being rigorous and honest with yourself at this point might save you a lot of anxiety later on (and reassure you that's it's worth the impending investment of time and effort):

1. Will this project engage my students?

Our first instinct, particularly if it was our own idea, is to say 'yes'. But is this a dispassionate response? How will you know?

The Learning Futures schools use a checklist to gauge the likely engagement of students in any given project idea. We call it 'the Four Ps of Deep Engagement'. Before going too far with an idea for a project ask yourself whether the project is:

- Placed – is it located in a place that is important to students (e.g. their home, community, town, city or virtual environment)?
- Purposeful – will it result in a product, service or body of knowledge that others will make use of? Will the process seem authentic to students?
- Pervasive – will students be sufficiently engaged in the project's activities that they'll want to voluntarily take the learning outside school and school hours? Is it likely to broaden students' horizons?
- Passion-led – Does the project tap into students' passions?

2. Will this project engage me?

Projects are extended learning opportunities, and not just for students. Your own enthusiasm will be required when students hit blocks and dead-ends. It's important that you are personally curious about the project's outcome, that you will learn new things from it.

If the outcome of the project doesn't matter much to you, it probably won't matter much to the students, either.

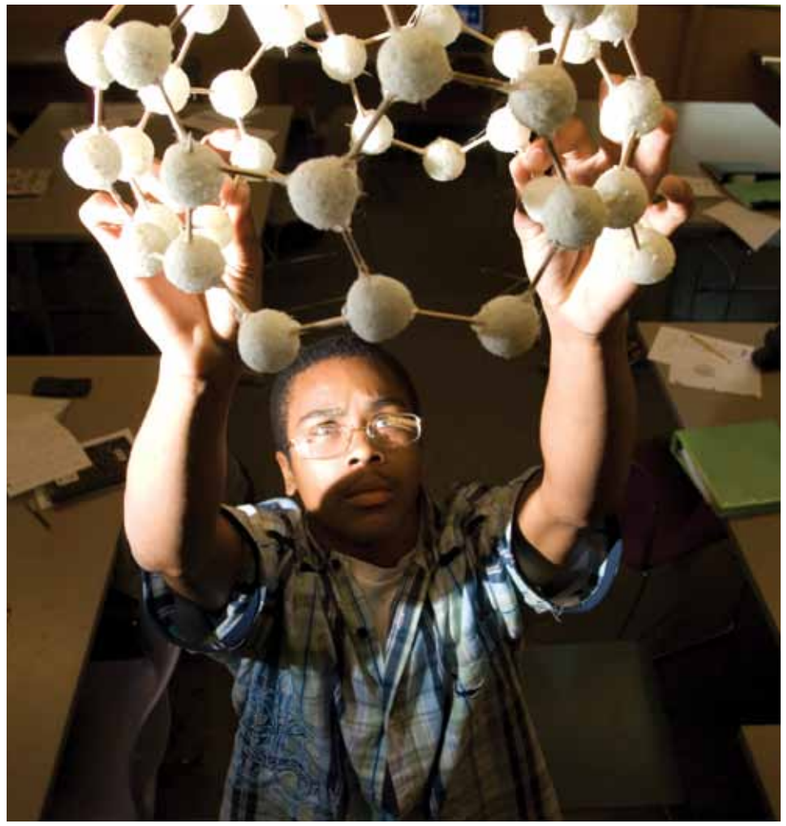
One of High Tech High's mantras is 'teach to your passion' – because that's what's going to drive you, and your students, to produce high-quality work.

3. Will my students learn something meaningful from this project?

There are highly engaging, enjoyable projects that will not add much to students' learning.

In order to avoid this, it's a good idea to make a list of the things you expect your students to have learned: this should include subject content, skills, as well as attributes to be developed (e.g. confidence, resilience, resourcefulness). You can read more about this in the section on backwards planning (see page 42).

These three questions are difficult questions to ask, but, if the answer to either of the first two questions is 'probably not', or if the list you've written in response to the third question feels too thin, your project will benefit from a rethink.



Coming up with an 'essential question'

The best projects always contain an 'essential question' that both inspires and requires students to conduct serious research.

It's never too early to start thinking about the essential question (or questions) that your students will be pursuing. However, the essential question will probably change as you design your project, and it may be that once you have finished the design, your essential question has transformed completely since you first started thinking about it.

There are three criteria for a compelling essential question:

- It should be a question that people ask in the 'real world'
- It should be a question that has no easy answer, and stretches students' intellectual muscles
- It should be a question that ignites students' imaginations.

Finding a question that fits these three criteria is not easy: it takes time, trial and error, and lots of discussion with your colleagues (many teachers say that they never finalise an essential question until after they have had a project tuning).

Some of the best essential questions are ones that students come up with themselves. You can help them to do this by introducing a 'burning issue' (for example, the fact that the planet appears to be running out of oil). By discussing the issue and doing some initial research, groups (or individual students) can come up with a question that will guide each of their enquiries (for example, 'Is manufacturing as efficient as it could be?', 'Do electric cars have a future?', and 'How have past civilisations coped when they ran out of resources?').

Another way to start with students' questions is to run a student-led enquiry (see page 54), in which students come up with their own essential questions to pursue, based on their own passions.

Essential questions that are specific to your local context can be particularly effective. For example, a project at High Tech High (which is less than twenty miles from the Mexican border) started from the essential question 'How are things different when you cross the US-Mexico border, and why?' This elicited more specific sub-questions including 'Why do people illegally cross the border into the U.S. from Mexico but not vice versa?', 'Why can't I drink the water in Mexico?', and 'Why is a McDonalds so hard to find in Tijuana?'

TIPS: Try using a variation on one of these essential questions from past projects

- How have the simple inventions of the past helped to create the complex life of today?
- How can an idea be transformed into a product that could make us millions?
- Why do humans need to protect the earth, and how can we as 12-year-olds play a role in this?
- How have ancient civilizations influenced each other?
- How do drugs impact our bodies, our families, our community, and our world?
- Is war ever justified?
- How have maritime discoveries, advancements, and events shaped our world?
- How can an election candidate effectively persuade voters to elect her/him?
- How can a home be designed to have minimal impact on the environment?



Time to start talking to your colleagues

The sooner you start talking to your colleagues about your ideas, the better your project will be. If you don't want to talk to people at your own school, you can find lots of teachers who are excited about project-based learning by going online (see page 84).

Once you've got a more fully developed project plan, you will want to hold a formal project tuning (see page 58), but at this stage it's better to keep it informal.

Bring a summary of your project ideas, and a list of things you're excited about and things you're worried about. Then, try using the following prompts for discussion:

- How well does this project fulfil Adria Steinberg's six As of Project-based Learning? (See below)
- How could I make the project more rigorous, or connect it to the community?
- Could the final output be presented in a different format?
- Between us, can we think of other teachers, friends, parents, or anyone else who we could approach about getting involved in this project? What roles might they play?
- Are there any organisations that might be able to help, such as businesses, museums, social enterprises, universities, clubs, or other schools?
- What are our initial venue ideas for the exhibition?

TIPS: Check your project against Adria Steinberg's 'six As' of project-based learning

Educationalist Adria Steinberg has developed a set of design principles for project-based learning that she calls the six As. It is useful to check your project against these at all stages of design.

AUTHENTICITY

Projects should:
- use a real world context
- emanate from a problem that has meaning to students
- result in a product or performance that has personal and/or social value.

ACADEMIC RIGOUR

Projects should:
- address key learning standards (could be national, local, school specific…)
- pose essential question(s) of relevance to the student
- develop habits of mind and work associated with academic and professional disciplines

APPLIED LEARNING

Projects should:
- engage students in solving semi-structured problems
- demand skills expected in high-performance work organisations
- require students to develop organisational and self-management skills

(CONTINUED)

ACTIVE EXPLORATION

Projects should:
- extend beyond the classroom
- connect to field-based investigations, community explorations, and work internships
- require real investigations using a variety of methods, media, and sources.

ADULT RELATIONSHIPS

Projects should:
- connect students with adult mentors and coaches from the wider community
- expose students to adults with relevant expertise
- engage adults in the design and assessment of student projects.

ASSESSMENT

Projects should:
- provide milestones/checkpoints
- involve lots of reflection for students and teachers
- result in exhibitions and performances
- be grounded in personal, school, and real-world standards of performance.

2. Design the project

Decide what you want your students to learn, and plan 'backwards' from there

So you've got an idea for a project, and you've sharpened it up in a discussion with a colleague. Now it's time to get serious about designing it.

'Backwards planning' is a very simple way of working. To begin, write down everything that you expect your students to learn from doing this project. This could include all kinds of things: knowledge of course-specific content, 'generic' skills like working in teams and critiquing drafts, specialist skills (which could range from statistical analysis to carving wood), and personal attributes such as self-confidence. It's helpful to write everything down in your own words, but this is a good time to see what 'required' content (such as national curriculum or state standards) your project can cover. For more on how to design projects based on required content, see 'Designing a project based on the 'power standards' (page 43).

Once you have your list of 'learning goals', decide how you will be able to tell whether or not a student has learned each item on the list.

Once this is done, you have the project's learning outcomes and a plan for assessing them. This will make your project more robust, and give you something to show anyone who comes around asking to see some evidence that you're doing 'serious' work.

Also, don't forget about the exhibition – it's never too soon to start thinking about how and where the work will be exhibited.

TIPS: Design a project based on the 'power standards'

For most teachers, the curriculum requirements, or 'standards', constitute the single greatest barrier to doing project-based learning.

Expeditionary Learning, an organisation in the US that works with schools to engage hard-to-reach students through projects, helps teachers to deal with this by starting with what they are required to cover, before they do anything else. First, the teachers sit down with an Expeditionary Learning 'coach' and look at everything that they are expected to cover in a year. Usually, the list is so long that it will be impossible to teach it all, so the coaches ask two questions: 'What on this list do you believe the kids absolutely must know by the end of the year?', and 'What will they be penalised on standardised tests for not knowing?'

The teachers use their responses to these two questions to narrow the list of required content down to a set of 'power standards'.

Now, they can design projects that the students cannot complete successfully without mastering the 'power standards'.

Ron Berger, Chief Programme Officer at Expeditionary Learning, gives an example of a project built around the 'standards':

Let's say your students are required to learn the history of World War Two. It's unlikely that you will be able to design a product that will include all the content they'll be tested on, but that doesn't mean you can't make a project that requires that they learn it. For example, if the kids are going to go out and interview World War Two veterans and create a book honouring them by featuring their stories, then at the beginning of the project you can say 'Everyone in this class needs to know all about World War Two, because when you're interviewing somebody and they start talking about a battle, you need to know what that battle is, and how it relates to the rest of the war. To respect these veterans, we need to be experts! So over the next two weeks, we are going to work flat out to bring ourselves up to speed on World War Two, using all kinds of resources.'

RON BERGER, CHIEF PROGRAMME OFFICER, EXPEDITIONARY LEARNING

Do the project yourself

If you are asking your students to conduct research and build, design, paint, draw, or write something, you will have much more success if you do it yourself before you ask them to. There are several reasons for this:

- If the project is unworkable, you'll find out in advance (this does happen).
- You will have a sense of where your students may run into difficulty, and you can plan accordingly.
- You will get a feel for how long it is going to take.
- You will have a model to show the students before they begin, so your students know what your expectations are.

There are some projects that it is difficult or impossible to 'do yourself first' – for example, projects in which students have the total freedom to choose their medium, projects that include public performance, or extended projects in which students (for example) set up a shop, or run a local political campaign. In these instances, it is a good idea to identify discrete sections that you can do in advance, and give them a try.

Make contact with experts outside the school

Draw on the list of experts and organisations that you brainstormed with your colleagues, and ring up some people. Explain the project, and ask them to help make the project more authentic by providing models, working with students (in school or on a field trip), or offering an exhibition venue. A few tips are listed below:

- Be bold about this. Just make sure you can explain clearly what the project is about, and what they could do for you, and you'll be fine (but don't phone people until you're clear about both of these things).
- You'll be surprised by how willing people will be to help you set up meaningful work for your students. And remember, you're contacting them because they are experts, which is a nice thing to be seen as, so they're likely to be particularly receptive.
- Once you have made your project plan, make an abbreviated version of the plan that you can give to your project partners from outside school. This will be a more useful reference to them than the full project plan.

Fill out a project plan

Particularly when you're starting out, it's much easier to plan your project using a template than to just write up your own document – following a template will also ensure that you don't forget about anything important. You can use our template (see page 88).

The first thing to do is fill in the plan with everything you've already done: the project idea that you've already sharpened up with a colleague, the things that you want every student to have learned by the end of it, and the ways that you intend to assess them.

Your project plan won't be complete until you've gone through every step in this section – and even then, it will be substantially revised after you hold a tuning session.

Who should see the project plan?

Your full project plan will be useful to you and the teachers you are working with, and you will want to share it with the teachers and students who help you to tune your project.

For everyone else who is involved in your project (such as students, parents, outside experts, and the exhibition venue), you will want to produce a shorter 'project sheet'. You can see an example of this on page 94.

TIPS: Offer students choice, but not unlimited choice

If you offer limited options (three to five) for final products you will allow students to become experts and be able to teach other students. This will free you up so you can push the more advanced students and bring up the struggling students. The first year I did my music instrument building project I allowed students to choose to build whatever instrument they wanted. I had students building xylophones, guitars, ocarinas, flutes, pan flutes, acoustic guitars, electric guitars, mbiras, marimbas, and synthesizers. As a result, many students had to look to me for help instead of their fellow students. I have always found that students learn more when they learn from each other instead of the teacher.

CHRIS WAKEFIELD, TEACHER

Work out your project's timeline

This is one of the most important 'structures' a teacher imposes on a project, because it makes a potentially daunting project feel manageable to students, and helps you make sure that they will have time to accomplish everything that you expect from them.

If possible, post your timeline online so that students, parents, and other members of staff can check it whenever they need to.

Set interim deadlines and plan regular check-ins with your students

You can never check your progress against your projected timeline too often. This goes for your management of the project as a whole, and for each individual student's management of their project.

It's a good idea to hold weekly check-ins with all your students (or all the groups, if the students are doing the project in groups).

At each check-in, work with students to set tasks for completion by the next check-in, and make sure you both have a copy of the tasks you've agreed (again, it's best if this can be stored online). Check-ins also give you the opportunity to find out how the project is going so that you can make adjustments to your plans.

In addition to the check-ins, you will need to set interim deadlines. This will include deadlines for drafts, and final deadlines for specific components of a product (such as the videos in the Blood Bank project – see page 92).

You may also want to schedule quizzes to make sure students are gaining the knowledge that they need to be acquiring.

Schedule critique sessions

Critique sessions will tend to follow draft deadlines (since students will be critiquing each other's drafts), but they are distinct events, and they will usually take at least forty minutes.

You can learn more about critique on page 28.

Plan your exhibition

See Section 5: Exhibit your project (page 66).

Plan your assessment

Assessing throughout the project

Assessment is not something that happens once, at the end of a project – you assess your students' work throughout the process.

On your timeline, plan in a series of 'check-ins' to take place throughout the project, to make sure students are on track. These may be short papers, quizzes, journal entries, meetings with the teacher, and critiques.

Use multiple drafts in assessment

Assessing multiple drafts means you can assess a student's improvement, as well as assessing the quality of their final version. For more on this, see page 26.

Assessment isn't just about the final product

"Teachers often mistakenly presume that a project's final product is the only thing they should assess, which leads them to assume that they should be able to tell whether the kids learned what they needed to learn by looking at the final product.

Actually, assessing what kids know is ongoing throughout a project. The product is the motivation for learning the material, but it won't demonstrate that they learned it all. For example, in the physics standards project (see page 51) each kid only demonstrated one physics concept, so how do you know that they learned the rest of the material?

The answer to this question is that the book isn't the assessment. You can assess what they've learned before the book comes out, and afterwards. In Physics Standards they gave all the students a physics test with all the concepts in it.

You need to do assessment throughout the project so that when they're doing great artistic stuff, you know that they know what they need to know. You can't leave it all to the end."

RON BERGER, CHIEF PROGRAMME OFFICER, EXPEDITIONARY LEARNING

The final assessment

Your final assessment will focus on the products that your students have produced, and how they went about producing them (the process). If you have established criteria for assessment, as described above, this will be fairly straightforward. Remember that not everybody needs to produce the same product in order to demonstrate their learning (see 'Personalise the project', page 52).

Assessing the process can be more challenging – this is where it can be helpful for students to have kept project journals or blogs throughout the project. You can then assess their work throughout the project by referring to these as a supplement to your own observations.

You may want to have a separate assessment of knowledge, such as an exam. This could come before or after the exhibition (just make sure you space out the exam and the exhibition, so you and your students have time to give both the attention they deserve). One effective way of doing this is to make an exam that covers information presented by all of the groups during the project. This will ensure that students learn a wide range of content, as well as giving them an incentive to study each other's work closely.

TIPS: Avoid group marks

Avoid the impulse to give 'group marks' (that is, giving the same mark to everyone in a group). These can lead to bad feeling in groups if people aren't 'pulling their weight', and it encourages students to over-specialise (one student does all the research, one student handles everything technical, and nobody gets to experience the full scope of the project). Find a way to identify and assess individual contributions to the product: peer assessment, student journals and teacher/expert observation will all help you with this.

Questions that your final assessment should address

Does the product meet or exceed the criteria we set at the start at the project?

You can come up with assessment criteria at the beginning of the project by taking the 'model' that you produced, a product from a previous year, or a product made by a professional, and asking the students to describe what's good or interesting about it. The words they use (guided and, if necessary, supplemented by you) can then be categories for assessment. For this exercise, use the instructional critique protocol (see page 98).

Has the student developed the skills required for the execution of this project?

Here, you will want to refer back to the learning goals you identified in your backwards plan (see page 42). You will have identified a range of skills that you want your students to have learned. By doing the project yourself, you will have verified that these skills are still pertinent. All you really need to do now, is to involve the students in identifying what 'good practice' looks like, at every step of the way, and build your agreed criteria around that.

Has the student learned the curriculum content required for this project?

The process followed here is much the same as for the assessment of skills, with one important difference: your project plan should include the essential curriculum content for the project. As a result, much of this will be considered 'non-negotiable', though it is still important to have students co-construct the process. So, for example, you might ask students to determine how they will present the content knowledge they've acquired through the project (they might do this through an essay, quiz, presentation, film, etc).

Where possible, your project design should avoid the separation of content knowledge from technique and skills development. Your assessment strategies should reflect this too.

Sources of assessment

Having assessment data from a variety of sources is essential to project-based learning, as it reflects the independence, interdependence and adult world connections integral to the learning process. So you want to ensure that assessment includes the following:

- Self-assessment – This should emphasise the importance of student reflection, not just the mark that the student feels they deserve.
- Peer assessment – This a key element in assessment of project-based learning: you can't be with every group all of the time, and this will make it easier to assess students individually within a group.
- Teacher assessment – You can use the same assessment methods within a project that you would in any other context.
- Outside expert/audience – This can take place as an event in its own right (such as a critique session), or it can happen as part of the exhibition. Remember that the audience will need guidance from you in what to look for, and what questions to ask. One effective strategy is to ask a few people to attend an exhibition as 'panellists' who will assess students' work. You can see an example of a rubric for panellists on page 96.

TIPS: Use 'Spaced Learning' to help students learn a lot of curriculum content in a hurry

'Spaced Learning' is a technique for getting a large amount of information into your long-term memory in about an hour, using three 'inputs' (usually in the form of short lectures) divided by ten-minute breaks. Teachers are combining Spaced Learning with project-based learning in order to ensure that their students are getting both a deep understanding of subjects, and acquiring a wide breadth of required curriculum content.

Learning Futures has developed a free guide to Spaced Learning in partnership with Monkseaton High School, in Northumberland (UK). You can download it here: bit.ly/o6rA3u

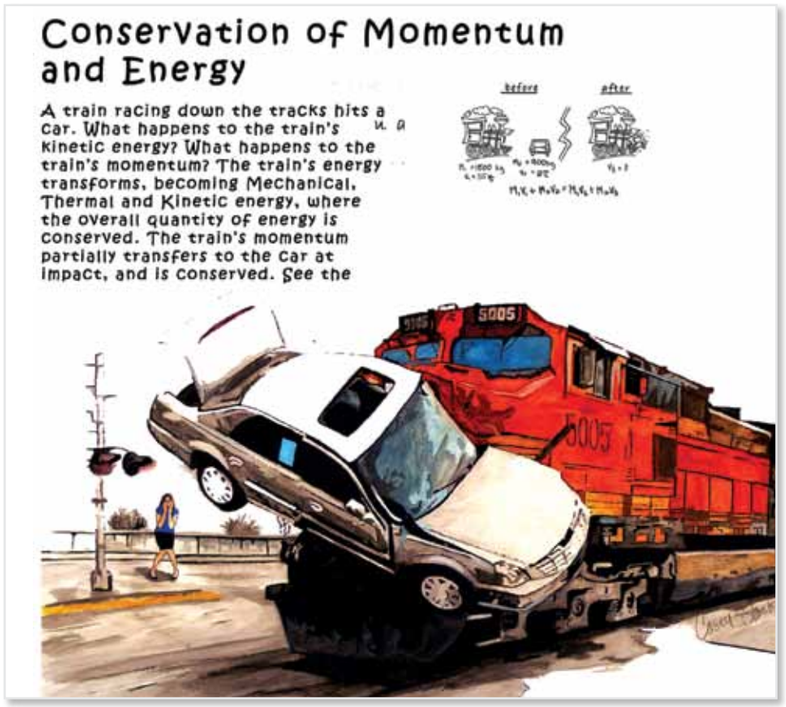
STORIES: Making the Standards into a project

Teachers Andrew Gloag and Jeff Robin have found an inventive way to demonstrate how one can cover standardised curriculum content through projects. They put the state curriculum standards at the heart of a project by having students illustrate the California state standards for physics.

This is the page one student created in order to illustrate conservation of energy as it applies to falling objects:

It's worth mentioning that all the pages in the book were produced to a standard similar to this one – not because the students doing the project were unusually talented, but because of the combination of extensive instruction, redrafting, and critique that they all went through.

You can read more about this project and see more examples of student work here: bit.ly/yrryva



Personalise the project

You can do project-based learning with students of all abilities, and all ages – in fact, for struggling students, projects can spotlight a whole range of different talents and skills that may not be brought out by 'traditional' work. Projects offer students many 'points of entry', and many ways to shine.

Successful projects are designed so that students make decisions for themselves throughout the process. For example, a teacher might set the area of the curriculum that a project will focus on, but let students choose the medium of their response (film, comic strip, news article, etc). Or, a teacher might predetermine the medium of students' response, but let each student choose what to focus on.

However, you need to make sure you are designing the project with all your students' needs in mind, so that each student can demonstrate their learning in a way that will be challenging, but not impossible. A few tips are provided below.

Decide which parts of the project are non-negotiable, and which are flexible

Every project will have some 'non-negotiables', and some elements that students can personalise to suit their own interests and needs. For example, in the physics standards project (see page 51), every student was required to make a painting that illustrated a physics concept, but they chose their own concept, and came up with their own example to illustrate it (these examples included two surfers colliding on a surfboard, a speed skater making a turn, a clown being fired out of a cannon, and a man dragging an enormous cupcake by a rope).

At the conclusion of another project, a student who spoke very little English decided to give a bilingual spoken-word performance in addition to producing a written piece of work. Giving a performance did not exempt the student from the writing assignment, but it gave him an opportunity to shine: rather than just being 'the student who struggles with English', he was the student who gave the great performance.

Personalise through 'Voice, Choice, and Audience'

Project design should indicate a clear direction but offer many pathways to a solution.

Rob Riordan, President, High Tech High Graduate School of Education:

> *"These more flexible parameters may be determined by input from your students ('voice'), by giving your students the freedom to choose between options or propose their own ('choice'), and by helping your students decide who the audience will be for their project – and what that audience will be looking for."*

Make sure that the whole class benefits from what each student learns

A project requires students to do in-depth research into a particular area of the curriculum. The price for this in-depth knowledge is that their focus will necessarily be narrow.

However, this narrow focus does not need to prevent your students from gaining a broad knowledge of the subject. You can make sure all your students benefit from each other's research by requiring that each group teach their topic to the rest of the class, and testing the whole class on everybody's topics.

You can also use online tools to make sure that each student's research benefits everybody. For example, teacher Martin Said uses a programme called WallWisher (www.wallwisher.com), which allows people to stick 'post-its' on a virtual wall, to collect links to online resources. So, for example, if students produce podcasts about different periods of twentieth century history, they can all contribute to making a 'wall' full of useful links that everyone can use.

In addition to making sure that students encounter a wide breadth of knowledge, it's important to make sure your students encounter a wide breadth of skills – you can ensure this by requiring students to rotate roles within their groups during a project, and making sure the same students don't fill the same roles from project to project (much like adults, students will tend naturally to drift into a specialism).

It's worth saying something about competition here. Competition between groups can be a great motivator, but it also puts a limit on how many people each student can learn from. If groups of five are competing against each other, each student only has four other people available to learn from (since everyone else will be in competition with them). On the other hand, if an entire class of thirty students are all working together (albeit on individual projects), each student has twenty-nine other people they can learn from. In fact, many teachers embed collaboration into a project's success criteria by declaring that the group has not succeeded unless everyone's project was a success.

STORIES: Putting students at the centre: the student-led enquiry

Not all projects begin with a teacher's idea: projects can also begin with students deciding to learn more about a subject, or master a skill, refining their plan with help from their teacher and peers, and then carrying out a project of their own devising. This type of project is particularly good for fostering student engagement, as well as helping students to take responsibility for their own learning.

At Matthew Moss High School in Greater Manchester (UK), students have taken on projects including building a catapult, designing and making tee shirts 'from scratch', building a car engine from parts, and refereeing a netball match (this last one chosen by a student with severe learning difficulties).

Teacher Mark Moorhouse gives an account of how the 'car engine' project developed from a vague interest in fast cars to a serious undertaking:

A group of three students wanted to do a project on cars. In this instance, the scrutiny phase, in which their learning plan is challenged to destruction by both me and the rest of the class, was paramount. I suggested that the learning from taking a high-performance engine apart would be real and significant and they'd actually get to find things out and push themselves. They were really excited by the reality of it: real engine, real tools, and off we went.

As luck would have it, I had three expired Subaru EJ20TT engines at a friend's garage. Initially I planned to bring a complete unit in for them to strip, but I started to worry about the toxicity of old engine oil and health and safety. Then I remembered that my friend and I had one stripped and cleaned in bits already. So the challenge evolved to building the engine from bits – just as good and far cleaner and safer.

Whilst the lads were searching on the internet for the engine's 'build-sheet', I was working out how to get all these engine parts to school. Finally got the engine delivered in sections in bin bags to my house and then transferred it all into one of my local authority refuse wheelie bins. The next morning I was in suit and tie dragging the bin through the streets of Castleton to school. The few cars about at that time seemed happy enough to drive around me, albeit staring a bit in the process, presumably wondering 'What's that teacher from Matthew Moss doing nicking someone's wheelie bin?'

I put the bin at the back of school, and by 9.30am the three learners had everything out and spread around. These students spend all of Monday morning on their projects, and I visited them a couple of times until break started at 10.50am. A light drizzle was setting in now as I went to tell them to come in for break time, but they politely refused the invitation.

CONTINUED

What was clear was that they were in the current of a real learning flow, and had built up significant momentum. They had hypotheses in the air about which sections were going to fit where. It was absolutely intense. And how many times does our traditional timetable interrupt flow when it takes off? With myself and the Head teacher watching them through the window, I left them to it, still seriously and seamlessly engaged.

MARK MOORHOUSE, TEACHER

STORIES: A Student's take on project-based learning

High Tech High Graduate Zachary York had a brain tumour removed in 2000, when he was twelve years old. Following his surgery, he had trouble retaining information in his short-term memory. He started studying at High Tech High and found that he could learn more effectively through project-based learning than through 'traditional' approaches. Zachary has since graduated from the University of Arizona, and now works at High Tech High as an academic coach.

Here, Zachary explains why he finds project-based learning so effective:

One of the great things about project-based learning is that the students are able to personalise their learning for themselves, a process which begins when they start thinking about how to respond to the project model or the essential question.

From the advent of this learning style in my life, to adapting it into a university lifestyle, the use of project-based learning enabled a learning of self. When I was a student at HTH and presented with the task of my senior project, I knew that in order to shine I would need to use all that I had learned through my four years in one grand exposé. I chose to work on a philanthropic front, to raise money and awareness for paediatric brain-tumour research by climbing Mt. Whitney in California in order to directly fund my surgeon and his research. With this project, I was given the opportunity to use all that project-based learning had taught me.

In short, project-based learning allows one to translate what they have learned into a language and method that allows individual growth in addition to team growth. It is with extreme honesty that I pledge the entirety of my future success on how High Tech High taught me to examine the world, and further the advent of project-based learning in my life.

You can read more about Zachary on his blog at zacyork.wordpress.com

TIPS: Try these ways of personalising projects for students with special educational needs

Projects can work especially well for students with special educational needs, though you need to plan with those needs in mind. Here are a few tips:

- Sit down with the student, their parents, and any other adults who are working with the student, to see how the project fits into their broader educational plan, and what accommodations may be necessary.
- Have predetermined partners.
- Have specialists help with daily tasks by reinforcing routine.
- Reserve computers for kids who need them – this can help some students to be much more productive.
- If needed, book specialist support workers early – this can be especially useful for helping students prepare for presentations.
- Make sure there are quiet spaces to go if the classroom gets too loud to concentrate.
- Work out the best way for an individual student to show what they know – not everyone needs to demonstrate their learning using the same medium.

Of course, many of these strategies apply to all students.

Checklist: What you should have at the end of the design process

You've now taken your initial idea and turned it into a project design, made a project plan, tried the project yourself, and worked out how you will assess the project.

Once you've finished designing your project, you should have the following:

- A model of the product that students will be creating, made by you
- A full project plan
- A project timeline
- A 'project sheet' for students, parents, and partners from outside the school, that describes the project, lists the milestones, and explains the plan for exhibition and assessment (including key dates).

You can find examples of a whole range of project documents, as well as overviews of seven different projects, at www.hightechhigh.org/pbl.

3. Tune the project

Once you've planned your project, it's time to have a 'project tuning' session.

This means presenting your plans to a group of colleagues, who will give you constructive feedback, come up with ideas that you haven't thought of, and warn you of potential problems that you may not have anticipated.

It is also very helpful to invite students to be part of the tuning – they will have insights into the process of doing a project from their perspective, which may take you by surprise. Doing a project tuning also sets the stage for the peer critique that your students will be doing during the project, so it's good for them to see you modelling how to receive critique graciously and constructively. Tuning is critique for teachers, and the benefits of 'tuning' and 'critique' are exactly the same.

You don't necessarily need to conduct a project tuning with colleagues from your own school. In fact, you don't need to have everyone in the same room: some teachers conduct tunings remotely, using conference calls or web-conference software.

A project tuning follows a tight protocol – this was developed by the National School Reform Faculty and refined by High Tech High, and tends to be much more useful than a more open-ended discussion. The formality of the structure may feel a little bit stilted or unnatural at first, but it normally starts to feel natural about partway through your first tuning session.

What to bring to the tuning

Bring the following items to the tuning:

1. Your project plan
2. The model you've made of the product
3. One or two 'burning questions' for the tuning group – in other words, what you would like them to focus on.
   a. Examples of burning questions:
      i. 'How will I make sure that students acquire the knowledge that I want them to acquire, as well as developing skills?'
      ii. 'How can I give students enough time to be comfortable working in an unfamiliar medium?'

Ground rules for tuning

High Tech High uses the following three ground rules for tuning. You can use these if you want, modify them, or come up with your own. Whatever you do, it's useful to remind everyone of the ground rules at the beginning of every tuning session.

- **Share the air:** If you tend to talk a lot, make sure you don't dominate the conversation, and that everyone has the opportunity to speak. Equally, if you tend not to speak very much, make sure that you are contributing – otherwise nobody will get the benefit of your insights.
- **Be hard on content, soft on people:** Make sure that discussion (especially criticism) is focused on the project, not the person. This distinction needs to be crystal-clear in order to maintain a culture that is both rigorous and collegial.
- **Be Kind, Specific, and Helpful:** For more on this, see page 28.

TIPS: How to distinguish between 'clarifying' and 'probing' questions

It's not always easy to distinguish between 'clarifying' and 'probing' questions, particularly when you're new to project tuning.

Ben Daley, Chief Operating Officer at High Tech High, uses the following rule of thumb: 'If I think the presenter knows the answer to my question, it's probably a clarifying question. If I think they might struggle to give me an answer, it's probably a probing question'.'

Project tuning protocol

Time: 40 minutes

Size of group: One facilitator, one presenter (or more, if the project is a collaboration), and 3–10 other people (optimally).

Who should be there: staff whose opinions you value, and students who will be thoughtful and honest (it's best to have students with a range of ability levels in the room).

Step 1: As everyone arrives, hand out the project plan

- The group should either sit in a circle, or around a table.
- Take a moment to remind everyone of the ground rules for tuning (see page 59)

Step 2: The presenter introduces their project (Time: 10 minutes)

- The presenter explains what their goals are for the project, gives an overview of how it will work and what will be produced, and (if appropriate) explains how the project fits into the wider context of their class.
- At the end of the introduction, the teacher gives the tuning group their burning question.

Step 3: Clarifying questions (Time: 5 minutes)

- Clarifying questions are used to get a clearer understanding of the project. They have short, factual answers.
- Examples: 'How long will the project last?' 'How many hours per week will students have to work on it?' 'Where will the work be exhibited?' 'Who are you planning to invite to the exhibition?'
- It's very easy to slip into asking probing questions at this stage. If somebody does so, the facilitator should gently intervene and ask the person who asked to hold onto that question until the next step of the tuning.

Step 4: Probing questions (Time: 5 minutes)

- Probing questions help the presenter to think about their project more deeply, and more expansively.
- Examples: 'How will students demonstrate their understanding through the final product?' 'What will you do if a draft takes longer than you anticipated?'
- Probing questions should not be 'advice in disguise' – for example, questions that begin 'have you thought of trying…' are not probing questions, and should be held back for the next step.

Step 5: Discussion (Time: 10 minutes)

- The presenter restates their burning question (the presenter may also wish to reframe their burning question at this point, in light of the clarifying and probing questions).
- The presenter then physically leaves the circle, goes off to the side, and listens silently to the discussion.
- The discussion should begin with positive feedback about the project. Depending on the group, the facilitator may want to state this explicitly, or just let it be implicit.
- After about eight minutes, the facilitator should ask the group whether they feel they've answered the presenter's burning question.

Step 6: Presenter's response (Time: 5 minutes)

- The presenter may share what struck them most during the discussion, how they now think about their project, and what next steps they plan to take as a result of the ideas that have been generated.
- It is not necessary to respond point by point to what the tuning group has said.

Step 7: Debrief (Time: 5 minutes)

- This is a time to reflect on the process of the tuning itself. The facilitator leads it by posing questions to the whole group.
- Examples: Did we have a good burning question? Did we stick to the question? When was a moment when the conversation made a turn for the better? Was there any point where we went off track? Did our probing questions really push the thinking of the presenter?
- There will be a tendency to veer back into a discussion of the project you've been tuning. Resist this.

Step 8: Closing the loop (Time: 5 minutes)

- This is a chance to say that one final thing you've been dying to say during the tuning. Participants share one of their take-aways with a partner or everyone in the group shares one take-away with the rest of the group.
- Participants may also share how participating in this tuning session will impact their own practice.

At the end, thank the presenter for sharing their work and their concerns, and thank the tuning group for their questions and advice. A tuning requires effort on everybody's part, and it's important to acknowledge this.

4. Do the project

Engage your students

How you introduce a project to your students can have a dramatic effect on how that project progresses, all the way through to the exhibition.

There are many ways to begin a project: one is to start by giving your students space to talk about what they are concerned about and interested in, and then talking about how the project can speak to these concerns and interests. You can also begin with a more formal project 'hook' – an event that is unmistakably different from your day-to-day classes, which introduces the product, the theme, or the essential questions of the project.

The most important thing is to convey your own passion for the project, because your class will pick up on this and it will help to overcome the resistance that can greet the beginning of a project (or, for that matter, anything unfamiliar that defies students' expectations). However, we recommend against putting on too much of a 'show' for students – or if you do start with a show, make sure you also create a forum for students to speak. The hook is as much about listening as it is about performing.

Teacher Cady Staff begins her projects with a silly video shot by her and her partner teacher, then follows this up immediately with a writing prompt for the students in which they can respond directly to the issues that the video has raised. This shows Cady where her students are coming from – what knowledge, preconceptions, and specific areas of interest they are bringing to the project. Then, when she explains the project in more detail the following day, she can draw on the students' writing in order to connect it to them.

Another teacher, Pam Baker, began a project on peaceful protest by inviting in a local musician (whom she knew already) who performed for the students, and then answered their questions about why, and how, he wrote protest songs.

Other teachers begin with a student discussion of the project's theme or essential question. This can be sparked by film or television clips.

Show your students a model of the type of product they will be creating (set clear expectations)

This might be your project hook, or you may do it after the hook. Either way, it is absolutely critical to the success of the project (if you're choosing between a flashy hook and a careful, full-class examination of a model, go with the model every time).

This is a good opportunity to show students the model that you made yourself. You might also want to show another student's work (though this will only work if you're doing a project that has been done before) or the

work of a professional. Teacher Vanessa Ryan introduces one project by bringing in students who did the project the previous year to show their own work and talk about the process of creating it.

Whatever you use, make sure that the model you show your students matches what you are asking them to produce – or if it doesn't, make sure they understand what aspects are different from what they will be doing.

Looking at a model together serves two purposes:

- First, it shows students what they are aiming for. Remember that they have probably never before attempted to produce whatever it is that they will be producing at the end of the project. If you have already done the project yourself, you know how difficult it is to create something without a model to work from.
- Second, it gives the class something to base its standards on. As a group, discuss the model – what is its purpose? How well does it meet that purpose? What looks most difficult to do? What looks easiest to do? What aspects are most important? What are least important? By having this discussion at the beginning of the project, the class develops a shared understanding of what 'good' looks like. You can use this as a basis for your assessment criteria.

The introduction of the model is your first critique session.

QUESTION: If I start the project by showing my students a model of what they're going to produce, how do I keep them from just copying the model?

You can handle this in the initial critique session, in which your students analyse the model as a group in order to identify the attributes that make it 'work'. Once they have done this, students will have a sophisticated understanding not just of the model itself, but of the issues that they will need to consider when making their own products.

When possible, it is good to show students a range of models with different qualities – all of which come from the same (or a similar) assignment.

Once your students have critiqued a model and identified its important attributes, it's important to stress to them that their task is not to replicate this model, but to use what they have learned from identifying its attributes in order to make something unique of their own.

Now, as long as you have regular check-ins with your students, you will be able to identify work that's too derivative early on in the process and sort it out before the students have invested too much time in it. But don't worry if student projects retain some derivative attributes – almost all student work, and most adult work, is partly derivative.

For more about check-ins, see page 46.

TIPS: Advice on logistics

Projects are logistically complicated. You may need to acquire materials that you have never needed before, use computers in ways that you haven't used them before, and rethink the way you use your classroom. The following are a few tips from teachers on the 'nuts and bolts' of project-based learning:

Getting the supplies you need for your project

Acquiring supplies is not always easy on a school's budget. Here are some ideas:

- Take an inventory of what the school has currently – you may be surprised by what's lurking around currently unused.
- Take a creative approach to materials, and don't be afraid to go to charity shops and go skip-diving.
- Ask for donations (governors, local businesses, parents).

Being strategic about software

In our digital age, software is likely to be at least as important to your students' projects as hardware. Here's some advice:

- Rely on your students: find out what computer programmes they've used before, and appoint knowledgeable students as 'technology experts'.
- Go online to ask tech-savvy teachers for advice (see page 84 for places to get in contact with tech-savvy teachers).
- Have a chat to whoever runs your school's IT very early on in your planning – tell them what programmes you're hoping to use and why, so that together, you can make sure that everything will work on your school's system.

Making your classroom work for you

You can't do anything about the shape of the room you work in, but you can plan it out so that it serves your project. For example:

- Designate specific work areas for specific kinds of tasks (eg online research, writing, rehearsing presentations).
- Plan how you will store works in progress before the project starts.
- Always leave time for clean up, no matter how close students are to deadlines (even if they're working outside the classroom).

Monitor the process

You may have designed your project within an inch of its life, with a timeline that tells you everything you expect to happen each day for the next six weeks, but your plan will start going out-of-date the moment the project starts. This doesn't need to be a bad thing – in fact, lots of the adjustments that happen to projects are improvements – but it means you need to have strategies for keeping track of how everyone's doing every step of the way.

Don't be afraid to adjust your design once the project is going

The project will never go according to plan. Don't fight this, embrace it – as long as you know how your students are doing, you can always make adjustments to your design. The only big problem would be not knowing how your students are doing – which is why you have check-in sessions built into your timeline.

Make sure that students' drafts are being archived

When you're in the middle of a project, archiving will probably be the last thing on your mind. But once the project's over, you'll be very glad to have copies (or photos) of your students' drafts – both because the record will be useful to your current students, and because you will be able to show the drafts to future students as models of project work.

Many teachers put students in charge of this, by appointing a few students to be a project's 'official archivists'.

QUESTION: Is teaching allowed?

When project-based learning is working, teachers' roles are transformed. Once they cease to be the sole assessor of their students' work, they become less like referees at a sporting event, and more like coaches, every bit as invested in their success as the players are (and every bit as uncertain about the outcome).

This is exciting, unfamiliar, and potentially terrifying, but it does not mean you won't be using all the skills you have developed as a teacher. Teachers of project-based learning do everything that other teachers do, from lectures, to seminars, to plenaries – it's the context for all of this that changes.

5. Exhibit the project

The first thing to say here is that booking the exhibition venue should be one of the first things you do when you're planning a project. There are lots of possible venues for exhibitions: museums, galleries, parks, cafes, churches, community centres, etc. Teacher Vanessa Ryan held a premier of student-produced films in a local movie theatre by guaranteeing that the audience would spend at least £250 on food and drink.

Promoting the exhibition

Once you have your exhibition venue booked, start planning for how your students will advertise the event. Promotion is a part of the project, and students will need to devote time to it if the event is to be well attended.

Students have promoted exhibition in a variety of ways: for example, they have put posters up in local businesses, distributed flyers, harnessed their social networking links, and contacted local radio and television stations.

When your students are working on a project with a local organisation, you can ask them to mention the exhibition on their website, and in any newsletters that they send out.

Most importantly, when students work with local people as part of a project (for example, by interviewing them), the students make a flyer with information about the exhibition right at the beginning of the project, then hand out copies to everyone that they interview.

Assigning roles for the exhibition day

Once you've secured a venue and made time in the schedule for students to develop and run a promotional campaign, you can start thinking about the event itself. The best way design an exhibition is to start by think about what 'roles' everyone will play. Here are some examples of roles you might assign:

- **Student organisational team:** make sure AV equipment is working, make sure event runs to time, go-to people for last-minute crises
- **Student front-of-house:** greet the audience and manage the crowd
- **Student presenters:** stand by their work in order to explain it and answer questions
- **Teacher:** getting to know the parents.
- **Audience:** looking at everybody's work, asking questions, providing constructive feedback.

As you can see, on the day of the exhibition the teacher plays a minor role. This is because it's important that the students take ownership of the event – it is all about their work, and they should be in charge of it. Also, it can be a very good idea to tell the audience explicitly what their role is – people often feel uncertain about what is expected of them at exhibitions, and will appreciate being given a clear brief. You can explain the audience's role by handing out a flyer to everyone as they come in.

The exhibition is a celebration of the project, not necessarily an assessment event. For some projects, however, assessment will be an important part of the exhibition. For example, you may have a panel of experts from outside the school come in to assess the work (to see an example of an assessment rubric for panellists, see page 96). In other projects, assessment may play a minimal role in the exhibition – for example, students might get points for showing up, and their management of the exhibition itself might be assessed. The important thing to remember is that the assessment component of exhibitions is optional, but the celebration component is essential.

There's one last thing to say about exhibitions: they offer a great opportunity to connect with parents: parents come to exhibitions who don't come to anything else, and they come because their children insist on it.

Be an archivist of your students' projects

The products that your students have produced for this year's projects can be the models at the start of next year's project. Make sure you have digital photographs of all the products, including the drafts. Over time, you will build up a rich 'archive of excellence'.

Don't give up!

Chances are, your first project will have had some big problems: students may have found it difficult to work in groups, the essential questions may not have been as productive as you'd hoped, critique may have been a struggle, and the final products may have been disappointing.

Even if all of this – and more – went wrong in your project, don't give up! Like pretty much everything in life, projects get better with practice. And, of course, they get even better with critique – so talk to your students and your colleagues about what went well, what didn't go so well, and what you might want to try in the future.

QUESTION: Can I pull the plug midway through a project that's going badly?

It's better not to, if you can avoid it, because it sends the wrong message to your students, and means that you need to do extra work in order to fill in the time that would have been taken up by your project. Revising a project, changing course to address new needs or understandings, is always preferable to giving up.

Mostly, projects start out feeling like they will be amazing, and reach a point in the middle at which they appear to be heading for disaster. But in the end, all projects occupy a wide grey area between perfection and total failure. Some are better than others, but the bad ones end up with some surprisingly positive results, and the good ones are never quite as good as they could be.

Having said that, it's awful to be in the middle of a project that feels like it's falling apart. The best thing to do if this happens to you is to talk to someone who's been there, and get some advice. If you don't feel like you can talk to your colleagues, then go online: ask a question on twitter, contact a blogger for advice, post a question on a forum (for a few places to start, see page 83). But don't suffer in silence – people who care about project-based learning like nothing better than to help out other people who are giving it a try!



QUESTION: How do I convince my headteacher of the value of project-based learning?

You know your headteacher, so you'll know what their priorities are. If they're worried that students won't learn the facts that they need to learn, explain that you'll be designing projects based around the curriculum content that your students need to learn. If they're worried about students' safety, make sure you have a good plan for this (you should do this anyway, really).

Also, if you're able to do a small project, make sure you invite your headteacher to the exhibition. You can convince many people of the value of projects by showing them the impact that an exhibition has on students – and on their families.

It's worth reading up on project-based learning in order to build up a strong case for it. You can find a good list of resources on page 82.

QUESTION: How do I convince parents of the value of project-based learning?

If you are concerned that parents will be suspicious of project-based learning, the first thing to do will be to provide them with a copy of the project sheet that you give to your students (see page 94 for an example). This will make it obvious that students are doing 'real work' that is structured, well thought-out, and rigorous. It will also put them in a better position to support their child, and give them a window into what is happening in your class.

However, in our experience, what really convinces parents is coming to an exhibition and seeing both what their children have produced, and how proud their children are of their achievements. So make sure you give parents the date, time, and location of the exhibition as early as possible.



SECTION 5

Integration

Building a culture of project-based learning in your classroom

All of the well-meaning project-based learning books combined could not have prepared me for the deluge of frustration that I experienced my first year as a project-based teacher. I worked hard, but at times it seemed like my students and I were going nowhere...

> *"Eventually, I learned that nothing could replace careful preparation and planning on my part. That said, I also knew that the most beneficial learning experiences allowed for active exploration. Through many mistakes and by observing my students and my colleagues, I discovered that my role was not to try to hold students' attention during forty-five minute lectures. It was to inspire students with a well-organized project that addressed real world problems, and then to create an environment conducive to learning."*
>
> KARL R.C. WENDT, 'AN ARTICLE OF FAITH' (UNBOXED 3)

Good projects depend on a classroom culture that respects (and demands) excellent work. And as Karl Wendt discovered, projects can be difficult to get used to, both for teachers and for students.

That's what this section is all about: we've identified five things you need to do in order to create a classroom culture that is conducive to project-based learning – what Ron Berger, chief programme officer at Expeditionary Learning, calls a 'culture of excellence'.

1. Ask your students about their prior experiences, skills, and interests

As with all teaching, projects work best when they are appropriate to the age and abilities of the students taking part, so if you aren't sure where your students are at NOW (and if this is the first time you've done a project with them, you probably won't be) then your first step is to find out.

One way to do this is to have your students write 'project CVs' with past project experience (both in and out of school) and personal interests. This will tell you not only how much experience your students have, but will also reveal untapped expertise and interests within the room (you never know who might turn out to be a model rocket enthusiast, or a breakdancer).

2. Foster student ownership of the learning

It might sound counterintuitive to build a culture of excellence by ceding control to students, but think about it this way: if students don't feel like they 'own' their own learning, why should they care about it? (as Thomas Peters and Nancy Austin pointed out in their 1985 book A Passion for Excellence, 'nobody washes a rental car').

There are many ways to help students to 'own' their learning: you can give them freedom to choose how to respond to a project brief, or the issue they want to pursue – or even design a project in which students decide both their topic and what they will produce (see the student-led enquiry, page 54).

You can also help your students to set the criteria against which their work will be judged, you can invite students to participate in 'tuning' sessions when you design your project (see Tune the Project, page 58), and you can introduce critique sessions (see page 28).

3. Establish a set of classroom 'norms', or 'ground rules', in which everyone feels invested

We've said a lot about protocols in this guide. We're big fans of using protocols, because they are great for certain kinds of activities. However, they only get you so far – at a certain point, you will need to have discussions that are not mediated by formalised rules.

This is where the 'norms', or 'ground rules', come in. Norms are the accepted behaviour in a group. Every group of people in the world has norms. Some are formalised, some are unspoken. Some are positive, and worth encouraging, and some we could really do without (such as the common norm that it isn't 'cool' to work hard in class).

The best way to create a set of norms in a classroom is to decide them as a group (taking suggestions from everyone), then write them on the wall and go through them as a group at the start of each project (and refer to them, as needed, throughout). Teacher Cady Staff's class does this at the start of every year. Past classes have come up with norms such as 'We are a team who serves as role models for younger students and each other,' 'We are a team who shares our passions,' and 'We are a team who says hi to each other in the hallway.'

You can also take time at the end of the day to point out students who are utilising the norms during an activity. This both reinforces the language of the classroom norms, and allows you to publicly recognise students who are not otherwise regarded as 'high status' within the classroom.

Probably the most important area to have a set of norms is group work – children (and adults) do not naturally work effectively in groups, but a clear set of norms can help things to run more smoothly.

The simplest set of norms we know comes from Ron Berger: 'Be Kind, Be Specific, Be Helpful'. They are designed specifically for critique, but they are useful for all kinds of interaction in the classroom.

4. Help your students learn to fail, and learn from failure

Broadly speaking, students take one of two approaches to failure: either they are terrified of it and rarely if ever encounter it, or they regard it as their natural state of being. One could describe these two groups as 'novices at failure' and 'experts at failure' respectively.

BUILDING A CULTURE OF PROJECT-BASED LEARNING IN YOUR CLASSROOM

It isn't helpful for students to be either novices or experts at failure. Instead, students should be 'connoisseurs of failure'. They should be able to recognise it, respond to it, and learn from it, understanding that as well as being a temporary frustration, it is an opportunity to learn.

However, failure on its own is not enough – if you want students to value and learn from failure, they must have time to improve what they've done. This means planning projects to take longer than you expect them to, and trusting your instincts if a project feels too ambitious for the time allotted to it.

5. Trust your students, and give them reason to trust you

It is our experience that when you give more responsibility to students, they generally step up and surprise you with their maturity.

Having said that, trust on its own is not enough – you, the teacher, are responsible for creating the conditions in which your students learn from their failures, and ultimately be successful. Furthermore, your students need to trust you to, as Karl Wendt puts it, 'lead them to the edge of their ability, but not past it.'

Your students also need to trust each other, and trust themselves to be able to achieve something that may, at the outset, look pretty unattainable.

Karl Wendt advises attending to the process of building trust at the beginning of the year, and letting it happen slowly:

> *"I have learned that trust does not grow quickly using scripted team building exercises. Instead, trust occurs when students feel like they are known and understood. Executing a small hands-on project early in the semester gave my students confidence that they could do engineering, as well as the chance to get excited about it. It gave me the opportunity to talk one-on-one with the students and hear what they were interested in."*
>
> KARL R.C. WENDT, 'AN ARTICLE OF FAITH' (UNBOXED 3)

In fact, carrying out a small, low-stakes project at the beginning of the year will also help you to implement the other four strategies for creating a culture of excellence: it helps you find out what students have done before, it gets them used to taking control of their own learning and following a set of classroom norms, and it gives them a chance to make mistakes and learn from failure.

SECTION 5: INTEGRATION



SECTION 6

Conclusion

Conclusion

We hope this guide has inspired you to bring project-based learning into your classroom, and that it has provided lots of ideas, tips and tools to engage and challenge your students. High Tech High have been perfecting their approaches for over a decade, and they'd be the first to acknowledge they're still learning. The Learning Futures schools are at a much earlier stage in their journey, and can testify that doing rigorous, purposeful project-based learning that leads to results that students take pride in is not easy.

But it's worth it. When students do projects, they surprise themselves, their parents, and their teachers with what they are capable of. When they present their work to a wide audience, they become confident and articulate advocates for themselves, who will go on to stand out at university and in the world of work. When making multiple drafts and seeking critique becomes the norm, students develop a work ethic that demands that they achieve excellence – not in order to satisfy anyone else, but in order to satisfy themselves.

Projects also draw subjects together so that students experience learning as an integrated whole, rather than a series of separate silos across the hours of the day.

And projects foster not just student engagement, but also school engagement with local communities, families and business. They help overcome false separations between intellectual and practical skills and the world of adults and students.

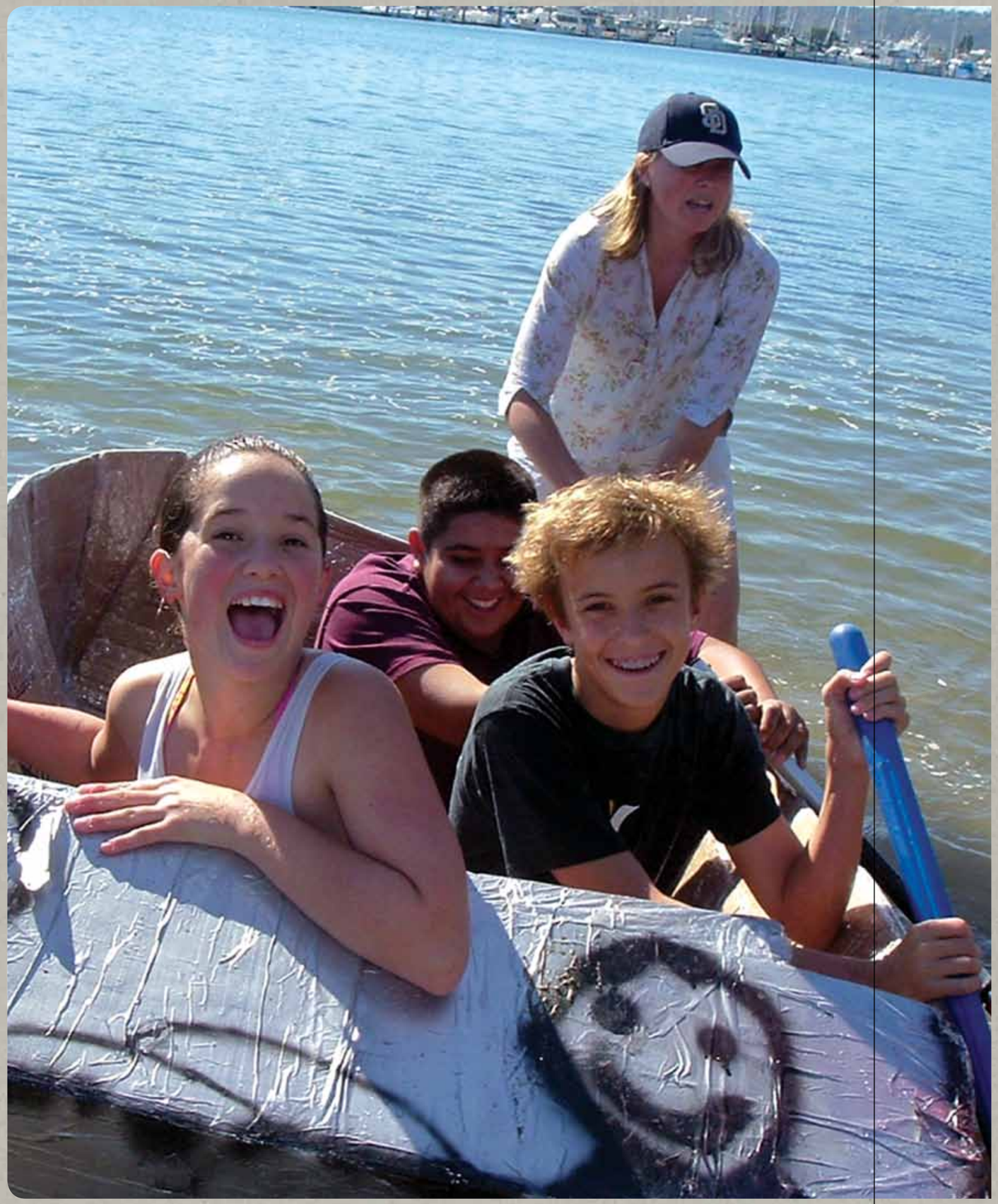
So one final time, we want to drive home what you need to do in order to design and run great projects:

- Design from your own (and your students') passions
- Make sure you tune projects with your colleagues and students
- Make sure your students create multiple drafts, and critique each other's work
- End every project with an exhibition.

And, always, remember to have fun with it. Good luck!



SECTION 6: CONCLUSION



APPENDIX 1

Learn more and meet people

- **Further reading**
- **Ways to get in touch with other teachers doing project-based learning**

Further reading

Books

Ron Berger, ***An Ethic of Excellence: Building a Culture of Craftsmanship with Students*** **(Heinemann 2003)**

- It's only 156 pages long, but as far as we know, this is the world's best book about project-based learning. Berger draws on thirty years of experience as a primary school teacher, and his advice on teaching is peppered with anecdotes about real projects. Adults are routinely moved to tears (in a good way) by this book – just read it.

Juli Ruff, ***Collaboration and Critique: Using Student Voices to Improve Student Work***

- This is a rich source of information and advice about student critique, based on research carried out by a teacher at High Tech High..
- You can download a free PDF here: bit.ly/p3sqO7. You can order a hard copy from here: bit.ly/pAVq8G

Project Based Learning Handbook: A Guide to Standards-Focused Project Based Learning for Middle and High School Teachers **(Buck Institute for Education, 2003)**

- This is a very thorough guide to project-based learning, from the world's foremost organisation dedicated to project-based learning. Full of good advice and useful resources. You can order a copy from here: bit.ly/oOcjsA.

Journals

Unboxed: A Journal of Adult Learning in Schools
(www.hightechhigh.org/unboxed)

- Unboxed is a quarterly journal published by High Tech High. Each issue is packed with articles about running projects, with analysis of what works and what doesn't.

Websites

Buck Institute for Education (www.bie.org)

- As we said above, The Buck Institute is the world's foremost organisation dedicated to project-based learning. Their website is full of videos and other useful resources for teachers.

Edutopia (www.edutopia.org)

- Another great website full of resources. Some overlap with the Buck Institute, but the two are distinctive enough that it's worth looking at both. The blogs and discussion forums are particularly worth exploring.

West Virginia Department of Education (bit.ly/westvirginiapbl)

- This houses a collection of very thorough project examples and project document templates for teachers of every year group.

Enquiring Minds (www.enquiringminds.org.uk)

- This project, run by Futurelab (a UK-based organisation specialising in innovative education) and Microsoft, has produced a collection of useful materials on enquiry-based learning.

High Tech High: Seven Successful Projects (www.hightechhigh.org/pbl)

- This website looks in detail at seven high tech high projects, with examples of learning goals, project timelines, assessment rubrics, and other useful stuff.

Expeditionary Learning (elschools.org)

- Expeditionary Learning is an organisation that helps schools in America to engage hard-to-reach students, in part through project-based learning. Their website has useful resources for teachers here: bit.ly/nmQ4ab
- They are in the process of creating an open archive of over 300 project examples from around the world. For now, you can see a smaller collection of projects here: bit.ly/qqf6NS

Envision Schools Project Exchange (bit.ly/qIzxzR)

- Envision Schools is a group of charter schools in America that use a great deal of project-based learning in their curriculum. In the Project Exchange, they have created an extensive and accessible collection of projects for high school students.

Blogs

Experts and Newbies (biepbl.blogspot.com)

- The Buck Institute for Education's official blog. Good writers, good information, and opportunities to participate in online discussion sessions.

Connect! (calgaryscienceschool.blogspot.com)

- The 'professional learning journal' of the Calgary Science School, in Canada – resources, discussions, new ideas, and reflections by teachers.

Inquire Within (inquiryblog.wordpress.com)

- This blog is all about doing enquiries with students and writing about what happens. They are always looking for new contributors, so you could end up writing for this one as well as reading it.

Ways to get in touch with other teachers doing project-based learning

Social media has been very good for the teaching profession: it is now possible to meet, share ideas with, and get advice from teachers and researchers from around the world. Here's how to get started.

Get a Twitter account

If you don't have a twitter account yet, set one up (there's a good step-by-step guide here: bit.ly/r6MJqs).

Once you've set up your account, search for the phrase #edchat, #pbl and #ukedchat (that last one is specific to the UK). People add this little tag (known as a hashtag) to messages about education, and hold regular themed discussions on Twitter. Once you're involved, you can suggest topics for the themed discussions – and you can ask for advice at any hour of the day or night.

Go to a teachmeet

Teachmeets are free events organised by and for teachers to get together and share the things they're most excited about, from projects they've run, to websites they've built, to innovative teaching methods that they're trying for the first time.

Teachmeets started in the UK, and the vast majority still take place there, though they are beginning to spread internationally. Go to the Teachmeet Wiki (bit.ly/o1ahnU) to sign up to attend.

Even if you can't make it to one, you may be able to watch it remotely, or watch videos of the presentation later on.

Take part in a High Tech High 'collegial conversation'

Every few months, High Tech High holds 'collegial conversations' online, which you can take part in wherever you are in the world. To find out when the next one is happening (and to look at what took place at past conversations), take a look here: bit.ly/pr4NtG





APPENDIX 2

Project documents and protocols

- Project planner
- Project timeline
- Project sheet
- Assessment rubric for exhibition ‘panellists’
- Critique protocols
  - Instructional critique protocol
- Gallery critique protocol

Project planner

You can use this to help you to design your project, and to help you to explain the project to your colleagues during the project tuning.

PROJECT NAME:

TEACHER(S):

SUBJECT(S):

1. Project summary

What are your students going to do, and why are they doing it?

2. Essential questions

An essential question should inspire students, require them to conduct serious research, and relate to a real world issue

3. Products

What do you want students to do/write/create/build?

4. Learning goals

What do you want students to learn?

Identify the **curriculum content** that students will learn in this project.

Identify key **skills** students will learn in this project. List only those skills you plan to assess.

5. Timeline/milestones

List the key dates and important milestones for this project.
(eg check-ins, critique sessions, deadlines for drafts and specific product components)

6. Personalisation

Say how you will personalise the project, especially for individual students who will need specialized support

7. Exhibition venue

Where will the exhibition take place?

8. Exhibition plan

How will the exhibition be promoted? How will your students exhibit their work? Who will you be inviting?

9. Assessment criteria

How will you be assessing the learning goals you identified?

Curriculum content:

Skills:

(Note: Once you've completed this section, make sure you add all the assessment points to the project timeline)

Sample project timeline: The Blood Bank Project

The following sample timelines come from High Tech High's Blood Bank project. This project used two timelines – one that gave a high-level overview, and one that gave a day-by-day breakdown. We have included both.

This timeline gives an overview of what will take place during the project:

Week	General	Biology	Multimedia
1–2	Introduce the Blood Bank and what they do, how it works, who it helps. Students will choose partners and instructional content.	Blood physiology, blood cotting-Platelets. The immune system, role of blood, white blood cells and lymphatic system	Storyboarding. Photoshop to After Effects
3–4	Present to classes	Biofeedback – role of hormones and pituitary glands. Circulatory system Interaction wtih respiratory alveoli Erythropoetin physiology and relationship to blood bank	Video editing and capture Storytelling technique Voiceovers
5–6			Finish diorama and hang with working DVD *DEADLINE WEEK 6*
7–8	Make a book about each others' projects, know the science because there is a test at the end of week 10 and you can use your books. Promotional designs		
9–10	Secondary community reaction video and teaching outreach to middle schools and high schools		
11–14	Special event groups will plan and execute Blood Bank event at HTH first week of December		
	Presentation		Diorama with DVD community reaction videos

SAMPLE PROJECT TIMELINE

This timeline shows what will take place in Art on every day in the project:

Week 1	**8–25**	**8–26**	**8–27**	**8–28**	**8–29**
	Look at assignment and talk about planning. Make three shapes out of paper.	Draw each of these shapes and combine the three.	Combine multiple shapes together and work on shading, colored pencils, charcoal pencils, link.	Still lifes with charcoal	Still lifes with charcoal. Shading and critique.
Week 2	**9–1**	**9–2**	**9–3**	**9–4**	**9–5**
	No school	Sketch up and/or graphic options	Trace collage. Images to apply polygons. Start to scan.	Scan, recolor, learn value, create a digital image.	Look at the digital and the hand drawn, critique and start to plan.
Week 3	**9–8**	**9–9**	**9–10**	**9–11**	**9–12**
	We will look at different artists and their sculptures and how they plan their work.	Start planning with your partner to solidify subject and shape.	Work on plan.	Present your ideas to me, Blair and the class. 20 points.	Present your ideas to me, Blair and the class. 20 points.
Week 4	**9–15**	**9–16**	**9–17**	**9–18**	**9–20**
	Present your ideas to me, Blair and the class. 20 points.	Make changes and resubmit before you start on your design and construction.	Make changes and resubmit before you start on your design and construction.	Start design poster.	Work on poster.
Week 5	**9–22**	**9–23**	**9–24**	**9–25**	**9–26**
	Work on poster.	Work on poster.	Poster due. 50 points	Get posters back and start to build diorama.	Build diorama.
Week 6	**9–29**	**9–30**	**10–1**	**10–2**	**10–3**
	Build diorama.	Build diorama.	Build diorama.	Build diorama.	Build diorama.
Week 7	**10–6**	**10–7**	**10–8**	**10–9**	**10–10**
	Check diorama and make changes. 10 points.	Check diorama and make changes. 10 points.	Finished and with video. 220 points.	Finished and with video. 210 points.	Finished and with video. 200 points.
Week 8	**10–13**	**10–14**	**10–15**	**10–16**	**10–17**
	Look at dioramas and have critique. Quality of components (multimedia, construction, poster). The goal is to find 3 changes and fix them.	3 changes and fix them.	3 changes and fix them.	3 changes and fix them.	Fixed and finished. 50 points.
Week 9	**10–20**	**10–21**	**10–22**	**10–23**	**10–24**
	Start working on the books that each group will produce that will help them learn about each other dioramas in both...				
Week 10	**10–27**	**10–28**	**10–29**	**10–30**	**10–31**
	..sections of the class. Students will learn book production and graphics that will help them get the information across				
Week 11	**11–3**	**11–4**	**11–5**	**11–6**	**11–7**
	in the most efficient and clear manner. They will also use these books to study from for their test and exhibition.				
Week 12	**11–10**	**11–11**	**11–12**	**11–13**	**11–14**
Week 13	**11–17**	**11–18**	**11–19**	**11–20**	**11–21**
			Book due. 220 points.	Book due. 210 points.	Book due. 200 points.
Week 14	**11–24**	**11–25**	**11–26**	**11–27**	**11–28**
	No school	No school	No school	No school	No school
Week 15	**12–1**	**12–2**	**12–3**	**12–4**	**12–5**
				Check all books. 50 points.	
Saturday December 6th – SHOW					
Week 17	**12–8**	**12–9**	**12–10**	**12–11**	**12–12**
			Books due. 100 points.	Senior exhibition	
Week 18	**12–15**	**12–16**	**12–17**	**12–18**	**12–19**
				TEST 200 points	

Sample project sheet to give to students and parents: Economics Illustrated

When you begin a new project, it's important to give your students a document that sets out what the project is about, and how it is going to work. You may also want to share this with parents.

The following sample project sheet comes from High Tech High's Economics Illustrated project. It is designed for 15–16 year old students.

Project title: Economics Illustrated

Length: Eight weeks

Instructors: Dan Wise (email@address.com) and Jeff Robin (email@address.com)

Essential questions:
- How do economists view the world? What language do they use?
- What can economics teach us about human behaviour?
- What can economics teach us about current events?

Deliverables:
- A two-part book entry on an economic term
  - Part One (the "left side") contains a definition of the term, at least three examples of its application, and a corresponding linoleum block print
  - Part Two (the "right side") contains an article, of approximately two pages, applying the economics terms to a current event or facet of human behaviour
- A lesson for peers on the economic term

Expected outcomes:

Students will know	Students will be able to
• What economics is • The basic principles of supply and demand • Twenty-five to fifty economic terms; their definition, illustrative examples, and how they apply to human behaviour and current events	• Read and discuss a non-fiction book on economics • Conduct research about an economic term • Give a lesson to peers on an economic term • Conduct research and write a non-fiction article about the application of an economic principle

Timeline:

Timeframe	Content / Deliverables	Assessment
Week 1	• Students learn basic economic principles, including supply and demand • Students choose book club books	• Quiz on lecture content
Week 2	• Students continue to learn basic economic principles • Students begin reading book club books in small groups (two to four students each) • Students fill out survey on interests related to economics	• Quiz on lecture content • Book club responses and discussions
Week 3	• Students are assigned economic terms, based on their survey responses • Students research their terms	• Students provide five sourced definitions of their term and seven sourced examples of their term • Book club responses and discussions
Week 4	• Students begin to deliver lessons on their economic terms • Students continue to research their own terms	• "Left side" paper • Quiz on other students' terms • Lessons evaluated (1/3 teacher feedback, 1/3 student feedback, 1/3 peers' quiz results) • Book club responses and
Week 5		• "Right side" paper draft • Quiz on other students' terms • Lessons evaluated (1/3 teacher feedback, 1/3 student feedback, 1/3 peers' quiz results) • Book club responses and discussions
Week 6		• Completed "Right Side" paper • Quiz on other students' terms • Lessons evaluated (1/3 teacher feedback, 1/3 student feedback, 1/3 peers' quiz results) • Book club responses and discussions

Model rubric for exhibition panellists

Exhibitions are a great opportunity to get people from outside school involved with assessment – this brings fresh perspectives to the project, and means students aren't just getting feedback from you and their classmates. Approach a few people in advance about being panellists, and give them a rubric like this one to help them structure their response to what they see.

Rubric for panellists: Vermicomposting project

Thank you for coming to our exhibition of learning! You will be roving the room and watching students present their work, asking them questions and rating the level of their responses and performances as a whole. Please try to visit all stations if possible.

Use this guide to help you rate the level of student responses:

Level of response:	**Expectation:**
1	Student's answer is ***incorrect***. Student's communication is unclear. Student does not show an understanding of the science content of the question.
2	Student's answer is ***mostly correct***. Student's communication could be improved. Student shows surface-level understanding of the science content of the question.
3	Student's answer to question is ***correct***, clear and well communicated. Student demonstrates a strong understanding of the science content of the question.

Suggested questions: Here is a list of questions to help get conversations with students started. Interviewers may also ask other questions or expand on these.

- Tell me about the significance of your poster.
- Why is vermicomposting beneficial?
- How is vermicomposting done?
- How did your group teach the class about your subject?
- Tell me about the nutrient cycle.
- What are producers, consumers, and decomposers?
- What is the message of your Public Service Announcement (PSA)?
- Tell me about the worms.
- How can I make a worm bin?

*Please make use of the student nametags and use names whenever possible while writing your comments

Station number _____

Student Responding:	**Level of Response:**	**Comments:**

Additional Comments on Presentation as a whole (please use student names as much as possible or appropriate):

We would love your feedback:

Are the students conducting themselves professionally and scholarly?
Are the students being kind to one another and working together?
Are the students knowledgeable when communicating about the science content?

We thank you for your support!

Critique protocols

For more information about critique, see page 28.

Instructional critique protocol

Time: 35–40 minutes
Group size: Whole class (20–30 students)

Preparation: Selection of work for critique

- There are two important criteria for the work you are choosing: it should exemplify the kind of thing your students will be producing, and it should be work of quality (though it doesn't need to be the work of an 'expert' – for example, it's likely you'll want to hold a critique of the model of the product that you've produced yourself).

Step 1 (optional): Framing the critique (5 minutes)

- The teacher tells students what aspects of the work they should be focusing on, and displays them at the front for everyone to see.
- This step is especially useful with a group that has never done critique before, because it gives a clear focus to the critique.
- The downside of this step is that it imposes boundaries on the discussion, which may prevent other insights from emerging – so in some instances, it will be better to skip this step and have a more open-ended critique.

Step 2: Silent examination (10 minutes)

- Every student studies their own copy of the work, taking notes on what impresses them most about it, and what they think could be done to improve it.

Step 3: Discussion in small groups (10 minutes)

- In groups of 3–5, students discuss their observations about the work. As a group, they decide on six aspects of the work that they admire, and three recommendations for improving it.
- If you are framing the critique, remind students to make sure their list covers all the aspects of the work that you have told them to focus on.

Step 4: Whole-class discussion (15 minutes)

- The goals of this discussion are to identify the attributes of excellent student work for this particular assignment, and to show how these could be applied to the work under examination (thereby modelling the process of revising your work). Once those attributes are identified, they need to be named by the students so they so that they can be used.
- By the end of the discussion, the class will have a list of attributes of excellent work, as well as a set of strategies for revising their drafts so that they become excellent. If you used a set of lessons to 'frame' the critique, the list should cover them, though it may also include things that you hadn't thought of before.

Gallery critique protocol

Time: 30 minutes
Group size: Whole class (20–30 students)

Step 1: Students display work (5 minutes)

Step 2: Silent gallery walk (5 minutes)

- Students walk around the classroom, silently observing all the displayed work. They may take notes if they wish.
- Students can also stick post-its with their comments on pieces of work.

Step 3: What did you notice? (5 minutes)

- In this discussion, students can only comment on what they have noticed (eg. this portrait is centred on the left eye, this poem doesn't use any punctuation except commas, this solar oven uses mirrors as well as foil). They cannot offer any opinions or judgments.
- The purpose of this is to get people to notice aspects of the work that they may have missed, and to listen each other before they begin to debate.

Step 4: What do you think? (15 minutes)

- In this discussion, students point out what they found most compelling and interesting in the work they observed. Each time they choose a piece of work, they must say exactly what they found compelling about it – being as precise as possible (they may need help from the teacher and their peers in order to draw this out).
- The teacher also points out what they found particularly interesting in the work that they observed.
- The teacher writes down students' insights in order to identify and codify specific strategies that any of them could use to improve their work.

Acknowledgements

First of all, thanks to Dave Price, Laura McBain, and Rob Riordan, who have been contributing to and critiquing this guide from the beginning. Thanks also to Mark Moorhouse from Matthew Moss High School, Darren Mead and Martin Said from Cramlington Learning Village, Kelly Flahive from Alice B. Beal Elementary School, Neal Watkin from Copleston High School, and Jeff Robin, Blair Hatch, Chris Wakefield, Jay Vavra, Tom Fehrenbacher, Andrew Gloag, Bobby Shaddox, Stacey Lopaz, Pam Baker, Ben Daley, Karl Wendt, Dan Wise, Ben Krueger, Cady Staff, and Larry Rosenstock from High Tech High, for their contributions and advice. Thanks also to Adria Steinberg, who came up with the six As of Project-based Learning, and to the Buck Institute for Education for inspiration.

Thanks to the rest of the Learning Futures Project Team: Denise Barrows, Abigail Knipe, Matthew Horne, David Jackson, Valerie Hannon, Ruth Deakin-Crick, and Vicki Selby.

Special thanks to Ron Berger from Expeditionary Learning for comments, advice, and inspiration, and to the whole Expeditionary Learning team for their work in project-based learning, which has been a rich source of insight and ideas both to High Tech High, and to this guide.

Finally, thanks to everyone else who read drafts and gave advice. You know who you are.

Photos courtesy of Emile Holba and High Tech High.
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Developed by the Learning Futures project in partnership with High Tech High, this guide offers step-by-step advice on planning and managing extended, interdisciplinary projects, as well as useful protocols for critique sessions, templates for important documents such as project plans, and examples of high-impact projects.

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