

Project Based Learning as a Catalyst in Reforming High Schools

Jason Ravitz
Buck Institute for Education

ABSTRACT

This paper presents initial results from a survey of project based learning conducted across a dozen strata of high schools including several major reform networks. This approach to instruction appears to be central to progressive reforms in small high schools. We found relationships to reforms such as teaching across the curriculum, student personalization and community engagement. The most professionally engaged teachers were more frequent users of project based learning and related practices. Equity concerns are discussed in the context of a review of other national studies, and a national evaluation by the American Institutes for Research provides baseline data for comparison.

Descriptors: High Schools, Survey Research, Educational Reform

For a version of the instrument with descriptive results visit: <http://tinyurl.com/26hjm3>

Introduction

It is conventional wisdom that American high schools are in trouble, with reports of drop out rates of 50% or higher in major urban centers. This situation has been a focus of attention of US Department of Education, state and local government, educators and foundations like the National High School Alliance (2008). The Bill and Melinda Gates Foundation invested nearly a billion dollars in transforming high schools and creating smaller learning communities. Findings to date indicate that while many smaller high schools have created a more personalized environment, instructional reforms have generally lagged behind these structural and cultural changes (American Institute for Research & SRI International, 2005; Quint, 2006, Robelen, 2005). It also appears that across many surveys of practices that higher income students are more likely to experience teaching reforms (Camburn and Han, 2008)

The current study offers a unique description of the type, duration and quality of student learning experiences in reforming high schools, focusing on project based learning as a possible catalyst and outcome of reforms. Its purpose is to focus on teachers who are pursuing a progressive reform agenda including investment in PBL as an instructional strategy. Our study does not address other high school reform models that are more focused on reforms or instructions other than PBL, nor does it address high schools and teachers who are not involved in reforms.

Conceptualizing PBL

The Buck Institute for Education (BIE) is a non-profit that funded the current study. BIE seeks to promote effective use of PBL through distribution of Handbooks and online resources, as well as support for professional development with partner organizations.

Project Based Learning (PBL) is an innovative and empirically proven instructional strategy that engages student in learning and encourages deep understanding. Based on decades of research in cognitive psychology (e.g., Boaler, 2002; Bransford, Brown & Cocking, 1999), PBL has been shown to be especially effective with unmotivated, low achieving students (Mergendoller, Maxwell & Bellisimo, 2003). Recent interest has developed from the recognition that students are not being prepared for productive lives in the workforce and society by traditional instruction (e.g., as noted by the Partnership for 21st Century Skills, 2008).

Effectively designing and implementing projects can help teachers deliver high quality assignments as called for by American Institutes for Research and SRI International (2005), giving students authentic tasks framed by rigor, relevance and relationships, and promoting student well-being and hope (Newell & Van Ryzin, 2007). However, research shows that use of project- and problem-based learning is difficult to implement well. Effective use depends on the instructor having acquired a mastery of the content as well as teaching methods (David, 2008; Hmelo-Silver & Barrows, 2006) and project management skills (Mergendoller, et al, 2006).

We defined PBL for the survey in a way that would include a wide range of approaches and expertise, but required at least the following: 1) extended student investigation, 2) in-depth inquiry into a topic, 3) some degree of student self-direction or choice, and 4) presentation by students of their findings, results or conclusions. This definition is consistent with inquiry-based or problem-based instruction and we do not distinguish between these in our study.

Instrument Development

Prior to launching our study, we commissioned baseline analyses from a national survey conducted by the American Institute for Research's (Spring 2005 Teacher Survey). Staff from AIR helped us identify items that they thought were related to project- or inquiry-based learning (14 items, standardized Cronbach's alpha=0.86). We also requested analyzes of correlations of this index with other measures of the school environment in their study—coherence of leadership, teacher collaboration, personalized support for students. These school environment measures were strongly correlated with each other ($r=.5$ or higher), and somewhat less (about .30) with PBL-related items. This suggested that teachers in schools that are implementing structural reforms are using PBL to a greater extent than others, but a less than perfect correlation requires further exploration.

In addition to replicating the PBL-related index from the AIR study, we also reviewed items from other surveys for ideas about what was most important to consider, for example concerning students' support for each others learning (Bishop, 2003). Finally, wrote and piloted our own more detailed questions about PBL practices and conditions such as variations in teaching responsibilities, school structure and climate for teachers and students,

demographics and background variables, and professional development opportunities. New items included questions about planning and implementation of PBL including assessment, technology use, student personalization, community involvement, as well as barriers to PBL use and equity of outcomes.

We piloted the new survey in 2006, using methods similar to the “cognitive interviews” (Desimone & LeFloch, 2004) meaning we observed and interviewed teachers completing the survey and revised the instrument extensively until the questions seemed to generate a reasonable set of responses in both heavily reforming and more traditional settings.

Study Population and Sample

We limited our study to public high school teachers whose responsibilities included at least one of the four “core” academic subject areas – math, science, social studies or English -- and who had individually invested in PBL (through BIE materials or workshops) or who had worked in a school where there was an investment in PBL (usually through a partner organization but sometimes through bulk purchases of BIE handbooks or school wide workshops).

A number of school reform models use projects as a central instructional strategy. Partners identified who supported the study by helping construct staff lists for the survey included Envision Schools, Edvision Schools, New Tech High, High Tech High, the North Carolina New Schools Project. We also included teachers and schools who purchased BIE materials or attended workshops through the Center for Effective School Practices in New Jersey and Ohio or the San Diego Renewal High Schools initiative.

We estimate there were more than 5000 teachers in the study population from 2003–2006. We were able to identify 2746 teachers in this population using lists from partners and the BIE database. From this list we randomly sampled 1568 using probabilities that varied by stratum. Responses were then weighted inverse to the probability of selection. For example, if we selected 50% of teachers in stratum we weighted responses by 2.

The survey was administered using a web-based tool (www.surveymonkey.com), and customized emails using Mail Merge in Microsoft Word. Each teacher was sent up to five communications about the survey, a pre-notice, an initial invitation to take survey, two follow-up emails with progressively more emphatic text, and a copy of the final letter sent on letterhead. This communications strategy borrowed heavily from Dillman (2006), however in addition to a \$5 social incentive provided with the initial invitation we also offered a \$15 economic incentive in the final communications to encourage more responses. The overall response rate to the study was 36%, after excluding ineligible respondents and bounced emails, and 33% if we count bounced emails as non-responses (Table 1).

Table 1. Sample and Response Rate by Strata

Source and Strata	Sample Size	Valid Responses	Response rate (eligible)	Response rate (contacted)	Weighted N
BIE Database					
Individual Handbook Sales	196	23	18%	20%	29
Bulk Handbook Sales (> 4 per school)	267	43	19%	20%	57
Workshop Sites	282	43	24%	28%	172
Partners					
High Tech High	41	30	79%	79%	30
High Tech High affiliates	35	13	39%	41%	13
New Tech High	142	74	58%	64%	132
Center for Effective School Practices	188	18	16%	16%	24
Edvission Schools	85	49	63%	70%	49
IEARN	36	3	09%	10%	3
North Carolina New Schools Project	121	62	54%	59%	82
San Diego City “Renewal” Schools	144	24	20%	21%	40
Envision Schools	31	24	89%	89%	24
Total	1568	406	33%	36%	655

Data indicated a good distribution of teachers -- ranging from schools where BIE materials had been intensively adopted to over 1/3 of teachers who had never heard of BIE and almost half (47%) who had never used BIE materials.

RESULTS

Here are some examples of what we are learning so far across the entire sample.

- The most frequent source of ideas for projects is the teacher’s own ideas about what students should do or learn (71% said all the time or frequently). The next most popular source was the Internet (53% said all the time or frequently). In contrast, students ideas were reported frequently or almost always by only 22 %. The least frequent source was parents or adults from outside the school (72% said rarely or never).
- The strongest reasons given for teacher PBL use was to teach skills beyond academic content, e.g., group work, presentation skills, management and 21st century skills (51% said “especially important”) and to make learning more personalized (48% said “especially important”) or challenging, varied and fun (43%) . A less frequently given reason was to teach academic content better (39%), while civic engagement and cross-cultural understanding were the least frequently given reasons, reported as especially important by 30% and 21%, respectively.

- Only 14% of teachers said they are using PBL less than in the past. In contrast far more (50%) reported using PBL more or much more now than in the past. The rest reported no change. Reasons given for the changes were a change in school, or a change in emphasis at the school (20% each), as well as a change in student populations (15%) and a change in understandings about how people learn (16%).
- Community connections are rarely used to generate projects. Parents and community partners were “rarely” or “never” a source of projects for 72% of teachers. In addition, 48% of teachers said their students never participated in community--based internships or projects, and another 30% said only “a few times”. Finally, 38% said they never or rarely planned projects based on needs or opportunities in the workplace or community, and only 21% said they did this frequently.
- When conducting projects teachers were least likely to say they were “very well prepared” in the areas of structuring student presentations so the whole class learns (only 15% said this), and finding existing projects that are high quality (20%).

Measuring PBL Use

When provided with our 4-part definition of PBL mentioned above, 85% said this was a type of instruction that they practiced, although 15% said they preferred to call it something else, e.g., inquiry, investigations, or group work. (These teachers were instructed to answer the survey as if it asked about whatever term they preferred). To stimulate recall of this kind of teaching, we asked specifically about fifteen common project types. Table 2 shows the percent of teachers who had conducted each type of project.

Table 2. Kinds of Projects Undertaken with Students, by percent reporting

Percent	Kinds of projects
83	A written product to be shared with others (newspapers, politicians, brochures, posters)
76	Writing a research paper
74	Artistic products or performances (e.g., pieces of music, art, drama, videos, etc.)
67	Observations or collecting data (e.g., water quality, plants or animals, traffic, opinions)
62	Researching competing views on an issue and holding a debate
61	Interviewing family or community members, documenting experiences or local history
54	Creating a museum-type display or exhibit for others to experience
52	Researching an issue in the community to make recommendations or a plan of action
52	Constructing simulations, or models (e.g. physical or computerized)
50	Creating a computer-based product or program (e.g., web page, blog, games, etc.)
50	Role-playing as stakeholders in simulated problems from real world (e.g., problem based)
40	Sharing data or interacting with students in other schools or experts (e.g., Project GLOBE)
39	Creating a working version of a physical object, structure, device, etc.
28	Creating and running a business or offering a service to the school or community
25	Developing relationships with others via the Internet (ThinkQuest, WebQuests, I*EARN)

The most frequently reported types of projects were written products, research and artistic projects, each reported by 75% or more. Creating computer based products or solving simulated problems based on the real world were reported by 50% each. Projects serving the

community or connecting with others via the Internet (WebQuests, ThinkQuest) were reported by closer to 25%.

A typical teacher reported conducting 8 of these types of projects, however the average number of projects per course seemed to be about 4 (56% of teachers reporting between 3 and 6 projects per course). The most reliable indicator for the amount of PBL seemed to be the percent of the course using PBL. Using this measure, 26% of teachers was that they conducted projects for one quarter of the course, while another 23% said they conducted projects for about half of the course.

Correlations of PBL use to AIR Index

The 14 item AIR Index listed items thought to be related to PBL use, but some of them were more directly related than others. Overall, an index constructed of these items had strong reliability (alpha = .90, with inter-item correlations ranging from .46 to .74). This index score was strongly correlated with percent of time spent on PBL ($r=.55$, $p < .001$). The items from the AIR index are shown in Table 3, sorted by the mean scores (with scores ranging from 1="never" to 5="almost every day") and showing correlations to the PBL time measure. Both of these measures – the indicator of overall time and the mean score on the AIR index -- are used in subsequent analyses. (The percent of time indicates only time spent, while the AIR index takes into account different qualities of instruction. As a result, a large percent of time spent on PBL coupled with low scores on the AIR Index probably indicates extensive but non-rigorous use of PBL).

Table 3. AIR PBL Index Items – Means and Correlations to PBL Use

Items in the AIR Index	Mean Score (1-5)	Correlation with % Time on PBL
How often did most of your students do the following....		
worked on multidisciplinary projects	2.56	.51
researched topics deeply enough to become subject matter experts	2.39	.40
decided how to present what they had learned	2.96	.33
collected, organized and analyzed information and data	3.34	.32
solved real world problems	3.16	.31
participated in community- or work-based projects or internships	1.84	.31
evaluated and defended their ideas or views	3.20	.30
orally presented their work to peers, staff, parents, or others	2.86	.30
How often you measure student performance using...		
Group projects	3.08	.50
Student peer reviews	2.35	.36
Portfolios of student work	2.22	.36
Hands-on demonstrations, exhibitions or oral presentations	3.12	.31
Individual projects	2.81	.29
Open-ended problems	3.00	.15

Low N = 518 Standard deviations ranged from .96 to 1.20. All correlations $p < .001$

Challenges for PBL Use

Teachers indicated how much different challenges conducting PBL either limited their use of PBL or its effectiveness (Table 4). The scale ranged from 1="Not a challenge" to 4="A major challenge". The most frequent challenges were lack of time for both planning and implementation. These were also strongly correlated with lower scores on the amount of PBL use (mirroring barriers to Internet use in Ravitz, 1999).

Lack of student experience or skills was another frequent challenge. This did not seem to limit the amount of PBL use, but was related to lower scores on the AIR index. It appears PBL is used an equal amount even when teachers are challenges with inexperienced students, but perhaps they do not include the variety of assessments and practices represented in the AIR index.

Table 4. Challenges conducting PBL and correlations to PBL use

Challenges conducting PBL	Mean Challenge (1-4)	Correlations to...	
		% time on PBL	AIR Index
I lacked time to find, create or plan projects	2.82	-.29**	-.32**
I lacked time in the curriculum to carry out projects	2.67	-.44**	-.43**
My students lacked experience or skills for PBL	2.56	-.03	-.22**
Lacked funds, materials, or resources (e.g., access to technology, a library, art supplies, etc.)	2.54	-.14**	-.24**
Too many testing and accountability requirements	2.53	-.14**	-.17**
Too many students, or too large class sizes	2.50	-.12*	-.20**
Classroom space was limited (e.g., students couldn't leave projects set up, etc.)	2.48	-.08	-.06
I lacked models or examples for using PBL in my subject area with my students	2.37	-.35**	-.35**
Students had poor attendance and/or behavior problems	2.36	.00	-.18**
I lacked professional development or coaching in PBL	1.99	-.28**	-.29**
Class periods were too short	1.95	-.08	-.07
Parents or students expected me to use direct instruction, not projects	1.76	-.05	.00

** p < .001, * p < .01 Low N = 515, .86 < Standard deviation < 1.15

Lack of models for PBL and lack of professional development were relatively infrequent challenges, but when they were present they were strongly associated with less PBL use on both overall time measure and the AIR index.

Reasons for PBL Use

Developing skills beyond academics was the most frequently given reason for using PBL (an especially important reason for 51%). This is shown in Table 4. In contrast, using PBL to teach academic content more effectively was an "especially important" reason for 38% of teachers. The second and third most popular reasons were to personalize learning (48% especially important) and to make it more varied and fun (43% especially important).

Table 4. Reasons for PBL Use : Mean Frequencies and Correlations

Reasons for PBL Use	Mean	S.d.	Correlations to...	
			% time on PBL	AIR Index
to teach skills beyond academic content (group work, presentations, project management, 21st century skills, etc.)	2.41	.69	.29	.19
to make learning more personalized, tailored to students' individual interests or needs	2.35	.72	.29	.46
to make teaching and learning more varied, challenging, or fun	2.34	.66	.32	.14
to teach academic content knowledge and skills more effectively	2.23	.72	.27	.22
to promote students' civic engagement, contribution to the community or world	2.02	.80	.36	.31
to promote students' international or cross-cultural understanding	1.77	.88	.25	.29

All correlations $p < .001$. Low N =522 Means use 0="Not a reason", 4="Very important"

Interestingly, the reason that had the strongest correlation with overall PBL use was use for community engagement, one of the least frequently given reasons. In addition, use for personalization was most closely associated with the AIR Index, interpreted as a measure of rigorous instruction that is related to but not depending on PBL being used.

Where is PBL used?

PBL is clearly used most in schools that have restructured or undergone reform – charter schools and small start-ups more than comprehensive or converted schools (Table 5). This is consistent with baseline data from AIR (not shown).

Table 5. Mean PBL use by type of schools

Types of School	Low N	Means	
		% time on PBL	AIR Index
Small school, less than 500 students	281	.34	.24
Small learning community (in larger school)	106	-.07	.03
Large or medium size school	136	-.65	-.37
Non-Charter	384	-.19	-.12
Charter	140	.51	.40
Total Means	524	.00	.00
Total S.D.		(1.00)	(.66)

Mean differences are statistically significant, $p < .001$.

PBL is clearly used most in schools that have restructured or undergone reform. Charter school teachers used PBL much more than non-charter school teachers ($ES=1.48$, $p < .001$). Small schools are using PBL more than converted small learning communities and comprehensive high schools, a result that replicates AIR baseline data (not shown).

Structural Reforms Correlated to PBL

A number of additional reforms were strongly correlated to PBL use. Table 6 focuses on school structures and teacher climate-related reforms that on their face do not specify any particularly instructional practices.

Table 6. School structures and Teacher Climate Indicators related to PBL

School structure or teacher climate indicators	Correlations to...	
	% time on PBL	AIR Index
Multi-subject courses	.50	.56
A school-wide emphasis on skills beyond academics (e.g., collaboration, presentation or other "21st century" skills)	.40	.44
Block or flexible scheduling allowed extended periods for working on projects or other activities	.30	.43
Team teaching, teachers of different subjects assigned to the same course or group of students	.34	.35
School-wide rubrics for assessing student work across different subjects, grades, or courses	.25	.41
Using online teaching and learning strategies	.30	.34
Teachers were involved in school leadership, setting policies or making important decisions for the school	.23	.41
Teachers took a major role in shaping the school's norms, values and practices	.22	.42
A structure supporting multi-age groupings of students	.23	.36
Teachers had instructional coaching or critical friends visits between teachers	.19	.40
Teachers had regularly scheduled meetings focused on instructional practices and students' learning	.13*	.28

Note. All $p < .001$, except * = $p < .01$

These analyses showed a relationship between PBL use and a school wide emphasis on skills beyond academics, block scheduling, team teaching, school-wide rubrics, online teaching, teacher leadership and coaching. None of these have an explicitly obvious connection to PBL. Many of these items such as instructional coaching were more closely related to the AIR index items than overall time on PBL, suggesting a variety of practices associated with PBL require support from coaches and a supportive environment for teachers.

Which teachers use PBL?

The most PBL was reported by teachers of social studies. The average z-score for time spent on PBL was .31 for those who taught social studies "a lot" and .26 for those who taught it "a little". This was followed by English teachers. Those who did not teach English at all had a negative z-score of -.26. Those who taught science "a little" had higher z-score (.64) than those who taught it "not at all" ($z = -.11$) or "a lot" ($z = .02$).

Concerning the extent each individual subject was taught, the correlations were as follows:

Math .06 (NS)
 Science .08 (NS)
 Social Studies .22 (p < .001)
 English .15 (p < .002)

There were no statistically significant differences by grades taught, except teachers who did not have any 9th graders appeared to use PBL less than others, on average (Effect Size = .20, p < .05) While the above subject and grade patterns are relatively weak, there was a very strong and linear relationship for teachers of multiple subjects (Table 7).

Table 7. Interdisciplinary Teachers and PBL

Do you teach interdisciplinary academic courses?	Low N	Means	
		% time on PBL	AIR Index
Never	91	-.62	-.49
Sometimes	145	.01	.01
About half the time	49	-.02	.31
Most of the time	73	.70	.41
All of the time	64	.87	.61
Total	421	.12	.05
S.d.		(.98)	(.66)

Both comparisons are statistically significant, p < .001

Professional Engagement

The teachers who were most professional engaged tended to use PBL more than others. This replicates Becker & Riel's (1999) findings about Internet use and constructivist-oriented practices. We asked teachers about involvement in 11 activities beyond their teaching assignments. A count of these (e.g., working with students before or after school, serving on school wide committees) was a very strong predictor of PBL use on both our PBL measures. These teachers tended to be more experienced, except for some of the young and extremely engaged teachers in the reform networks (analyses available from author). A count of the number of professional activities undertaken outside of the classroom was correlated .23 with the time spent on PBL and .41 with the AIR Index (both correlations are statistically significant, p < .001). This suggests professional engaged teachers conduct more PBL and use more of the practices in the AIR index.

Student Personalization, Best Work, and PBL Use

Finally, we analyzed a number of student experiences that are generally associated with school reform but no particularly pedagogy. A number of reform conditions or practices associated with student experiences were strongly correlated to both measures of PBL use, particularly the AIR index measure (Table 8)

None of the following by necessity require PBL, yet the relationships are quite strong -- meeting individually with students, developing close relationships with them, seeing them strive for knowledge and encourage their peers, having individual learning goals, mixing learning with other subjects and making the most opportunities to learn. These are all reforms

for students that have been advocated by school reformers independent of any teaching practices. It is interesting to see that they occur more frequently when PBL and related practices are used. We do not know the direction of this effect, but it appears that desire for personalization of student learning and seeking their best effort is more likely to lead one to use PBL than not.

Table 8. Correlation of PBL measures to Student Work and Attitudes

How often my students...	Correlations to...	
	% time on PBL	AIR Index
Met individually with me to reflect on their progress and receive support	.34	.54
Formed close academic advising or mentoring relationships with me or another teacher	.33	.54
Demonstrated that they were striving for in-depth knowledge, not just superficial learning	.32	.55
Encouraged and supported their peers as learners	.29	.51
Had an individual statement of their learning goals that they periodically reviewed with me	.30	.50
Experienced academic learning that was linked to other subjects, e.g., computers or foreign languages, arts, etc.	.25	.41
Gave their best effort and made the most of opportunities to learn	.24	.42

All $p < .001$. Minimum N = 502.

Equity of PBL Impacts and Use

A final set of analyses address concerns about the equity of PBL use. This includes questions about whether high quality PBL is made equally available to low performing, income and language minority students.

Concerning the level of student performance and English skills, teachers seemed to believe that PBL was “particularly effective” with average and high achieving students (47% and 41% strongly agreed). In contrast, only 18% strongly agreed that PBL was particularly effective for students that struggle with academic English. Use with English learners appeared to be a problem, even for many of the stronger PBL using teachers.

Concerning low income students, our findings are different from those reported by Camburn and Han (2008) whose review of several large national surveys concluded that “high income students are more likely to receive certain kinds of desirable learning opportunities than low-income students”. Our data (Table 9) suggest there is no such negative correlation, even a slightly positive correlation ($r=.11$, $p < .01$) between use of PBL and the proportion of low income students. There was also no correlation between the low income percentage and the AIR PBL index ($r=.04$, NS), suggesting that a wide variety of practices are used equally with low income students as not within our sample.

For teachers in schools that had purchased bulk copies of the BIE Handbook there was a strong positive relationship between the proportion of low income students and the overall time spent on PBL ($r=.23$, $p < .13$, NS), but there was no relationship to the AIR PBL index ($r=.04$, NS).

For BIE Workshops, the result was in the same direction, but even more dramatic. The correlation between PBL use and the proportion of low income students was strongly positive ($r=.46$, $p < .001$, $N=108$), but again there was no correlation to the AIR PBL index ($r=.05$, NS, $N=172$). These findings suggests the use of PBL with low income students in these strata may have been somewhat superficial or not particularly rigorous.

Table 9. With what types of students is PBL used?

Proportion of Students Who...	Correlations to...	
	% time on PBL	AIR Index
were alternative, continuation or transfer students (e.g., who struggled in their other schools)	.17***	.20***
were planning or seemed likely to attend a 2- or 4-year college after high school	.02	.18***
came from low income households (e.g., eligible for free or reduced lunch)	.11**	.04
seemed on track to graduate with their class (e.g. in 4 years)	.02	.08*
were taking mostly career-related or technical courses	-.10*	-.02
were of African American descent	-.06	.00
qualified as special needs or special education students	.04	-.01
were of Hispanic descent	.01	-.08
struggled with academic English - reading or writing	.09*	-.04

*** $p < .001$ ** $p < .01$, * $p < .05$

One of the partner organization's schools it actually spent more time using PBL with students from low income backgrounds than others using both the percent of time measure ($r=.25$, $p < .21$, NS, $N=27$), and the AIR PBL index ($r=.24$, $p < .13$, $N=40$). Another network, however, showed less PBL use with low income students on the AIR index ($r=.28$, $p < .06$, $N=45$), and time spent on PBL overall ($r = -0.29$, $p < .05$). Future analyses will address the extent to which challenges for PBL were greater in schools with more low income students.

Conclusion

Our study begins to fill in gaps in our knowledge of PBL use in progressive reforming high schools. There appears to be a very real relationship between a variety of high school reforms and use of PBL. We conclude that PBL is a central element of reform, even when there is not an "obvious" connection, e.g., to individualized instruction, teacher culture and professional engagement. It also appears, at least within our population, that the biggest equity concern involves limited English speakers, more than low performing and low income students. This is a finding that requires further examination.

PBL and high school reform are most likely mutually reinforcing, with PBL helping to engage students in the community and to personalize their learning, and an emphasis on these reforms potentially leading teachers to try more PBL.

Future analyses of practices “across the curriculum” will focus on science, social studies, and interdisciplinary courses that have not been the focus of studies to date (e.g., as noted by Camburn and Han, 2008) . In addition, analyses provided of the partners in this study (represented by strata) and their extensive refinement of PBL approaches will offer an even more useful view into teaching within the context of high school reforms today.

REFERENCES

- American Institutes for Research & SRI International. (2005). *Executive summary: Evaluation of the Bill & Melinda Gates Foundation’s High School Grants, 2001-2004*. Washington, DC: Authors
- Becker, H. & Riel, M. (2000). *Teacher professional engagement and constructivist-compatible computer use*. UC, Irvine. <http://www.crito.uci.edu/tlc/findings>
- Bishop, J. (2004). Why do we Harass Nerds and Freaks: Towards a Theory of Student Culture and Norms? *Journal of School Health, 74*(7), 235-251. http://www.allaboutkids.umn.edu/WingfortheWeb/42189%20AmSch_Bishop.pdf
- Bomotti, S. & Duggan, J. (2005). *Smaller Learning Communities: A Synthesis of Evidence-Based Research*. Washington, DC: MPR Associates. http://www.mprinc.com/products_and_publications/search.aspx?pubID=351
- Camburn, E. & Won Han, S. (2008). *What Do We Know About Instruction From Large-Scale National Surveys?* WCER Working Paper No. 2008-1. http://www.wcer.wisc.edu/publications/workingPapers/Working_Paper_No_2008_01.php
- Coalition of Essential Schools (2006). *Measuring up: Demonstrating the effectiveness of the Coalition of Essential Schools*. http://www.essentialschools.org/pub/ces_docs/about/results/results_kids.html.
- David, J. (2008). What Research Says About Project Based Learning. *Educational Leadership, 65*(6).
- Desimone ,L & LeFloch, K (2004). Are We Asking the Right Questions? Using Cognitive Interviews to Improve Surveys. *Education Educational Evaluation and Policy Analysis, 26*(1), 1-22.
- Dillman, D. (2000). *Mail and Internet Surveys: The Tailored Design Method (2nd Edition)*. New York: Wiley & Sons.
- Hmelo-Silver, C.E. & Barrows, H.S. (2006). Goals and strategies of a problem-based learning facilitator. *Interdisciplinary Journal of Problem Based Learning, 1*, 21-39.

- Mergendoller, J. R., Markham, T., Ravitz, J., & Larmer, J. (2006). Pervasive management of project based learning: Teachers as guides and facilitators. In C. M. Evertson & C. S. Weinstein (Eds.), *Handbook of Classroom Management: Research, Practice, and Contemporary Issues*, Mahwah, NJ: Lawrence Erlbaum, Inc.
- Markham., T., Larmer, J. & Ravitz, J. (2004). *Project Based Learning Handbook: A guide to standards-focused project based learning, 2nd Ed.* Novato, CA: Buck Institute for Education.
- National High School Alliance (2008). *Resource guide for action.* http://www.hsalliance.org/call_action/p_l_e/research.asp
- Newell, R. & Van Ryzin, M. (2007). *Growing Hope as a Determinate of School Effectiveness.* Phi Delta Kappan, February, 2007.
- Partnership for 21st Century Skills (2008). www.21stcenturyskills.org/
- Quint, J. (2006). *Meeting five critical challenged of high school reform: Lessons from research on three reform models.* New York, NY: Author. <http://www.mdrc.org/publications/428/full.pdf>
- Robelen, E. (2005). Gates high schools get mixed review in study. *Education Week.* November 16, 2005.