Preparing teachers for project-based teaching

In effective project-based classrooms, teachers support disciplinary learning, engage students in authentic work, encourage collaboration, and build an iterative culture.

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These days, it's almost impossible to have a conversation about education without hearing phrases like "student-centered," "deeper learning," or "project-based." Everywhere, districts, school leaders, and curriculum developers are launching new initiatives to promote instruction that gets students creating, investigating, performing, and experimenting, rather than taking notes and tests. Here in our own backyard, the School District of Philadelphia recently introduced an "innovation network" — a group of schools all implementing different versions of active, student-centered instruction.

The energy around this kind of instruction is palpable. But while the buzzwords may be new, the challenges we face in transforming learning opportunities for students are old and familiar. And if we've learned anything from reform efforts of the past, it's that if we fail to support teachers, our efforts at change will likely fail. Why? Because teachers and teaching are the keys to transforming what

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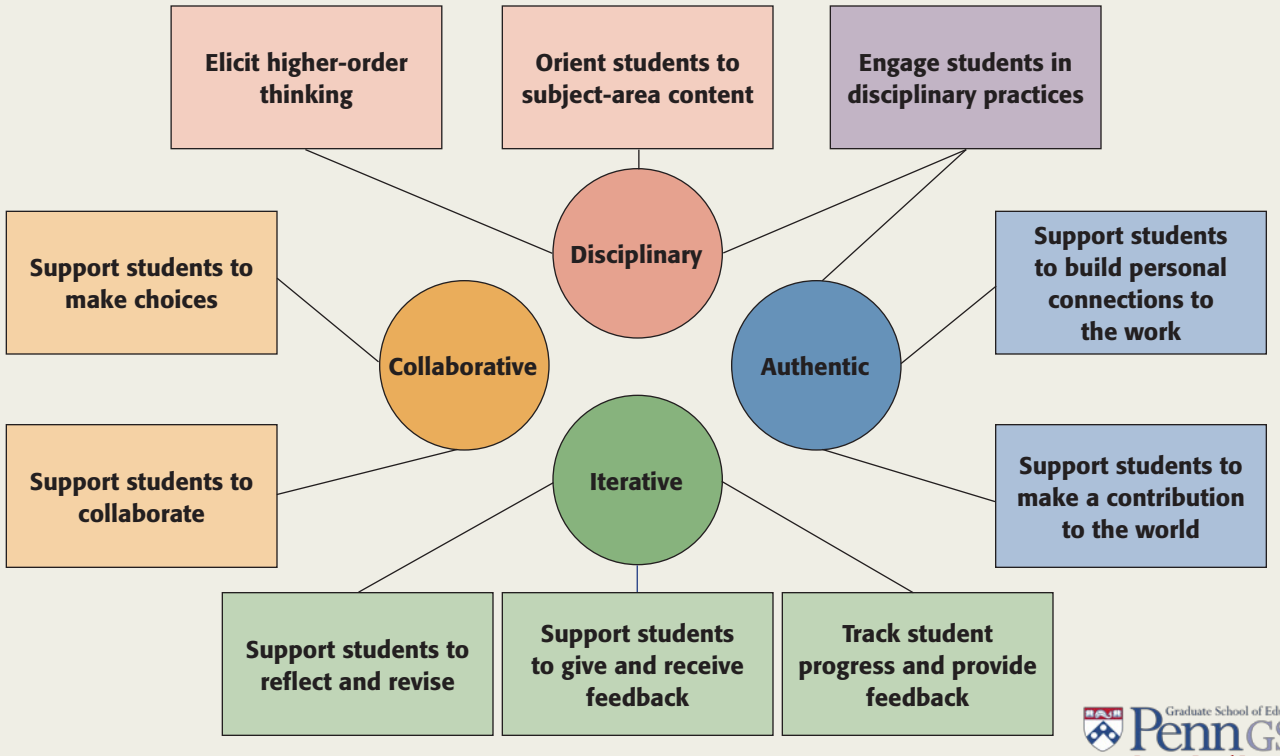
FIGURE 1.
The Core Practices of Project-Based Teaching



happens for kids in schools. So how can we expand the ranks of teachers who provide genuine opportunities for students to engage in intellectually rich and personally meaningful learning experiences?

Designing transformational learning opportunities for teachers, both in preservice programs and in professional development, requires that we have a deep understanding of what student-centered, active learning entails. In pursuit of this goal, we studied expert practitioners of one prominent student-centered teaching strategy, *project-based learning* (PBL). Our goal was to better understand their instructional practice so that we might help teachers newer to this pedagogical approach follow in their footsteps.

We conducted a modified Delphi study, surveying almost 50 experts in project-based learning (including researchers who have studied project-based learning, teachers who were identified by their principals as accomplished project-based practitioners, and leaders of organizations that promote project-based learning). We then interviewed 15 of the teachers we surveyed and collected video of their classroom practice, which allowed us to identify and describe what they do in their classrooms to support effective project-based learning. We found that our participating teachers focused on four primary goals: supporting deep *disciplinary* content learning, engaging students in *authentic* work, supporting student *collaboration*, and building an *iterative* culture where students are always prototyping, reflecting, redesigning, editing, and trying again. To achieve these four goals, the teachers enacted a repertoire of teaching practices, which we have come to call *core practices of project-based teaching* (see Figure 1).

Defining project-based teaching

While project-based teaching has no single, precise definition, its advocates generally agree on certain basic characteristics of the approach (Edutopia, 2014; Larmer & Mergendoller, 2015; Thomas, 2000). These include giving students opportunities to study a challenging problem, engage in sustained inquiry, find answers to authentic questions, help choose the project, reflect on the process, critique and revise the work, and create a public product. Although the teachers in our study operationalized these elements in somewhat different ways, all of them incorporated most of these components in their project-based practice.

Much of the literature on project-based teaching and learning focuses on curriculum, but we have sought to build a framework focused on the practice of *teachers*. This effort draws on the work of a number of teacher educators, ourselves included, who have tried to ensure teachers have opportunities to develop the practices associated with ambitious instruction so that *all* students, particularly students historically underserved by schools, receive rich learning opportunities (e.g., Ball & Forzani, 2009; Grossman, Hammerness, & McDonald, 2009). As Jean Anyon (1980) pointed out long ago, students in upper tracks or in more elite settings are much more likely to have such opportunities. Helping teachers develop practices associated with project-based instruction might help us interrupt the regime of rote, test-prep instruction that permeates too many schools affected by poverty.

Project-based teaching may be suitable for all students, but no single instructional practice is appropriate all of the time. That's why our core practice framework is organized around instructional *goals*. When a teacher decides to enact a practice in a particular moment with a particular group of students, that instructional decision must be appropriate to the context and purpose of a lesson and the larger goals for learning.

Core practices of project-based teaching

Below, we describe four instructional goals and related project-based teaching core practices that we observed in our studies of expert teachers (see Figure 1). We also provide examples of ways to apply these practices in project-based classrooms, illustrating just a few of the ways that teachers might enact these core practices to achieve the four instructional goals.

Disciplinary: Cultivating subject-area learning

High-quality project-based learning is grounded in the academic disciplines and includes serious attention to subject-area knowledge and skills. Some PBL teachers start with content standards and then build projects around them, while others start with project ideas and then identify the specific content they aim to teach. Regardless of their approach, however, accomplished PBL teachers don't just assign projects for projects' sake. Rather, they use projects to 1) elicit higher-order thinking, 2) orient students to subject-area content, and 3) engage students in disciplinary practices.

Assigning students to work on a project does not, on its own, guarantee that these kinds of learning will result. To promote higher-order thinking, for example, teachers need to stay actively engaged with their students, constantly pushing them to analyze data, synthesize information, evaluate their work, and justify their claims. In our research, we often saw teachers ask members of project teams to defend their strategy for completing the given task or to pursue a new line of inquiry. Of course, teachers who do not teach with projects may also do these things, but project-based teachers leverage the project itself as they enact these practices, using the goals of the project to focus students on disciplinary learning.

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In an 11th-grade U.S. history classroom, for example, we observed a group of students working together to develop a proposal, which they would submit to the mayor, for the city to erect a new monument to a forgotten local civil rights hero. Halfway through the period, the teacher checked in with the group, read its opening statement, and said, "I know you found some exciting things when you were digging through the documents at the historical society's archive. Are there specifics from those documents that might be convincing to the mayor?" In this case, the teacher used the goal of presenting the project to the mayor to focus students on analyzing primary source historical documents.

We found that in addition to pushing students to engage in higher-order thinking, accomplished PBL teachers also made frequent efforts to turn students' attention to subject-area content. This addresses the challenge of students completing projects in ways that are creative and interesting but that don't necessarily help them understand the given material. For example, as a team of students was preparing a report to the city council about the sources of water pollution in a local stream, a teacher asked the students to turn to one another and explain what fecal coliform bacteria levels indicate about stream health. It was a brief task, taking the group away from its report for just a couple of minutes, but it called upon the students to retrieve their subject-area knowledge and consider how to apply it to their work. Accomplished project-based teachers regularly make such connections, ensuring that students understand and ground themselves in academic content.

Finally, in working to support subject-area learning, accomplished PBL teachers engage students in the practices of academic disciplines. In other words, they don't teach students *about* science — they get them to *do* science, engaging them in problems or questions that are specific to a discipline, using its methods. For a history teacher, say, this might involve posing a problem of historical significance and then supporting students in using the tools of historical inquiry to approach that problem. For example, to help her 8th graders prepare to lead a simulation about Ellis Island for 5th graders at their school, a teacher began by asking, "What was the experience like for immigrants as they navigated their way through Ellis Island?" Then she engaged her students in doing what a historian would do to answer that question: reading primary sources and assessing the reliability of each account by examining the source of the document, contextualizing it, and corroborating it with other primary sources. In other words, an accomplished PBL teacher doesn't just tell students what Ellis Island was like so that they can create a simulation; she engages her students in *historical inquiry* into the experience of immigrants at Ellis Island and then supports students to use what they have found to develop their final project.

Note also that disciplinary inquiry is important to project-based teachers even when projects are interdisciplinary. Interdisciplinary isn't a synonym for non-disciplinary; instead, it means that multiple disciplinary investigations are occurring at once. In this case, for example, the students spent three days investigating primary source documents to understand what immigrants experienced at Ellis Island. On the fourth day, however, they used the interpretive tools of a literary scholar to interpret Emma Lazarus' poem displayed at the Statue of Liberty, which they planned to post at the entrance of the simulation.

Authentic: Creating relevant experiences

In the most general sense, authenticity refers to a desire to ensure that the significance of a student's work in the classroom extends beyond the classroom walls. The accomplished PBL practitioners in our study expressed a strong belief that school learning experiences should have meaning and value outside the classroom. However, while some researchers have framed authenticity as primarily relating to "real-world problems," our study suggests a broader conceptualization, including both *disciplinary* (often real-world) problems and *existential* problems that are primarily of interest to students themselves rather than to a discipline (e.g., do we shape ourselves or are we shaped by our context?). To do this, teachers enact practices that 1) engage students in disciplinary practices, 2) support students to build personal connections to the work, and 3) support students to make a contribution to the world.

Disciplinary work is inherently authentic, insofar as students are actively engaged in producing knowledge, not just consuming it. If they are *doing* history (examining historical artifacts to answer authentic historical questions); *doing* science (asking questions about natural phenomena and then engaging in the scientific method to test hypotheses); and *doing* mathematics (making sense of and describing the world by finding patterns, modeling phenomena, creating arguments, and solving problems), then they are doing the authentic work of those disciplines.

Accomplished PBL teachers work toward authenticity by orienting students to the world beyond the classroom.

But at the same time, project-based teachers also strive to make students' work authentic to the students *themselves* — to who they are and what they care about. Consider the example of students examining primary source documents to investigate the history of immigration in Europe and then using what they learn to write to their senators, making a historically informed argument about contemporary U.S. immigration policy. To keep this work connected to students' own interests, stances, and motivations, every time the teacher confers with a student about their progress, she begins with some version of "Tell me what you want our senator to know about your personal beliefs," or "First, I want to know where you stand on this issue — and then we'll get into what you're learning from the primary sources," or "How is your own perspective on this issue evolving as you're digging deeper into your research?" This teacher is treating her students' personal stances as a serious and central part of the project. It would be easy to facilitate this project without taking students' beliefs, motivations, and perspectives into account, but this teacher's facilitation draws out her students' beliefs and experiences and uses them as the foundation of her instruction.

Finally, we found that accomplished PBL teachers work toward authenticity by orienting students to the world

beyond the classroom. The teachers we studied strive to engage students in work that makes a contribution to their community or reaches the outside world in some way. Much of this work is done through project design (e.g., selecting an authentic audience for the project or inviting members of the community into the classroom to help students determine the direction of a project). However, teachers also consistently remind students of the audience and purpose for their work. When a teacher confers with students who are designing audio tours of a local watershed, she might say, "Remember, the first people who are going to take this audio tour are the 5th graders when they go on their field trip on October 1. Remember how little you knew about watersheds when you were in 5th grade and remember what held your interest when you were that age." In many small ways, teachers constantly orient students to their audience, and in doing so, teachers support the authenticity of their students' work.

Iterative: Cultivating a culture of production, feedback, reflection, and revision

When students participate in complex and extended projects, teachers will have to spend a lot of time providing feedback, guiding reflective activities, and helping students consider how they can improve their work. The PBL practitioners we spoke with 1) track student progress and provide feedback, 2) support students to give and receive feedback, and 3) support students to reflect and revise. So what does this aspect of PBL look like in practice?

When you walk into a PBL classroom, it can sometimes be hard to find the teacher. As opposed to a more traditional scenario, where the teacher holds forth from the front of the room, PBL teachers often move around, checking in with individuals or groups. This can be some of their most important work — assessing student and group progress and determining what sort of feedback or intervention will allow them, or the entire class, to take the next step in their learning.

PBL teachers employ a variety of strategies to track students' progress and provide feedback. In many of the classrooms we observed, students used shared documents (like Google docs) that both the student and teacher have access to, allowing the teacher to observe and track student work in progress. As teachers make professional judgments about student learning, they also provide in-the-moment feedback. Sometimes this takes the form of a direct correction, but often it comes in the form of a question or suggestion to refer to a resource in the classroom. While providing in-the-moment feedback, most accomplished PBL teachers resist telling students that something is wrong with a project, and instead ask probing questions that encourage students to reflect on the project's progress and make appropriate adjustments.

Supporting the iterative nature of the PBL classroom also requires helping students to give, receive, and use peer feedback. A student may be able to receive plenty of feedback but lack the interest or skill to use that feedback effectively. Thus, accomplished PBL teachers assess not just the student's understanding of content, but also their ability to use feedback to reflect and revise. These teachers model the use of feedback for revision, coach students on how to use feedback they receive, and assess how drafts change over time to understand how students have incorporated feedback.

At the same time, accomplished PBL teachers also develop students' capacity to provide feedback to others. To enact this practice, teachers create opportunities for students to give feedback to one another, but they also model what good feedback looks like, providing feedback on the feedback that students give, suggesting ways to make it more helpful.

Most projects include several opportunities for students to construct interim products, drafts, or prototypes that can be the source of valuable feedback from the teacher and other students. However, reflecting on feedback and incorporating it into a revised product is not easy. Accomplished PBL teachers thoughtfully design these opportunities, often through modeling and scaffolding. Many of the teachers we spoke with expressed the belief that if they were not actively modeling the process of reflection and revision, then they were not living up to their mission as a project-based teacher.

Collaborative: Building student agency in learning communities

The nature of project-based learning often brings students together to collaborate over sustained periods of time. This in-depth and sustained collaboration requires particular attention from teachers, as they help students work together effectively. We found this goal to include two core practices. Namely, PBL teachers 1) support students to collaborate and 2) support students to make choices.

While many teachers hope to promote student collaboration, both new and veteran teachers often struggle to help students work together effectively, going beyond merely helping each other do what could be independent work. The richest collaborations involve not just mutual support but true interdependence, where success requires the group to draw on each member's insights, perspectives, knowledge, skills, and experiences. Consider the example of students in a math class who are designing the layout of a bike path system for their city. Students must identify patterns within traffic data they gather, create

mathematical models that help them calculate predicted commuter times between several nodes across the city, and work to design a bike path system that is as efficient as possible. Given such a complex assignment, each student group must find ways to leverage the assets of every group member. For this to happen, though, teachers must support students as they define their roles and responsibilities, design and manage thoughtful group processes, and reflect on and refine their collaborative efforts. Teachers may offer scaffolds and structure to support novice collaborators, closely monitor group participation and communication, and intervene when necessary. Teachers may also offer models, prompts, and other resources to ensure students are building their capacity to work effectively together.

Further, accomplished PBL teachers cultivate student choice and ownership within a collaborative setting. In a traditional classroom, students might choose their own topic, audience, questions to pursue, or product to create. However, PBL requires students to make these decisions *together*, and this kind of negotiation doesn't come naturally to most young people. Teachers have to build this skill intentionally, over time, helping students learn how to choose and design a project that meets everybody's interests and is appropriate in scope — ambitious and challenging but not overwhelming. To do this, the teacher might provide a set of protocols for groups to use at the onset of their work to establish their group norms, roles, and working agreements. Supporting choice also means the teacher must be intentional about when to intervene in the work of a group. The teacher may push a group to justify their decisions by asking questions such as, "What was the criteria you considered when you chose that particular option over others?" Alternatively, teachers may intervene to help struggling groups reflect on their process by offering their own observations and asking questions to help group members consider how best to move forward.

Toward teacher development for student-centered learning

> "Those who have been required to memorize the world as it is will never create the world as it might be."
> – *Judith Groch*

If teachers are to come together to learn about and improve their instruction, it is critical for them to have a shared language with which to analyze and reflect on their work in the classroom. To that end, we have identified a set of core practices involved in successful project-based teaching.

To grow professionally, however, teachers need more than just shared goals and terms. Building off of our PBL core practice framework, colleagues at the Penn Graduate School of Education have worked with several partners (including EL Education, Inquiry Schools, and the Workshop School) to develop an intensive professional learning program for experienced educators committed to student-centered instruction, as well as to redesign our preservice teacher program around student-centered practices. Teaching in this way is ambitious and sophisticated work, requiring expert application of knowledge and constant adaptation to diverse contexts and students. We believe that, to do this well, teachers need an equally sophisticated and ambitious set of learning experiences.

The promise of project-based learning and related student-centered pedagogies lies in their ability to prepare the next generation of citizens to confront a host of complex problems, from rising tides to rising inequality. None of these problems have an easy solution, and all will require people to work together in sophisticated ways, leveraging diverse expertise, creativity, and perseverance. In its most developed form, project-based learning provides students with rich opportunities to practice working together on worthwhile, meaningful, and complex tasks. However, without a deep commitment to preparing teachers in how best to support such learning, our latest efforts to transform classrooms will follow an all too predictable path — from enthusiastic exhortations to dismal failure and a return to didactic classrooms. Our hope is that by better articulating the practices teachers actually need to be successful, and by investing in high-quality professional development, we can change the trajectory of teaching and of our students' futures. K

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