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The Quest for Deeper Learning and Engagement in Advanced High School Courses

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Key Points

- GLEF and a research team from the University of Washington worked with Washington's Bellevue School District to develop and assess the impact of project-based learning on upper-level courses in high school.
- Research suggests that Advanced Placement (AP) courses may focus too much on accelerated content at the expense of deeper conceptual learning.
- The number of students taking AP courses has grown, but along with this the number failing has increased. GLEF and the research team tested project-based learning (PBL) to counteract this trend.
- Results after two years are promising. Students in the PBL-AP courses are performing as well or better than students in traditional AP courses.
- Other education funders are encouraged to use an iterative design process, work with a diverse design team, and bring in partners who can contribute needed expertise and resources.

Introduction

The George Lucas Educational Foundation (GLEF) seeks to improve education by identifying and advocating innovative, scalable approaches to teaching and learning. Its vision includes core strategies for effective and engaging instruction, authentic assessment, and teacher preparation. GLEF is expanding its approach by going beyond the identification of promising educational practices to also interpret data, illustrate trends, and conduct research that assesses and validates innovative educational approaches. This article describes one of GLEF's primary initiatives: to collaborate with teachers, researchers, and educational leaders in the design and implementation of rigorous, project-centered, year-long courses and the study of their effects.

Since 2008, GLEF and a research team from the University of Washington have been working with Washington's Bellevue School District to develop and assess the impact of project-based learning approaches on upper-level courses in high school. The project began by studying the effects of changing the nature of instruction in an Advanced Placement (AP) course. AP courses are offered extensively throughout the U.S. and include independent assessments developed by the College Board, which develops and markets AP and other tests. A recent study by the National Academy of Sciences has provided reasons and guidelines for improving the courses. Its main finding was that "the inclusion of too much accelerated content can prevent students from achieving the primary goal of advanced study: deep conceptual understanding of the content and unifying concepts of a discipline" (National Research Council, 2002, p. 1). The College Board has been attentive to this finding and is working to overhaul courses such as Biology to reduce some of its overwhelming content expectations and also to organize the content around core ideas.

The work we report in this article involves the AP U.S. Government and Politics course, which unlike the Biology course retains its original, vast load of content. Based on a number of research-

based principles, our team of teachers, researchers, and educational leaders created a new version of this course organized around project cycles designed to help students learn the content with deep understanding that will support subsequent transfer to future problems (National Research Council, 2000; Darling-Hammond et al., 2008). GLEF has a long-standing interest in project-based learning and comprehensive assessment. This research effort represents GLEF's first attempt to develop a course in collaboration with other experts and educators and then evaluate its effectiveness with a variety of student populations.

Context

Project-based learning (PBL) takes many forms. Ours is designed to enhance learning by having students participate in authentic projects that provide a meaningful context for learning important content. For example, instead of simply learning about the Constitution and the Supreme Court, students acquire the knowledge and skills necessary to actually take on the roles of the justices and the lawyers who argue before them. Then, an expert in the judicial process gives students feedback on their performances. As one student noted, "you have to learn stuff completely differently in order to prepare for questions and arguments than learning to simply prepare for a memory test." Our goal is to combine remembering with the kinds of "adaptive expertise" (Hatano & Inagaki, 1986) that can prepare them for future education, careers, and life because they begin to understand when it is important to learn with understanding and when it is sufficient simply to memorize facts.

We began with AP courses because they are considered by many to be among the best to be found in the American high school. Indeed, they are often touted as the gold standard of the high school curriculum. There are currently more than 30 courses, ranging from Calculus to World History. These courses are developed not by a single teacher working alone but by committees of scholars and teachers working with assessment specialists from the College Board. Some courses are one semester in length, others one year, but all end with a high-stakes test. Students who receive a passing score (3 or higher of 5 points possible) often have an edge in college applications. Some colleges allow these students to skip the beginning course in a sequence and go directly to the subsequent course.

This research effort represents GLEF's first attempt to develop a course in collaboration with other experts and educators and then evaluate its effectiveness with a variety of student populations.

AP was developed in the 1950s for high-achieving students at elite prep schools, but it soon expanded to comprehensive public high schools, often as the upper curriculum track (Schneider, 2009). Today, its enrollment is skyrocketing in both urban and suburban schools. The number of AP test takers nearly doubled between 1950 and 1980 and then tripled between 1990 and 2000. There was a 13 percent jump in Latino and African American test takers between 2008 and 2009 alone.

Increasingly, school districts are lowering or removing AP entrance requirements and encouraging all students to tackle these "rigorous" courses. The motivation appears to be a combination of the new emphasis on "college readiness for all" plus increased attention to underserved urban schools with their greater number of students in or near poverty. The new thrust is that all students, in the name of equity, should have access to the gold standard.

Although the number of exam takers is growing, the number of students who fail AP is growing, too. Some believe this is inevitable and worth the cost. As one College Board official concluded, "I don't know an educator who wouldn't think it's a good tradeoff to take the risk and give more courses that we know have been good for the few" (quoted in Lewin, 2010).

We – GLEF and its research partners – do not accept this tradeoff. Instead, we want to develop an approach to AP coursework that helps a broader array of students succeed. We applaud the emphasis on equity of access to rigorous courses, but we also want equity of outcomes. This means aiming not only for higher enrollments but also for better instruction. Better instruction, based on contemporary research on how people learn, includes close attention to students' ability and encouragement to reflect on their learning; how and when students are encouraged to use, revise, and deepen prior knowledge in tasks that ask them to construct new knowledge; classroom and curriculum organization; and creating reading, writing, and other scaffolds to support performances beyond what could be achieved without them (National Research Council, 2000). Organizing AP instruction around a set of experience-based project cycles is our approach to helping more students (and teachers and schools) succeed. This is a difficult task due to the large amount of content covered in an AP course followed by the high-stakes test, but this makes an ideal set of conditions for testing our approach.

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Our PBL-AP Approach

Our approach is aimed at four goals:

1. the same or higher scores on the AP test as students taking a traditionally taught course;
2. deeper conceptual learning of the course content;
3. greater engagement, with appeal and success for a wider array of AP students; and
4. a course architecture that is sustainable and scalable by design.

GLEF and the University of Washington have partnered since 2007 with the Bellevue School District in Washington state. Under the leadership of former superintendent Mike Riley, the district dramatically increased the proportion of students taking one or more AP courses by implementing an open-enrollment policy and cultivating a district-wide expectation of AP course-taking. Bellevue borders Seattle and, like many other suburban districts, has an adequate resource base to manage the upheavals of innovation and to fund content-area curriculum leaders with whom we could collaborate along with teachers. For these reasons, it offers a fertile "greenhouse" for incubating new courses.

This collaboration prompted us to begin our work with an AP course that has one of the highest enrollments – AP U.S. Government and Politics (APGOV). There is broad interest in this subject because the course, whether taught as AP or not, has been a staple of the American high school curriculum for decades. The Bellevue teachers and curriculum leader with whom we worked requested that we begin with this course. The design principles draw on *How People Learn* (National Research Council, 2000) and project-based learning (e.g., Darling-Hammond et al., 2008). They are:

- rigorous experience-rich projects throughout the course (not only at the end);
- quasi-repetitive project cycles where each builds on the other, yielding deeper understanding;
- engagement that creates a need to know;
- teachers as co-designers; and
- an eye for scalability.

Projects as the spine of the course. Many PBL courses use a project as a "capstone" experience

at the end of the course. But in our approach to PBL, a series of interdependent projects allows students to work both collaboratively and alone to develop knowledge and skills across the span of the course. The project work requires heightened communication as students work to interpret texts and problems, develop and share opinions and reasons, and make collaborative decisions (Parker, 2010). The project activities make students' thinking and actions visible, and the course provides multiple opportunities for students to try out their current levels of understanding, revise them, and in this way deepen them iteratively.

Depth through learning cycles. Quasi-repetitive project cycles (Bransford et al., 2006), or what our teachers dubbed "looping," means that students have opportunities to revisit questions, ideas, and problems that arose in previous project cycles. The course's several projects are each conceived as a knowledge-in-action learning cycle in which students alternate between learning to act and acting to learn. A key aspect of our approach is that all the project cycles are united by a course "master question." For APGOV, after much discussion among the teachers, researchers, curriculum leader, and political scientists on the team, we settled on this question: What is the proper role of government in a democracy? As students move through the project cycles, they repeatedly respond to (loop back on) the master question and try again to generate a response, reflecting on what they have gleaned from the prior project cycles and the project cycle at hand. Here is inquiry-based learning – an intellectual investigation – but stretched throughout an entire course in order to help students develop "connected" rather than piecemeal knowledge (National Research Council, 2000).

Engagement first. In their paper called *A Time for Telling,* Schwartz and Bransford (1998) explored uses of texts, lectures, and explanations within the total repertoire of instructional methods. They noted that lectures can, of course, increase learning. However, lectures, texts, and other sources of expert knowledge can become more engaging and lead to deeper understanding when students first experience situations that create a need to know – "a time for telling." Therefore, our approach balances and orchestrates lectures and readings with project-based experiences. "When telling occurs without readiness," Schwartz and Bransford conclude, "the primary recourse for students is to treat the new information as ends to be memorized rather than as tools to help them perceive and think" (p. 477).

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Teachers as co-designers. Brown (1992) concluded that if classrooms are to be transformed from "academic work factories to learning environments that encourage reflective practice among students, teachers, and researchers" (p. 174), then experimentation on complex classroom interventions must be done as collaborative undertakings among teachers, researchers, and school administrators. This requires the design to be grounded constantly in school practice, not university laboratories or foundation offices. This design principle put our teacher-collaborators in the position of being curriculum makers – continually working to integrate AP content with a set of projects selected or designed collaboratively by the team. The teachers are also experts at helping the team leverage existing practices at their schools so that courses we co-design can work effectively.

Scalability. Per our fourth goal, our aim was not a "greenhouse" experiment that would display what is possible but improbable. We were not satisfied merely to show that complex interventions could establish a change in practice. Instead, we worked

with an eye to scalability, or what Ann Brown aptly called "migration." As she wrote, researchers "must operate always under the constraint that an effective intervention should be able to migrate from our experimental classroom to average classrooms operated by and for average students and teachers, supported by realistic technological and personal support" (1992, p. 143). As noted earlier, working with teachers as partners provides important scalability information that we considered from day one.

This was a "design experiment" in the research tradition of Ann Brown (1992). It was an experiment in the sense that a particular instructional treatment was tested but a design experiment in the sense that an innovation was designed and then iteratively tested and modified in a real educational setting – a public school, not a laboratory. "Design" here is an adjective modifying "experiment," but it also has a verb sense because the design work is ongoing and under revision at all times.

Method

Our research is now in its third year. In this article we report findings from the first and second years (2008-09 and 2009-10). During these years, the PBL-AP approach was implemented in APGOV courses in two Bellevue high schools. In both years, we focused on the following research questions:

1. Is it possible to get the same or better scores on the AP test with a well-designed PBL course than in a traditionally taught course?

2. Is it possible to achieve deeper learning than that measured by the AP test using a measure of "knowledge in action" that indicates deep understanding?

To address these questions, we used a nonrandomized intervention study design with statistically matched intervention and control groups. This was a "design experiment" in the research tradition of Ann Brown (1992). It was an experiment in the sense that a particular instructional treatment was tested but a design experiment in the sense that an innovation was designed and then iteratively tested and modified in a real educational setting – a public school, not a laboratory. "Design" here is an adjective modifying "experiment," but it also has a verb sense because the design work is ongoing and under revision at all times, continually modified based on on-the-ground experience and feedback.[1]

For comparability, all classes were yearlong APGOV. Within each school, all of the yearlong APGOV courses were the same type, either PBL-AP or traditional. We conducted the research first in the 2008-09 school year in three Bellevue high schools. Two of these schools implemented the PBL-AP approach, while the third served as the control group and used a traditional approach. In the following year, 2009-10, the same two high schools again implemented the PBL-AP approach, but the control schools were in a matched suburban California district.

Because we wanted to create a course that would be appealing to a more diverse array of students than would normally participate in AP, we selected for the PBL courses one high-achieving high school in the Bellevue district and one moderately achieving school, also in Bellevue. The latter school historically has fewer students passing the AP test and a higher proportion of students receiving free or reduced-price lunches.

[1] Additional information about our methodology can be found in Parker et al. (in press).

TABLE 1 Comparison between PBL-AP courses and Traditional AP Courses in Years One and Two

	Year One			Year Two		
	PBL AP High-Achieving School	PBL AP Moderate-Achieving School	Traditional AP High-Achieving School	PBL AP High-Achieving School	PBL AP Moderate-Achieving School	Traditional AP Moderate-Achieving Schools
AP Test:						
Average Score	3.5*	2.4	2.6	3.4*	2.3*	2.0
Standard Deviation (SD)	(1.2)	(1.2)	(1.1)	(1.3)	(1.2)	(1.1)
Number of students	N = 103	N = 100	N = 66	N = 86	N = 89	N = 87
Knowledge in Action Test:						
Overall: Average Score	2.3*	2.1*	1.6	2.2*	2.0	1.9
SD	(0.9)	(0.8)	(0.8)	(0.7)	(0.8)	(0.6)
Task & Client: Average Score	2.4*	2.2*	1.6	2.5*	2.2	2.0
SD	(1.0)	(0.8)	(0.8)	(0.9)	(0.8)	(0.7)
Influence Policy: Average Score	2.2*	1.9*	1.5	2.2*	1.8	1.7
SD	(0.8)	(0.8)	(0.7)	(0.7)	(0.7)	(0.6)
Controversial Issues: Average Score	2.6*	2.1*	1.8	2.4*	2.3	2.1
SD	(0.8)	(0.8)	(0.8)	(0.8)	(0.9)	(0.7)
Number of students	N = 95	N = 78	N =91	N = 82	N = 77	N = 114

* $p < .05$

In the findings section that follows, we distinguish between the results of these two schools in comparison with the control schools.

We measured student learning and engagement at various points each year. In this article, we discuss the results of two tests: the College Board-administered AP test and the Knowledge in Action (KIA) deep-learning assessment developed by the research team. The KIA assessment uses a simulated real-world problem to assess students' learning in the course. Whereas the APGOV test primarily measures students' mastery of content – their ability to identify and describe the structures and functions of government and changes in them over time – the KIA test assesses how well students can apply that knowledge in a novel scenario in which their charge is to monitor and influence public policy. Specifically, the test asks them to formulate a plan for well-informed political action on a controversial issue that is currently heating up. The KIA test is intended to complement the AP test as a measure of deep learning in the subject and is administered as a pre-test and

post-test (the latter following the AP test in May). When taking this test, students are instructed to take the role of an advisor to a member of Congress or an interest group in a particular place and time. In the scenario, students must mobilize knowledge from across the project cycles to draft an action plan for their client. Students' written answers to the KIA assessment were scored on four dimensions:

1. Overall quality: The student gives a high-quality response overall.

2. Task and client: The student directs context-specific advice to the particular member of Congress or interest group.

3. Influencing public policy: The student gives an informed political-process account.

4. Grasping controversial issues: The student analyzes the public-policy issue at stake and what makes it controversial.

Graduate students in political science were trained to score student responses, and inter-scorer agreement was acceptable at 93 percent (year one) and 90 percent (year two). When the two raters did not agree within one point, the paper was scored by an independent third rater and a mean rating was assigned to the response.

Results

Table 1 displays the results for years one and two in the two PBL-AP schools as compared with the control schools. An asterisk indicates that the PBL-AP students performed better to a statistically significant degree on the measure than students in traditional (control) AP classes. Where there is no asterisk, the PBL-AP students performed as well as the traditionally taught students; that is, there was no statistically significant difference between the two. Recall that one PBL school was historically high achieving and the other moderately achieving. Recall also that in year one the control group was high achieving, whereas in year two it was moderately achieving. In both years, the statistical analyses were adjusted for students' prior achievement.[2]

The results are promising. Students in the PBL courses are performing as well or better than students in the traditional courses on the AP test, and better than (or in one case, the same as) students in the traditional courses on the KIA test. In that one case, the lack of difference between PBL students from the moderately achieving school and the control students (also in a moderately achieving school) is likely a result of a "floor effect": *both* groups scored low on the Knowledge in Action test — on average a 2.0 on a scale of 1-6. This test requires proficient reading and writing skills and is given with a relatively short time limit. In other words, it is so difficult that the range (variance) of scores was limited — many students did poorly in both the intervention and control groups. This finding supports our goal as we go forward of creating reading, writing, and other scaffolds that can help less-prepared students succeed. It also supports current work to modify the KIA test in such a way that a greater range of scores is achieved, as is the case with the AP test.

But we should note that these are conservative conclusions with respect to learning differences. In the control classrooms, many more students opted out of taking the AP test than in the PBL classrooms. (Almost all the PBL students took the AP test.) We can reasonably assume that control students who opted out felt less prepared for the AP test and would have scored relatively poorly. If these students' scores had been included in the data, the differences between the control and PBL groups might have been even larger.

What Students Say

Let us allow a few PBL-AP students – all seniors – to speak for themselves and put flesh on our findings. Students participated in focus group interviews after they took the AP test in May.

[2] To control for students' prior achievement across schools, we used hierarchical linear modeling (HLM) for the statistical analyses of results. The models took into account students' prior achievement, including the student's scores on prior AP tests, grade-point average, and scores on the PSAT and the Washington Assessment of Student Learning-Reading.

This student speaks both to preparation for the AP test and engagement in the class:

> So I think this class did a lot better in preparing me for the AP test than other APs I've done. Part of it is the group work that encouraged me to actually do my work, even though I still didn't have the best track record. Part of it, I think, is the hands-on learning rather than just listening to lectures and book learning the whole time, at least for people like me, was a huge improvement (over) the APs I've taken. When I went in to take this one, I felt best about this and I came out feeling best, and I knew this stuff better than I've known any other AP, and I feel this just really worked.

The next student reflects on the real-world relevance of the projects:

> Project-based learning actually helps you to apply it to life because when you read things out of a book, you kind of wonder, "When am I ever going to use this?" That's a question that students ask almost every day.

And this student echoes our first design principle, using an interdependent series of projects as the spine of the course:

> So, I felt like learning it in this kind of setting where we're actually doing projects and stuff was definitely a lot more benefitting than any other class where you just read out of a textbook. Because with all the other AP classes, we learn mainly just to get the credit on the AP test, and then after we get that credit, it's almost like goodbye. But whereas we have the experience of actually trying to do this, I think I'm definitely going to remember it because I've actually done it before.

Year Three and Beyond

In year three (2010-11), there were two expansions of the work: additional support from the Bill & Melinda Gates Foundation allowed expansion to additional locations as well as the development of a second course. Using "design experiment" principles, we migrated the PBL-APGOV course to high schools in two urban districts (Seattle and Des Moines, Iowa) and to the Envision Schools, an urban charter network in San Francisco. Also, we developed and implemented a PBL Environmental Science course (APES) in Bellevue and simultaneously in the Envision Schools. This both continues and extends the work of the first two years. Using controlled studies, the project develops and investigates the effectiveness of a new approach to AP using principles from *How People Learn* (National Research Council, 2000) and project-based learning (Darling-Hammond et al., 2008). It pursues the four goals named earlier: achieving the same or higher scores on the AP test; deeper conceptual learning of the course contents as measured by a second test; greater student engagement with appeal and success for a wider array of students; and a course architecture that is sustainable and scalable by design.

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Summarizing, in the first two years the study involved a relatively advantaged suburban student population and a single AP course. The expanded study includes students who are more diverse across race, ethnicity, socioeconomic status, and prior academic performance; and they attend a wider range of schools – 15 schools ranging from high-achieving to low- or moderately achieving schools with high numbers of students receiving free or reduced-price lunches. It also brings the same course architecture to a second subject, APES.

Opportunities for Additional Research and Partnerships

Key areas for additional research and replication efforts include the following:

Redesigned PBL-AP courses incorporate more innovative instructional practices to guide students toward deeper understanding of content and more authentic work products. Yet these new courses do not lose academic rigor in the redesign process. In fact, they gain academic rigor thanks to their increased depth and authenticity. The right scaffolds, such as a range of formative assessment strategies, will improve the odds that all students will have the opportunity to succeed.

- *Scaffolding for student success.* We consider it a worthy goal to expand enrollment in rigorous, PBL-infused, upper-level courses to reach a broader population. To ensure that all students have the opportunity to succeed, we need to develop scaffolds to support learners who may need help in reading, writing, and working collaboratively with their peers. Traditional AP courses come with a heavy reading and writing load and also move at a fast pace through difficult content. Redesigned PBL-AP courses incorporate more innovative instructional practices to guide students toward deeper understanding of content and more authentic work products. Yet these new courses do not lose academic rigor in the redesign process. In fact, they gain academic rigor thanks to their increased depth and authenticity. The right scaffolds, such as a range of formative assessment strategies, will improve the odds that all students will have the opportunity to succeed. For example, reading specialists could be enlisted to support struggling students in PBL-AP classrooms.
- *Teachers as adapters.* Advanced high school courses are notorious for coverage (breadth, scope) and perhaps undeservingly famous for "rigor" because they lag behind contemporary research on how people learn and what counts as learning. Conventional classroom practices have the cultural weight of custom and changing them, as with any custom, is an ambitious enterprise. The key, according to Darling-Hammond and her colleagues, "is how these complex approaches are implemented" (2008, p. 15). It is well-known that in numerous short-lived but successful initiatives, "the successes were among students taught by the early adopters" (p. 15). In both years one and two reported here, it must be emphasized, the teachers were indeed the early adopters who had co-designed the course with the researchers. Consequently, the expansion to other courses, both inside and outside the AP stable, combined with the expansion from suburban to urban schools will still need to involve teachers as adaptors rather than adopters, for teachers best know their students, their courses, and their school contexts. Relying on their creative agency and on-the-ground experience is key.
- *Professional development for teachers*. Teachers who participated in this research in the first two years were actively involved as curriculum co-designers. Their experience points to the need for ongoing, collegial, high-quality professional development if the PBL-AP model is going to achieve greater scale. In PBL, teachers are challenged, like their students, to be problem solvers. With appropriate access to professional development, teachers will have opportunities to develop and refine the PBL-AP curriculum, increase their familiarity with PBL methods, learn from and with colleagues, and develop strategies to address specific issues such as the needs of struggling adolescent readers.
- *Expand to other high school courses.* So far, we have developed two PBL-AP courses. Both are built on the same basic architecture: a master course question with a series of inquiry-based

projects that loop back on the central question to build deeper understanding. Many more AP courses are ripe for redesign using this approach, but so are other high school courses outside the AP context. Our method has been to develop the curriculum first in a "greenhouse" setting – a district with adequate resources for curriculum research and development. A year of implementation generates feedback from the classroom, which we then incorporate into curriculum refinements in year two. With funding, more high school courses could be redesigned using this collaborative, iterative approach.

- *Expand to additional locations.* PBL-AP courses could be replicated nationally. However, broader replication will require having the right supports in place for student learning and for teacher professional development. Local districts may need additional resources for implementation, including teacher time for professional development and collaborative course design, funding for course materials (e.g., textbooks), and appropriate staffing.

Lessons Learned for Other Education Grantmakers

GLEF embarked on this initiative motivated by the lack of evidence-based, rigorous project-based learning across the high school curriculum. The expansion of GLEF's role in this project, beyond our more typical work documenting classroom innovation, has been a positive step for the organization, as it strives to increase impact and create systemic change in education systems based on 20 years of gathering stories from the field. The following lessons learned may be helpful to other philanthropic efforts:

1. Adopt an iterative design process so that your organization can change course based on lessons learned, particularly in the early stages, thereby improving the whole process. Similar to the way the Foundation develops products, we have embraced an iterative approach to our high school course creation and related KIA assessments. Throughout the project, team members have refined not only research methodologies but also instructional strategies and professional development plans based on what is working and may not have been evident early in the planning stages. This more flexible, responsive process has had the added benefit of keeping all of the stakeholders engaged throughout the project's lifecycle.

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2. Build a diverse team to seek solutions for diverse learners. As described above, our project team is committed to widespread access to rigorous courses and more meaningful learning for all students. While each of the project partners share a similar end goal, we have benefited from a diverse team with top-level expertise representing different constituencies including world-renowned education researchers, innovative teachers, district curriculum experts, and multifaceted expertise on the GLEF team to collaborate, document, and disseminate the findings.

3. Recognize the resources required and seek other partners to scale. Designing for diverse student populations and providing a robust assessment requires an investment and growing collaboration with like-minded partners. We started small to test the concept and, based on the early results, we are committed to expand the research. Similar to other efforts at GLEF, we hope to find additional partners who value the importance of this work.

Conclusion

Much like a well-designed project in PBL, this research effort began when GLEF asked a difficult and important question: Can project-based learning help diverse learners succeed in challenging academic studies? A partnership was formed – GLEF, the University of Washington research team, and an innovative school district – and an approach was developed collaboratively. We are encouraged by the results so far, which suggest that incorporating a rigorous form of project-based learning can be a helpful strategy for improving student learning and engagement in advanced high school courses. We continue to test our approach on one of the most challenging platforms – the Advanced Placement system, with its heavy content load and high-stakes exams – with a variety of student populations including those from economically challenged areas who are typically not expected to do well on advanced courses. In addition, our Knowledge in Action test reinforces the contribution that alternative assessments can make to gauge the effectiveness of the learning process. We hope that other education grantmakers who share our quest for deeper learning and engagement will find the approach, early results, and opportunities for further collaboration of interest.

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References

Bransford, J. D., & Schwartz, D. L. (2000). Rethinking transfer: A simple proposal with multiple implications. In A. Iran-Nejad & P. D. Pearson (Eds.), *Review of research in education* (Vol. 24, pp. 61-100). Washington, DC: American Educational Research Association.

Bransford, J. D., Vye, N. J., Stevens, R., Kuhl, P., Schwartz, D., Bell, P., Meltzoff, A., Barron, B., Pea, R., Reeves, B., Roschelle, J., & Sabelli, N. (2006). Learning theories and education: Toward a decade of synergy. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (2nd ed., pp. 209-244). Mahwah, NJ: Erlbaum.

Brown, A. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences, 2,* 141-178.

Darling-Hammond, L., Barron, B., Pearson, P. D., Schoenfeld, A. H., Stage, E. K., Zimmerman, T. D., et al. (2008). *Powerful learning: What we know about teaching for understanding.* San Francisco: Jossey-Bass.

Hatano, G., & Inagaki, K. (1986). Two courses of expertise. In H. Stevenson, H. Azuma & K. Hakuta (Eds.), *Child development and education in Japan* (pp. 262-272). New York: Freeman.

Lewin, T. (2010). Expansion of A.P. tests also brings more failures. *The New York Times.* Retrieved February 11, 2010, from www.nytimes.com.

National Research Council. (2000). *How people learn: Brain, mind, experience, and school.* Washington, DC: National Academy Press.

National Research Council. (2002). *Learning and understanding: Improving advanced study of mathematics and science in U.S. high schools, executive summary.* Washington, DC: National Academy Press.

Parker, W. C. (2010). Listening to strangers: Classroom discussion in democratic education. *Teachers College Record, 112*(11), 2815–2832.

Parker, W. C., Mosborg, S., Bransford, J. D., Vye, N. J., Abbott, R., & Wilkerson, J. (in press). Rethinking advanced high school coursework: Tackling the depth/breadth tension in the AP US Government and Politics course. *Journal of Curriculum Studies.*

Schneider, J. (2009). Privilege, equity, and the Advanced Placement program: Tug of war. *Journal of Curriculum Studies, 41*(6), 813-831.

Schwartz, D. L., & Bransford, J. D. (1998). A time for telling. *Cognition and Instruction, 16*(4), 475-522.

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