Rigorous Project-Based Learning An Inquiry-Based Educational Approach

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High-Quality Professional Learning for Project-Based Learning

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Supporting teachers in shifting to rigorous project-based learning requires a meaningful and sustained approach to professional learning rather than relying on disjointed, one-time workshops.

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Contents

Professional learning and project-based learning

Project-based learning (PBL), a highly effective and inquiry-based approach to teaching, must be tied to high-quality, sustained professional learning (PL). PBL is commonly understood as requiring a shift in the role of the teacher from that of "sage on the stage" to a facilitator supporting guided discovery and scaffolded inquiry, and a number of studies show that this shift results in more-effective learning (Brown, 1992; Brown & Campione, 1994; Scardamalia & Bereiter, 1991).

This paper describes a research-based professional-learning program designed to support teachers using the Knowledge in Action (KIA) curriculum, a project-based approach to Advanced Placement (AP) courses. Lucas Education Research, a division of the George Lucas Educational Foundation, hopes this paper supports schools and systems with best practices for implementation of Knowledge in Action and provides educators and administrators with insights into designing professional-learning opportunities for project-based learning generally.

Knowledge in Action started as a collaboration between University of Washington researchers and high school teachers with support from Lucas Education Research. The goal of this researcher-practitioner partnership was to leverage the key principles of how people learn to design a rigorous project-based learning approach for Advanced Placement courses. An influential study by researchers Daniel Schwartz and John Bransford (1998) guided course design by establishing an instructional sequence that requires students to make discoveries and collect knowledge about a subject ahead of attending to lectures, which can result in a deep understanding and retention of information. Also borrowing from a study by the National Research Council (2000), the Knowledge in Action scope and sequence purposefully revisits core academic content in a looped manner, allowing students to return to important ideas and practice critical skills through projects that build on one another.

Research has shown that KIA's approach is effective. A randomized controlled study designed to determine the efficacy of KIA in five large school districts looked at the impact of project-based learning on students' AP U.S. Government and Politics and AP Environmental Science exam scores. The study ⤢ found KIA students significantly outperformed non-KIA students, for example, by 8 percentage points on a pass/fail measure of the AP score.

In addition, researchers found that Knowledge in Action teachers were more likely than a comparison group to focus on student-learning objectives related to deeper learning skills, such as critical thinking, problem solving, and complex communication. They also provided students with more-authentic learning opportunities and were more likely to use student-centered practices. The Knowledge in Action teachers were less likely to lecture or prioritize test preparation than the comparison group.

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Lucas Education Research partnered with PBLWorks ⤢—an organization that provides teachers with tools and practices to facilitate quality project-based learning—to design the professional-learning program described in this paper. Rigorous research into how adults learn best and a set of core design principles, both of which are outlined below, underpin this model for professional learning. Together, they make up the foundation on which Knowledge in Action PL rests.

As mentioned above, projects make up the core structure of the Knowledge in Action courses, and they are strategically sequenced to build upon a driving

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question. The **AP U.S. Government** ⬀ course's driving question is, "What is the proper role of government in a democracy?" In **AP Environmental Science** ⬀, the driving question is, "How can we live more sustainably?"

Just as the Knowledge in Action courses for students center on a question to focus their inquiry, a driving question anchors the professional learning for teachers described in this paper. This allows teachers to engage in a learning experience similar to what their students go through. Specifically, Knowledge in Action professional learning is framed around the question, "How can we create a learner-centered classroom through projects?" Teachers work to develop answers and practices in relation to this question. In short, the PL model mirrors similar processes that students engage in during a Knowledge in Action course. At times during the professional-learning experience, the PL model asks teachers to wear a "student hat" so that they may experience teacher practices from the students' perspective.

This notion borrows from EL Education (originally Expeditionary Learning), which uses project-based learning. In EL Education PL, teachers wear their

"student hat" while immersing themselves in the student experience. Later, teachers put back on their "teacher hat" and reflect on and make sense of the experience. As one EL Education staffer put it, this "suggests experiential professional-learning strategies can be instrumental in supporting teachers in making sense of a teaching model that requires them to rethink conventional methods of curriculum design, pedagogy, and assessment" (Klein & Riordan, 2011).

The Knowledge in Action professional-learning model

The graphic on page 4 shows how professional learning is organized in relation to the Knowledge in Action curriculum over a school year. In a typical year, the professional-learning experience is a mix of in-person and virtual sessions. It begins with a Summer Institute and then transitions to full-day professional-learning sessions during the school year. Virtual coaching and on-demand support also are available throughout the
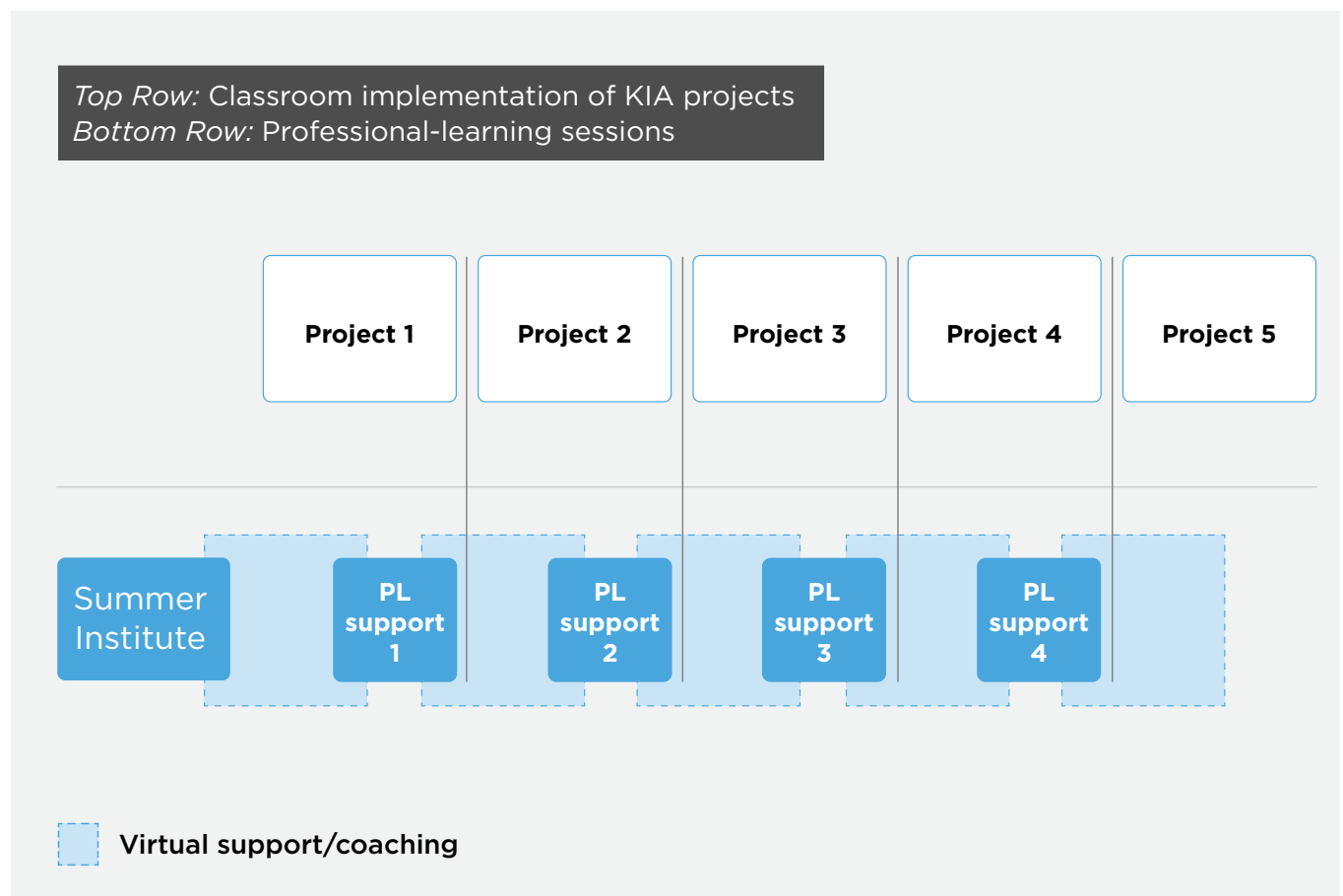
year. In addition, educators can access professional-learning resources through Sprocket, an online open educational resource hosted by Lucas Education Research. Details about these professional-learning resources are as follows:

- **Summer Institute:** Professional learning kicks off with a Summer Institute that consists of four days of on-site professional learning for teachers to learn about PBL and the curriculum. Participants work in small groups of around three or four teachers and a facilitator, focusing on the first project of the school year and considering how to adapt the curriculum to their own classrooms. The trained professional-learning facilitators possess deep content knowledge and expertise with project-based learning and coach the small groups of teachers in supportive professional-learning communities.

- **Professional-learning days:** Sustained professional learning throughout the year is a strength of this program. Ongoing professional learning during the school year consists of four in-person professional-learning days that occur before teachers launch a new project. Participants continue to work with their small groups in these sessions.

- **Virtual coaching:** Coaching cycles occur after in-person PL sessions. Through virtual meetings, phone calls, emails, or other means of communication, coaches work in small groups or one-on-one, as needs arise, to help teachers problem solve, with an emphasis on teaching upcoming lessons.

Professional Learning in Relation to the KIA Curriculum

Top Row: Classroom implementation of KIA projects
Bottom Row: Professional-learning sessions

| Project 1 | Project 2 | Project 3 | Project 4 | Project 5 |

| Summer Institute | PL support 1 | PL support 2 | PL support 3 | PL support 4 |

Virtual support/coaching

Adult-learning theory and Knowledge in Action professional learning

Project-based learning is an inquiry-based educational approach that builds students' capacity to think critically and problem solve, collaborate and communicate effectively, and engage deeply with academic content. When designed well and integrated into the school day, PBL can be more effective than a traditional, teacher-centered approach to instruction. In middle and high school, that often takes the form of overly relying on textbooks and lectures. While no single lever can transform our education system, PBL emphasizes a more student-centered learning environment that significantly improves student outcomes.

Supporting teachers in shifting to rigorous PBL requires a meaningful and sustained approach to professional learning rather than relying on disjointed, one-time workshops. Researchers from the nonprofit educational organization TNTP found that teacher complaints about PL stemmed from a sense that it wasn't customized to fit their needs. Less than half of the roughly 10,000 teachers surveyed said they received professional learning that was ongoing and tailored to their learning needs. The TNTP report found teachers spent an average of 24 hours per year participating in one-time professional-learning workshops, even though only 36 percent viewed them as a good use of their time (TNTP, 2015).

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Studies show that effective professional-learning programs must provide teachers with ample time to learn and practice new teaching methods and then reflect on what worked and why (Darling-Hammond et al., 2017). Research also demonstrates that the duration of professional learning is directly related to the degree to which teachers change their practice (Weiss et al., 2004).

Intensive, ongoing PL also pays off. When teachers are supported by ongoing coaching after PL workshops, their ability to transfer what they learned into their classroom occurs at a higher rate (Truesdale, 2009). In effect, coaching supports the difficult work of implementing a new teaching practice. Research indicates that strong PL must address the acquisition of new teaching methods and support the implementation of new skills in the classroom (Fullan, 2014). With Knowledge in Action, this support takes the form of virtual coaching after each PL session.

The design of the Knowledge in Action PL model draws on robust research, including but not limited to adult education expert Malcolm Knowles's writings on adult learning and educator Yvonne Trotter's synthesis of adult-learning theories (Knowles, 1988; Trotter, 2006). Below is an overview of the adult-learning theory underpinning the PL model described in this paper.

Adults are self-directed learners. For adult learners, motivation is strongly tied to choice. To be successful in their acquisition of skills and knowledge, teachers need to be self-directed in their learning. This should be reflected in the design of professional-learning programs, and educators should have the choice to participate in them (Glickman et al., 1997). Participants in Knowledge in Action PL enter the program voluntarily, which fosters strong agency and the self-direction necessary to ensure teacher buy-in.

But that's not always the case for PL programs. In a study conducted by the Boston Consulting Group on behalf of the Bill & Melinda Gates Foundation, less than one-third of teachers reported choosing most or all of their professional-learning opportunities. About 18 percent reported never having a say in their professional learning. That's despite the fact that teachers with more choice had higher levels of satisfaction with PL (Bill & Melinda Gates Foundation, 2014).

Adults respond to learning that's meaningful and relevant. Motivation in adult learners also is tied to meaning and relevance. Research shows that the most-effective professional-learning programs focus on teaching practices that are directly applicable to the classroom and are responsive to specific teacher "problems of practice"—aspects of teaching and learning that represent clear challenges that a teacher would like to explore in greater depth and that would make a difference for student learning if improved. Teachers are busy and often feel a sense of urgency related to their work. They will do the work necessary

to learn new skills and develop their practices when that effort is relevant to students and will improve teaching and learning at the classroom level (Glickman et al., 1997).

The in-person professional learning associated with the Knowledge in Action model directly relates to teacher experiences in the classroom, and facilitators use survey data collected after each session to identify precise teacher needs to address in upcoming PL sessions. Each professional-learning session focuses on a teaching practice. The professional learning over the course of the year builds upon teacher experience, providing just-in-time support for teachers in the midst of project implementation and adaptation.

Adults learn by doing. Just as is the case for students, teachers' participation in active learning and making sense of new information increases their learning and their ability to transfer it to their classroom (Gulamhussein, 2013). In short, active learning allows teachers to try new instructional approaches and see firsthand the same kind of learning that students experience.

The most-effective PL programs emphasize rigorous content and tasks (Aspen Institute, 2018). The Knowledge in Action professional-learning sessions include educator learning goals. And facilitators explicitly model for teachers strategies that connect to each learning objective. As learners in their own right, teachers receive time to reflect on the PL experience and how it connects to their own classrooms. Then, teachers try out new approaches they learned in their classrooms and discuss those experiences with coaches and peer teachers in their PL group. The approach is designed to create positive behavioral shifts in teacher practice.

In contrast, one of the reasons that the common professional-learning workshop model isn't effective at transforming teacher practice is that it does not encourage educators to be active learners.

Adult learning should emphasize problem solving. Teachers are problem solvers who want to apply new knowledge to the classroom, especially if they believe it will help their students. Numerous studies of high-quality professional learning emphasize the

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importance of having teachers engage in solving a problem that is important to them and their work with students. The design of the yearlong Knowledge in Action PL experience asks teachers to acquire knowledge and skills and then apply that learning to their own classrooms. Virtual coaching, in particular, centers on addressing actual problems and implementation challenges that arise in the course of classroom teaching. In addition, having a driving question to answer is at its core a problem-solving approach to PL.

Prior experience affects adult learning. Effective PL programs acknowledge teacher experience, practical knowledge, and expertise as strengths that should be respected and utilized (Trotter, 2006).
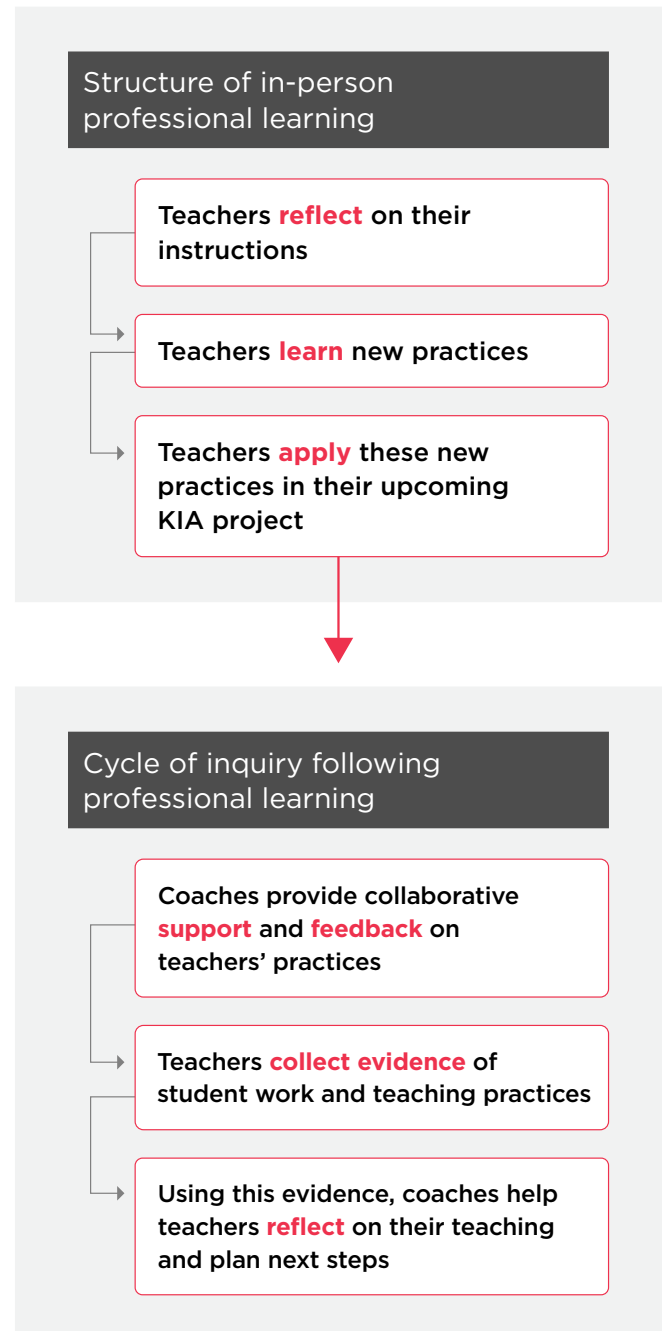
Educators' previous experience and expertise are tapped throughout Knowledge in Action professional learning. That happens first in the Summer Institute, during which facilitators ask teachers to reflect on past experience in relation to topics covered in the course of the institute. Then, during in-person PL, facilitators ask teachers to reflect on their own teaching and adaptation of the curriculum.

Adults learn through reflection. High-quality professional learning builds in time for reflection and feedback. Adults do best when they have time to think about the learning experiences they are participating in and to reflect on how those relate to their own personal context. Research suggests that providing teachers with such experiences yields positive results (Greenleaf et al., 2011).

Building this kind of reflective capacity is an essential aspect of Knowledge in Action professional learning. The program couples each learning experience with time to reflect upon its implications in the classroom. This is done individually through moments designed for writing and reflection, in one-on-one prompted conversations, and via group discussion.

The figure on the right shows the sequence of in-person and virtual PL over time and the recurring emphasis on reflection in the KIA program.

Sequence of Professional Learning Over Time

Structure of in-person professional learning

- Teachers **reflect** on their instructions
- Teachers **learn** new practices
- Teachers **apply** these new practices in their upcoming KIA project

Cycle of inquiry following professional learning

- Coaches provide collaborative **support** and **feedback** on teachers' practices
- Teachers **collect evidence** of student work and teaching practices
- Using this evidence, coaches help teachers **reflect** on their teaching and plan next steps

Core design principles of Knowledge in Action professional learning

In creating this PL model, Lucas Education Research and PBLWorks relied on the research on adult-learning theory described above. In addition, the developers of this PL program identified the following five core design principles as essential to high-quality professional learning associated with project-based teaching and learning:

CORE DESIGN PRINCIPLES

1. Trust and relationship building are paramount.
Effective PL fosters a culture of idea sharing and collaboration between peers. Just as tending to students' social and emotional needs is important in the classroom, it is essential to prioritize teachers' social and emotional learning needs during professional learning. Building trust is vital to creating a space where learning, reflection, and risk taking can occur. Teachers participating in this approach are in an inherently vulnerable position, in that they are expected to open up and demonstrate their own practice (Aguilar, 2013). As teachers shift their teaching methodology, it is critical that they feel supported to explore uncharted terrain and engage in open and honest conversations.

Knowledge in Action facilitators build close relationships with the teachers they work with by pairing up with the same educators throughout the year. Cohorts are small, with just a handful of participants in each group, to ensure teachers can foster meaningful relationships. If the teachers come to know and trust their coaches, they are more likely to feel emotionally supported in their exploration of new ideas and practices and will likely be more willing to implement these practices in their classrooms.

2. Facilitators must be experts.
Professional learning that has a positive impact on student achievement generally focuses on the content that educators teach and offers concrete strategies for teaching that subject matter (Darling-Hammond et al., 2017). In this PL program, which centers on AP course content, hired facilitators possess deep content knowledge of the subject

1. Trust 2. Expertise 3. Adaptation 4. Collaboration 5. Teacher Practice
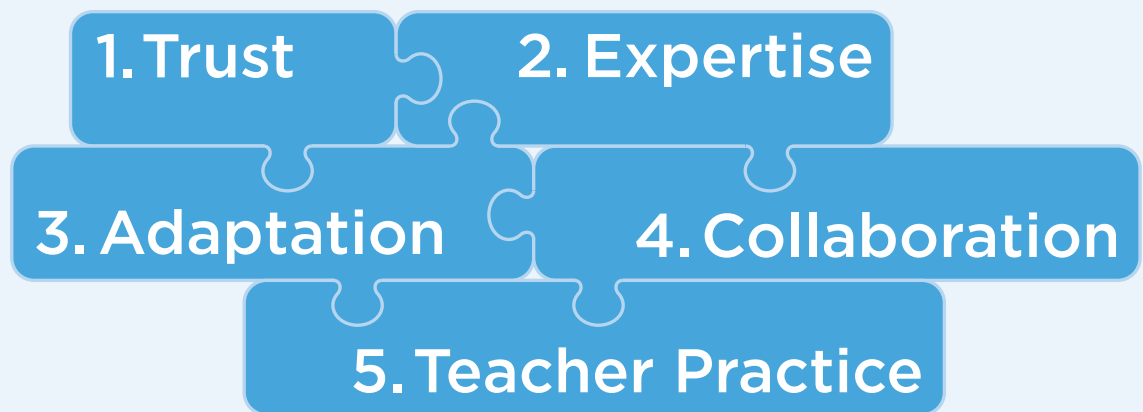
CORE DESIGN PRINCIPLES *(continued)*

matter at hand and the Knowledge in Action curriculum, as well as expertise in project-based learning. For good measure, facilitators are asked to review the curriculum intensively before the Summer Institute and subsequent PL sessions that take place during the year.

3. Adaptation is the expectation.
Too often, curriculum designers place an emphasis on preparing teachers to follow, rather than adapt, instructional materials. Yet teachers invariably adapt curricula and materials to fit their own classroom contexts according to student needs, teacher goals, local constraints, and values around teaching and learning. Curriculum developers must recognize that their designs are not fixed entities but, during implementation, are adapted to the local environments in which teachers implement them (Squire et al., 2003).

Knowledge in Action professional learning emphasizes adaptation of the curriculum through every interaction with teacher participants. Facilitators support teachers in developing an understanding of which adaptations are productive and won't undercut the efficacy of the curriculum.

4. A collaborative learning community is vital.
Special care is made to foster healthy, collaborative relationships among teachers participating in this PL program. Professional communities that operate outside schools' walls have been shown to have positive effects on student learning. These are often organized via networks that connect teachers around subject matter (Darling-Hammond et al., 2017). Knowledge in Action PL creates such networks.

In highly effective education systems, professional-learning circles exist in which peers support and challenge each other, allowing teachers to take risks to improve through feedback and observation (Learning First, 2015). Collaborative learning and

collegial support are hallmarks of strong PBL instruction and, similarly, are essential in the design of the Knowledge in Action professional-learning program.

5. Teacher practice should be front and center.
Teacher practice is at the center of Knowledge in Action PL. Just as educators must contextualize the curriculum to their settings, educators are encouraged throughout KIA professional learning to adapt their practices to ensure projects are relevant to their students' lives and experiences and the world around them.

The KIA professional-learning model certainly isn't alone in emphasizing the importance of teacher practices on student success. Lucas Education Research is supporting a study into the effectiveness of a professional-learning program developed by Pam Grossman, dean of the University of Pennsylvania Graduate School of Education (Penn GSE), and a team of colleagues. These researchers have designed a PL program for high school science and social studies teachers who use project-based learning. That program focuses on the use of core practices linked to goals associated with high-quality, rigorous PBL instruction. Those goals include fostering student collaboration and revision and anchoring lessons around authentic projects that encourage deep content learning. Teaching practices that the researchers look for include supporting students to make a difference in the world, helping students give and receive feedback, eliciting higher-order thinking, and orienting students toward subject-matter content, among other things (Grossman et al., 2019).

Researchers are currently conducting an evaluation of the University of Pennsylvania PL program to see if these core practices show up in participants' classrooms.

Conclusion

There is widespread understanding that each and every student needs and deserves access to the kind of rigorous, college-preparatory coursework found in Advanced Placement courses. But access alone isn't enough to drive student success. Knowledge in Action improves outcomes for students as measured by AP test scores and creates deeper learning experiences for students. This PBL curriculum, coupled with aligned professional learning for educators, is helping improve teaching practices and student outcomes. For a deeper discussion of designing high-quality, rigorous PBL curriculum, please see LER's white paper, "Designing Curriculum for Project-Based Learning."

We know from research into the effectiveness of Knowledge in Action and other studies that educators thrive when provided with sustained professional-learning opportunities that are inquiry based, collaborative, and rooted in disciplinary content.

Importantly, in the PL program described here, teachers spend the year mirroring the student experience and investigating the driving question, "How can we create a learner-centered classroom through projects?" Going through a professional-learning experience that reflects what high-quality PBL instruction should look like, and taking the student perspective, better prepares educators to transform their classrooms in positive ways.

Strong research revealing how adults learn effectively underpins the approach outlined in this paper. The learning must be practical and highly relevant to educators' lives and work experiences. It should also be problem based and offer opportunities for reflection. Additionally, this PL program centers on core principles that include the ideas that trust is paramount to effective learning, adaptation of these materials and this approach is necessary and must be supported, and teacher practice is at the heart of all good instruction and is integral to effective professional learning.

While Knowledge in Action isn't the only project-based learning PL approach available, in making this version of professional learning open and freely available, LER hopes it will support educators and school and system leaders to bring about transformative changes that make rigorous PBL the new normal for more students.

Through this paper, Lucas Education Research seeks to share the main features of the Knowledge in Action professional-learning model. Additionally, educators can find a more detailed Knowledge in Action PL manual on **Sprocket** ⧉, an online resource available through the LER website, where other PBL open educational resources can be found.

Furthermore, the College Board and PBLWorks have partnered to provide Knowledge in Action professional-learning opportunities to educators, and their PL materials can be found on the College Board website.

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