Promising Pathways to Success:

Using Evidence to Dramatically Increase Student Achievement

Part I – Understanding the Predictors of Placement and Performance in Foundational Course Sequences in English and Mathematics.

The California Community Colleges serve as open-access, come-as-you-are, educational institutions designed to serve all students, especially students who may unable to get into or who cannot afford four-year colleges. As a result, the breadth (and disparity) of educational experience and preparation of students attending community college poses substantial educational challenges. Long Beach City College had adopted the same approach as many community colleges - to assess student preparation using standardized assessments to meet students at their level of preparation. Nationwide, 40 to 50% of community college students assess as requiring math, reading, or English remediation (e.g., Bailey, Jeong, and Cho, 2010). For LBCC, more than 90% of our students assess into developmental coursework. In fact, the average number of semesters of developmental skills courses our students are required to complete to reach full college-readiness reached an all-time high of 5.6 courses in Fall 2011. The amount of remediation required significantly increases the time needed to complete educational goals and for far too many students becomes an insurmountable barrier, dissuading many from completing.

As with most CCCs and indeed the majority of community colleges nationwide, LBCC relied primarily on a single administration, high-stakes standardized assessment. More recent research by the CCRC has begun to strongly suggest that reliance on such methods for placement may dramatically underestimate student preparation for/ability to succeed in college level work (Belfield & Crosta, 2012; Edgescombe, 2011; Scott-Clayton, 2012; Xu, forthcoming). Further, the effects of this potential underestimation may be further magnified by the beliefs and expectations about student performance that such an assessment generates in faculty, staff, and the students themselves. In fact, the first experience the majority of community college students have with their college is being officially told by the college that they are not ready to attend.

At the time LBCC began the research, however, very little of that research had been published. What was fairly well known, however, was that the number of semesters of remedial coursework students are required to take prior to transfer-level coursework represents a significant barrier to the likelihood of completion of meaningful educational outcomes. Most troubling was that over time more students were assessing into remedial coursework and into more coursework despite the marked improvement of the college's primary feeder school district, Long Beach Unified School District, which was transforming itself into a high-performing, national and international award winning school district.

To examine more closely whether LBCC was effectively capturing the true potential of our students, Long Beach City College worked with the California Partnership for Achieving Student Success (Cal-PASS), an intersegmental data warehouse that facilitates longitudinal data exploration to create a dataset tracking all LBUSD students who matriculated to LBCC from 2001 (the first year available) through Fall 2009. From this initial data set, the analyses were narrowed further to students who

matriculated directly from high school to college (to avoid possible, difficult to measure intervening variables), for whom at least a full year of college data and a minimum of three years of high school data was available. Two distinct cohorts were examined – students who took English in their first semester and students who took Math in their first semester, again to avoid possible intervening variables, yielding 2742 students for the English cohort and 1947 for the Math cohort.

The key predictors examined in the two parallel research projects were:

- Final grade in discipline (Math or English, depending on the analysis): the letter grade the student earned in their final semester of HS coursework. For English, this was almost exclusively their spring senior year English grade. As only two years of Math are required at LBUSD, the final grade in Math could be from students second, third, or final year of HS.
- Final Math/English Courses Taken: For Math, the level of the final course taken (from Algebra, to Calculus) was used. For English, the course taken in their final year of English (though the primary distinction was between remedial senior year courses and AP courses, with the remainder of courses falling in between)
- High School GPA: calculated using all non-PE courses but excluding Math and English courses from the Math and English analyses, respectively, in order to separate the effect of overall GPA and grades achieved in discipline.
- CST Scores: the scaled score from California Standards Test taken in the 11th Grade (or earlier for Math if the student didn't take Math in the 11th grade)
- AG courses: the total numbers of courses taken that meet University of California A-G requirements during the student's 11th and 12th grades – a measure of the overall rigor of the students' high school curriculum.
- Level of course taken in college: a course's position in the overall sequence in English or Math (used for the performance variable only).

The two critical criterion variables at Long Beach City College were:

- Placement Level in Math/English: all incoming students are assessed into different levels of Math and English based on their score on standardized assessment examinations conducted prior to beginning courses at LBCC.
- Performance in their first Math/English course: because many of the basic skills English and Math courses are taken pass/fail, successful completion (C or better or pass) of students' first Math/English course taken at LBCC.

Predictive Models

Analyses of the relationship of high school achievement on placement level was done using an Ordinal Regression Model leveraging the ranked nature of placements. Analyses of the relationship of high school achievement with course success was done using a Logistic Regression. Systems of assessment and placement are designed to determine students' level of ability to place them in the course closest to their zone of proximal development (Vygotsky) or where they are most likely to achieve peak

performance and flow (Csikszentmihalyi) - where they are fully engaged and even challenged but are able to succeed at mastering the course material. Placing students too high can lead to shame, fear, frustration, and withdrawal and can overburden instructors with students unable to grasp the material presented without great deals of additional assistance. Placing students too low may lead to boredom and apathy and students who may be more disruptive in the classroom for lack of engaging work. Highly functioning systems of assessment and placement thus need to identify the factors that predict performance in the classroom. In other words, the variables that predict assessment should be highly related to the variables that predict performance in the classroom – that is, assessment and placement should be as aligned with performance as possible. To do otherwise would systematically undermine the utility of the assessment.

The research, however, revealed quite clearly that assessment and alignment were not well aligned at all. For the analyses examining how students were placed, the most powerful and near sole predictor of student placement was how student's performed on their last discipline-specific California Standards Test. In fact, the relationship was as strong as most commonly seen in test-retest measures of reliability. However, students' CST scores were among the **weakest** predictors of course performance at LBCC.

In contrast, students' discipline grades and their overall high school GPA were virtually unrelated to how students were placed into courses at LBCC. Ignoring students' entire twelfth grade experience and relying primarily on their 11th grade CST scores gives nearly the identical placement as generated by the college's placement process over a year or more later. Yet students' grades - both their overall GPA and their last grade in the discipline were the strongest predictors of performance in our courses.

In sum, to predict students' assessment and placement via standardized assessment at Long Beach City College, the best predictor was students' standardized achievement tests in high school with student performance in their classes in high school relatively unrelated. In fact, the CST in the other discipline (e.g., Math CSTs for predicting English placement) was as or more powerful a predictor of placement than grades in the same discipline (English grades for predicting English placement). In contrast, students' performance in their courses in high school, i.e., their grades, were the best predictor of students' performance in college classrooms, with both discipline grades and students overall GPA outside the discipline exerting independent predictive utility for understanding student performance in high school. Taken together, these results suggest the possibility of a dramatic misalignment between the measures we commonly use to assess and place students and those most likely to predict performance in our classrooms. Figures 1 and 2 illustrate the lack of alignment between the predictors of assessment in English and performance in English via the logistic and ordinal regression coefficients for the analyses of the two key criterion variables. Figures 3 and 4 illustrate a similar lack of alignment in Math (although 12th grade GPA alone was a more powerful predictor than overall GPA)
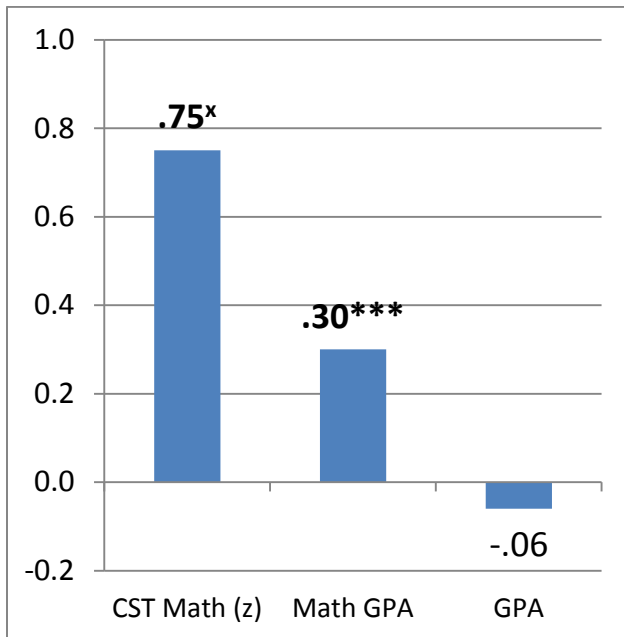
Figure 1. Ordinal regression coefficients predicting level student assessment in English.
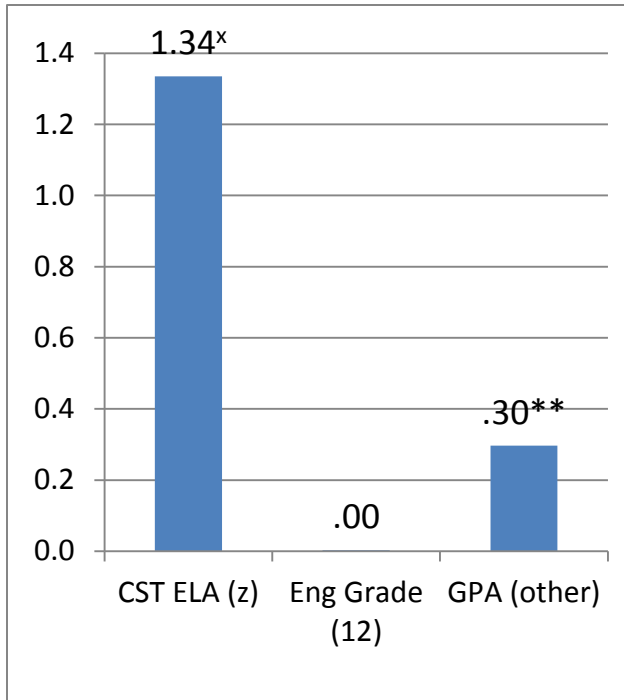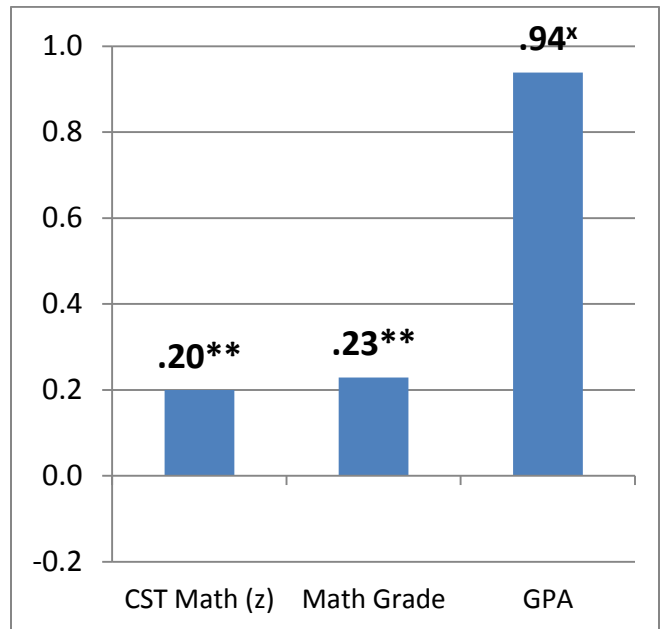

Figure 2. Logistic regression coefficients predicting student performance in English.
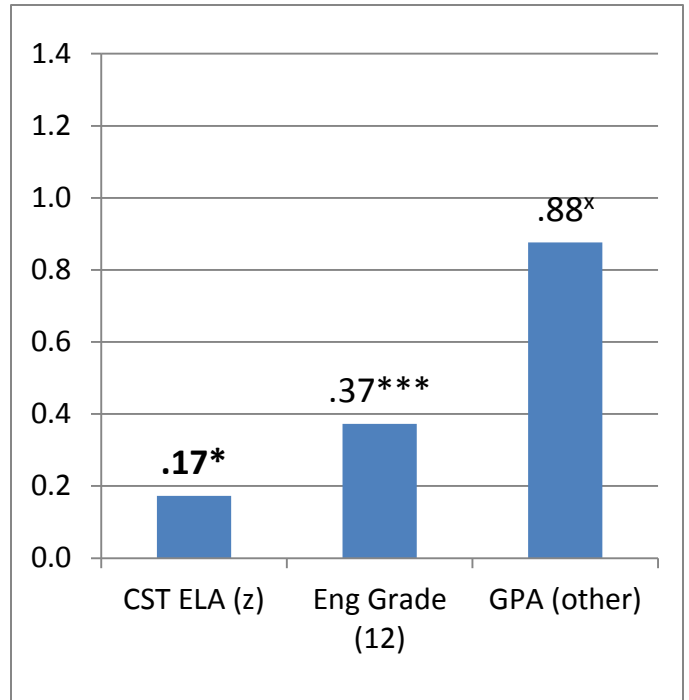
Figure 3. Ordinal regression coefficients predicting level student assessment in Math.

Figure 4. Logistic regression coefficients predicting student performance in Math.

* $p < .05$ ** , $p < .01$, *** $p < .001$, x = $p < 1 \times 10^{-18}$

As can be seen from Figures 1-4, it became immediately apparent that standardized assessments were failing to fully assess students capability to perform well in college-level work by failing to incorporate very important predictors of students performance in their college courses, how well they did in similar classes in HS and how well they did in high school classes generally. In fact, using the research to increase the alignment between how the college assesses students and how they are likely to perform in our courses clearly held dramatic potential both for students, by aligning their placements more closely with their zone of proximal development, and for instructors in the classroom, by placing students where they would be more optimally engaged in their work.

Initial estimates suggested that employing broad, evidence-based, multiple measures to holistically capture the potential of our students to perform college level work not only would better align placement with student ability but could also reduce the number of semesters of required development coursework for students by up to 50% in each discipline and increase the number of students immediately eligible for transfer-level English by almost 500%. In what is truly a testament to the quality of the college's faculty and their willingness to reflect upon and then take action based on evidence and research, the faculty acted quickly on this research to develop exceptionally large pilot programs to implement multiple measures assessment beginning in Fall 2012 as part of the Promise Pathways which is the second part of the research project.

**Part II: Evaluation of the Effectiveness of the Implementation as part of the Promise Pathways**

The college quickly moved to put the potential of this alternative, evidence-based method of placement to work as part of a first-year experience the college was developing called the Long Beach Promise Pathways. The tremendous promise of alternative placement was maximized through another key innovation: prescriptive scheduling whereby first semester education plans were developed via automation of the implications of the research above requiring students to complete key foundation courses in English and math beginning immediately in their first semester. Taken together, alternative placement and prescriptive scheduling have the potential to dramatically increase college completions while simultaneously reducing time to completion. The college collaborated with LBUSD to have all students who wished to participate agree to allow LBUSD to release their transcript information to the college. In all, 976 students were recruited to participate in the first year of the program. (Although 43 students dropped all of their classes the first day of classes, they and all 933 of the students who remained enrolled in the program are included in analyses of the program).

Assessment and Placement

In order to create alternative placements for students using the full measures available in their high school data, the logit link function at the heart of logistic regression was employed to generate predicted success rates for new students in English and Math at every level of those sequences. Placements were developed such that students would be placed in college-level coursework if their probability of successfully completing that work with a C or better was at least equal to the average success rate in the course. As soon as the college began to generate plans for students as student data became available, it became apparent that this method was going to dramatically change the pattern of

placement at the college. As can be seen from Figure 5, the percentage of students placed at transfer-level (non-remedial) coursework increased dramatically, almost five fold for English and more than three fold in Math compared to the most recent cohorts of students.

Figure 5. Percentage of students assessed into transfer-level in English and Math by cohort.
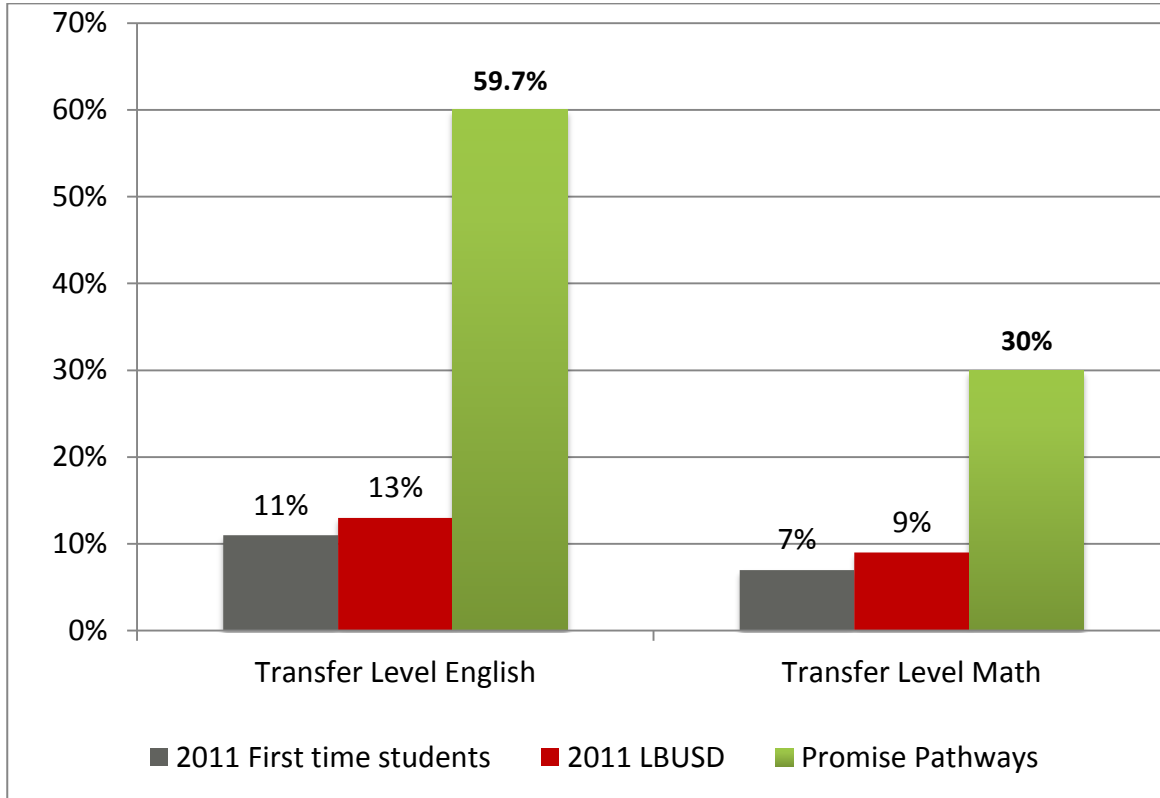
Success Rates in Transfer-Level Coursework in English and Math

Placing students in transfer-level work, however, might only be setting students up for failure if they're being placed into courses for which they are not adequately prepared. After all, the previous placement method would have placed about half of those additional students one level below transfer-level in English and another half three-levels below transfer-level. (Students are not placed two-levels below transfer-level at LBCC). However, the success rates of students in the Pathways in these transfer-level courses were slightly lower but did not significantly differ from the success rates of the other non-Pathways students in the courses at the same time, even though many of those students had progressed through multiple levels of additional preparation and, to do so, had persisted through multiple semesters or even years of the college, very strong predictors of success in themselves. See Figure 6.

Figure 6. Success rates in transfer-level courses in English and Mathematics in Fall 2012
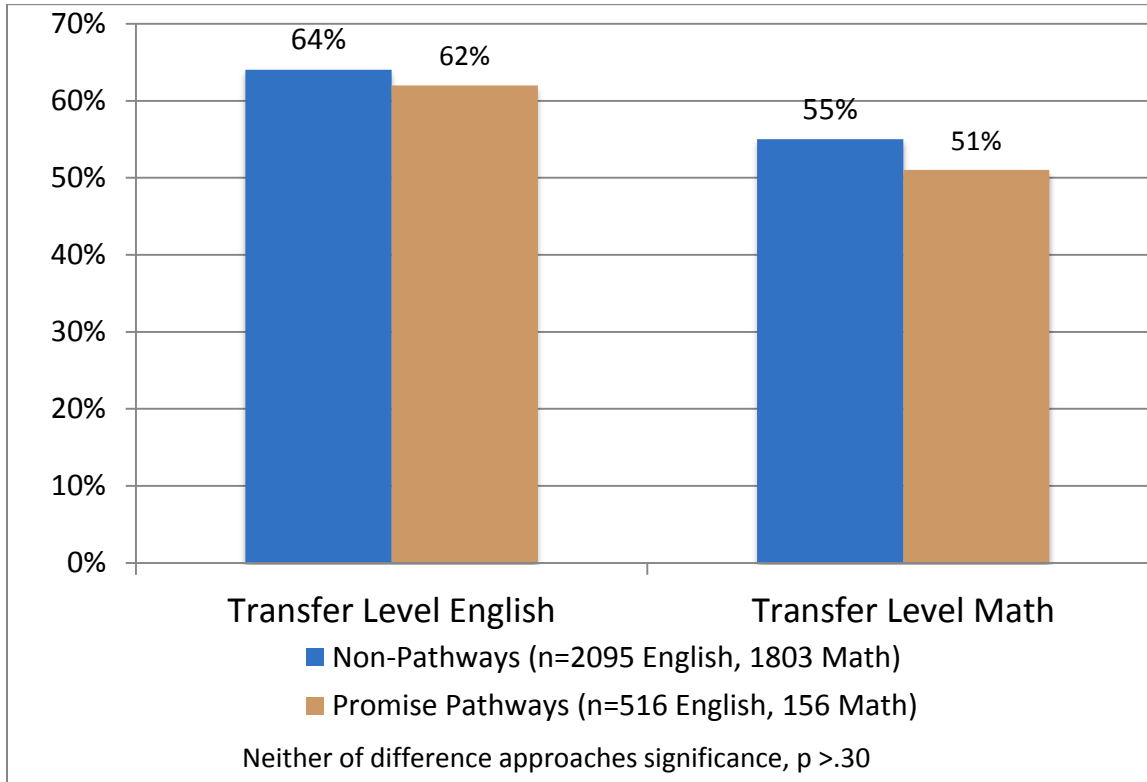
Impact on Achievement of Early Educational Milestones.

A key component of the detailed evaluation plan for examining of the overall effectiveness of the Promise Pathways and the new model of assessment and placement was the early and rigorous examination of the impact of the program on key early educational milestones, selected because of the depth of evidence of their predictive utility for achievement of educational outcomes including AA/AS degrees, high value certificates, and transfer to four-year institutions: completion of transfer-level math, completion of transfer-level English, and the achievement of behavioral intent to transfer. Behavioral intent to transfer is a key indicator developed by the California Community Colleges Chancellor's Office (CCCCO) as a way to determine the strength of students' intent to transfer to a four-year institution. They found that completion of 12 transfer-level units and the attempt of transfer-English or Math was a very powerful indicator of the likelihood of community college students to persist until successful transfer to and completion of their education at a four-year institution. Initial indications very strongly suggest that the program continues to measurably increase the rate of achievement of early educational milestones in comparison to the most recent cohorts of students from LBUSD, as can be seen in the Table 1 below.

Table 1. First year achievement of educational milestones by students in the Promise Pathways as compared to students from the Fall 2011 cohort of first-time LBUSD students.

Milestones Completed by End of First Academic Year	Fall 2012 Promise Pathways (N=976)*		Fall 2011 LBUSD (N=1660)	
	Percentage	N	Percentage	N
Successfully Completed Transfer Math	15.0%	146	5.1%	85
Successfully Completed Transfer English	41.4%	404	11.9%	196
Behavioral Intent to Transfer	35.9%	350	12.9%	213

Table 1 contains two notable elements which help maintain a very conservative approach to examining the effectiveness of the overall program. First, as mentioned previously, any student who began the program, even those that dropped all of their courses before census who wouldn't be and are not counted in the other cohorts, remain included in the denominator of the analysis, including 43 students who dropped all of their courses on the first day of classes once the registration freeze prior to the first day of classes was lifted. Second, because not all students from LBUSD participated in the program, the counts are also included so that it's easy to see that biased selection cannot account for the observed results as the number of students is in each case substantially higher than that of the much larger full cohort the previous year. Even if one included all the non-participants who didn't receive access to the alternative assessment and prescriptive placement, the students in the Pathways would still substantially outperform the previous cohorts.

In addition, these results were further compared against the typical rates of achievement observed by students from LBUSD in six years, using the most recently available six-year cohort. As can be seen in Figure 7 below, Promise Pathways students have completed these pivotal early educational milestones in their first year at a rate that exceeds, in some cases markedly, what the most recent available cohort achieved in six years. This suggests that the Promise Pathways is not just accelerating student achievement so that it's happening earlier in students' educational careers but is also opening doors to student achievement that would not have happened otherwise under the previous system.

Figure 7. F2012 Promise Pathways achievement in first year vs. 6-year rates of achievement for most recent (F2006) six-year cohort from LBUSD available.
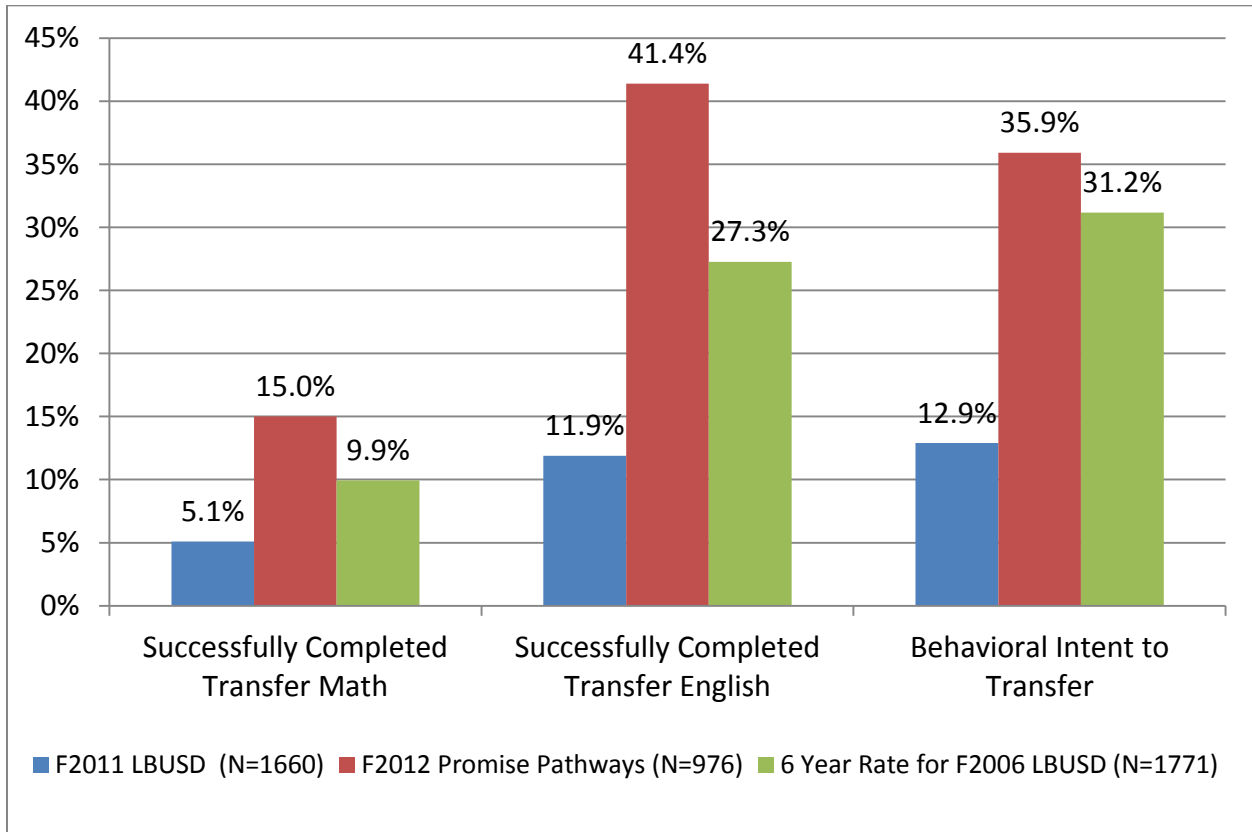

Finally, a propensity score matching analysis was conducted using the two most recent cohorts of students available as part of the Cal-PASS data set to compare against the test cohort of the Promise Pathways students to address as comprehensively as possible any and all potential confounds and third variables as one can in educational datasets. This type of analysis is widely considered to be one of the more rigorous and conservative analyses available in educational research and is accepted as a very high standard by the Department of Education and its Institution for Educational Sciences. Thus, to compare students who were as similar as possible, we created matched the two data sets on both primary and secondary matching variables as seen in Table 2. Together, these variables help control for a broad range of possible student characteristics including motivation, ability, persistence, commitment to education, and opportunity. In order to keep the number of students available for matching as high as possible, the Math and English variables were not used simultaneously. The resulting size of both the Pathways and propensity score matched comparison cohorts are provided at the bottom of the table.

Table 2. Variables used in construction of propensity score matching cohorts by analysis.

	Behavioral Intent to Transfer	Transfer-Level English Completion	Transfer-Level Math Completion
Primary Matching Variables			
Overall HS GPA	X	X	X
Last English CST Score	X	X	
Last Math CST Score			X
12th Grade English grade		X	
Last Math grade			X
Highest Math course taken			X
Secondary Matching Variables			
Total Units in First Term	X	X	X
Total Units in Second Term	X	X	X
Final Matched Cohort Size in Pathways and Comparison Group			
N of each matched cohort	871	852	726

The results of the propensity score analysis provide substantial additional evidence for the impact of the implementation of the evidence-based, multiple measures assessment with prescriptive placement as a consequence of the earlier research, even when controlling for a broad range of variables (including number of units taken).   As can be seen in Figure 8, on each of the key early educational milestones, students in the Pathways cohort very substantially and significantly outperform the propensity score matched comparison group, all **t**s >5.5., all **p**s < .00000001.

Figure 8. First year achievement of early educational milestones for Pathways and propensity-matched comparison cohorts.
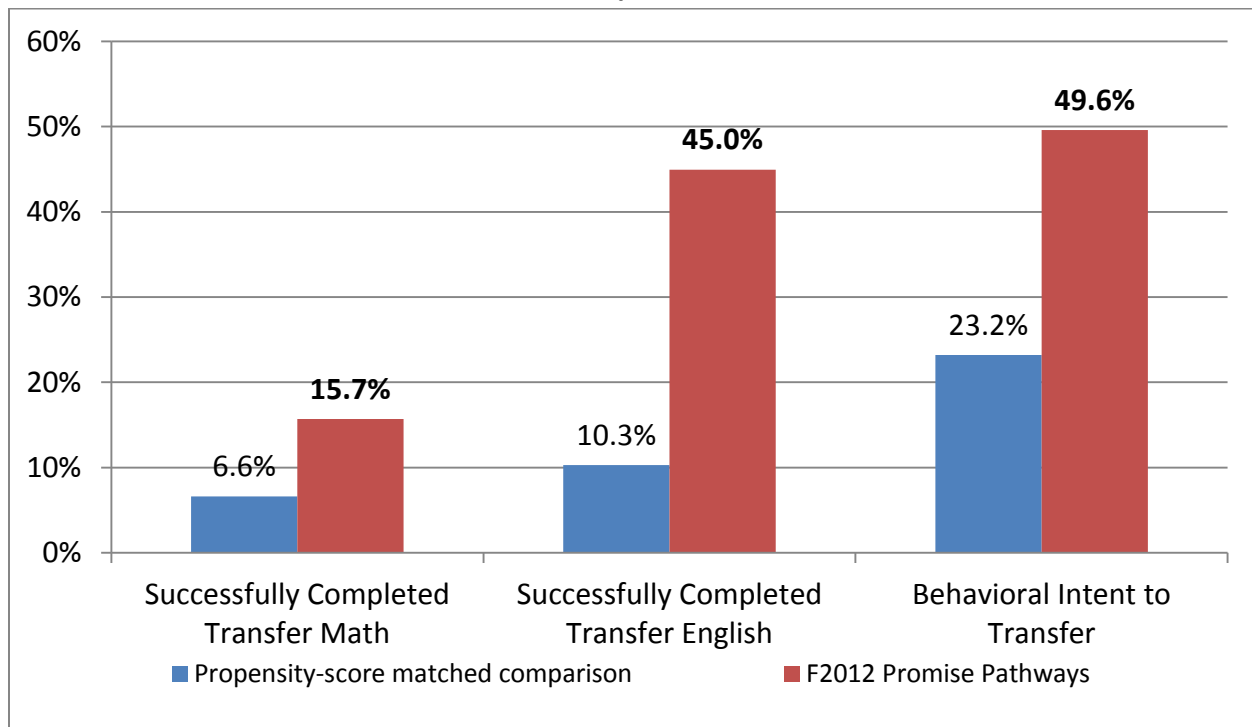
Impact Across Demographic groups

As a large, urban California Community College, Long Beach City College has a highly diverse student population that has just recently reached a majority of Hispanic students and is over 75% students of color with a majority of its students receiving Pell Grants and even more BOGG Fee Waivers. As a result the applicability of this research across demographic groups is pivotal to its utility at the college. As can be seen in the disaggregated achievement of early educational milestones in the first year for Fall 2011 (Figure 9), significant equity gaps in achievement exist across different demographic groups at the college (the blue line represents the achievement rate of white students from LBUSD in Fall of 2011).

Figure 9. First year achievement of educational milestones for F2011 LBUSD students by ethnicity
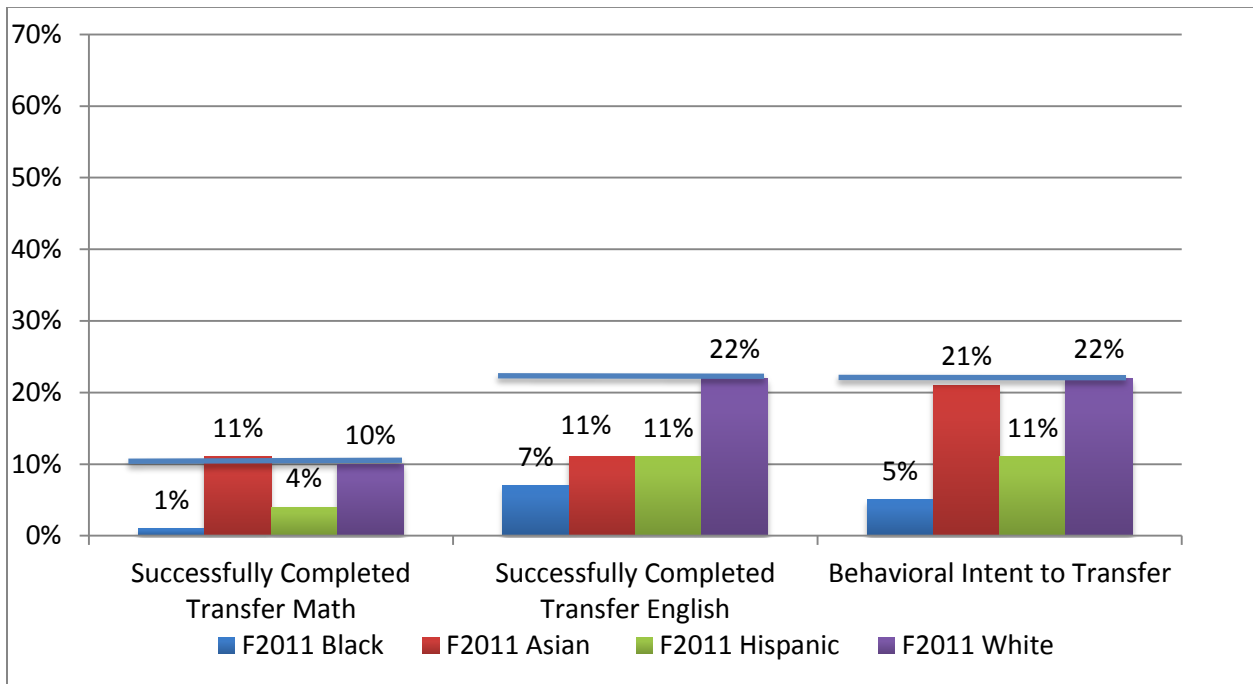

What's notable is to compare the change for students of color at the college in the Pathways in Fall 2012 compared to the previous cohort of White students whose rates of achievement are 2-3 times (and as much as 10 times) higher on some of the key early educational milestones than those of students of color in Fall 2011. As can be seen in Figure 10, for every combination of metric and demographic group (but one), students of color in the Fall 2012 Pathways cohort outperform, often substantially the previous year's cohort of White students. If it had been delivered solely as an intervention to close the college's equity gaps in student achievement, it would have been one of the most successful such interventions in recent community college history. However, it was delivered to all students regardless of demographic, so equity gaps remain (see Figure 11). Nonetheless, the dramatic improvements for students of color stand out as an important and uncommon success of the overall program.

Figure 10. First year achievement of educational milestones for F2012 Pathways Students of Color as compared to F2011 LBUSD White students
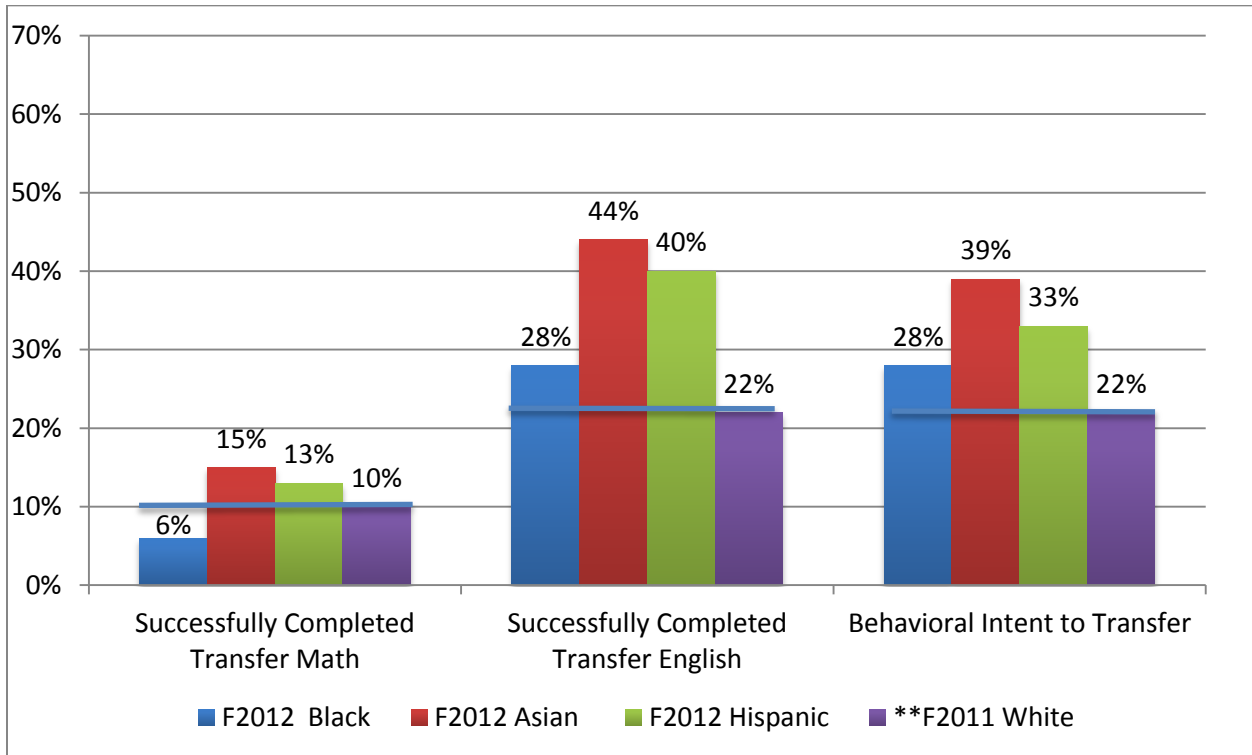

Figure 11. First year achievement of educational milestones for F2012 Pathways Students by ethnicity
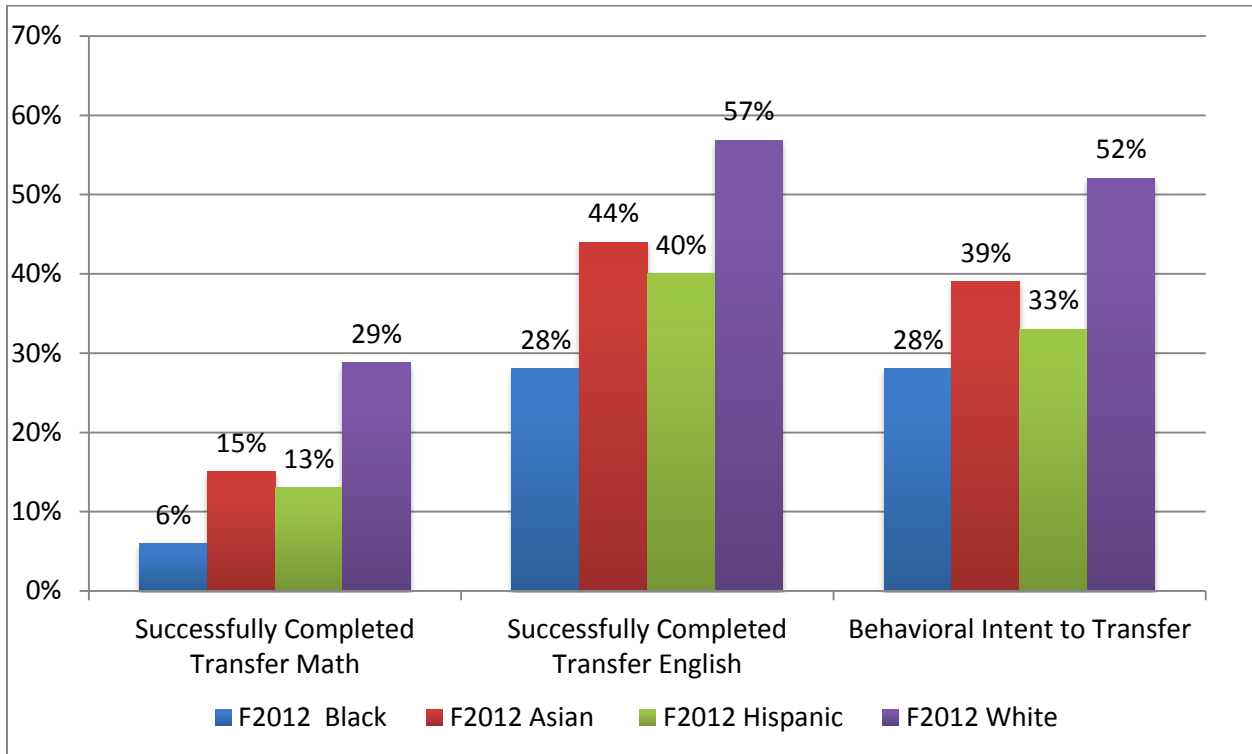
Impact on Time to Completion of Key Early Educational Milestones

Although the performance of students in the Pathways in comparison to the most recent achievement across six years discussed above (Figure 7) suggests a strong impact on time to completion of early educational milestones, one additional analysis was conducted on students who were enrolled in English 1 in Fall 2012 to get a better sense of the full impact of the evidence-based changes for students' educational trajectory. First, we examined the average time to take English 1 for all of the non-Pathways students enrolled in English 1 in Fall 2012 as a function of their initial English placement. As can be seen in Figure 12, student placed below transfer-level in English take a significant length of time to get to the course, even when one is only examining the students who have successfully made it there and leaving out all those that never make it. In fact, even though students at the college are normally as or more likely to be placed three levels below as they are one level below, their substantial underrepresentation in English 1 confirms other college research showing that relatively few of them ever reach transfer-level coursework in English. For students at those same levels of placement via standardized assessment, the picture is quite different once the evidence-based placement gives them access to English 1. Figure 13 above displays by placement level a rough estimate of the number of semesters of time that the achievement of the students in the Promise Pathways has been accelerated. In total, the 388 students who previously would have been placed below transfer level would have taken an additional 2277 semesters to get to English 1, or, ,on average an additional 5.9 semesters. This represents over **1100 years** of student opportunity costs that the Promise Pathways has saved students just in English and just in the very first year of the program.

Figure 12. Average number of additional semesters to English 1 by F2012 Non-Pathways students by original standardized assessment
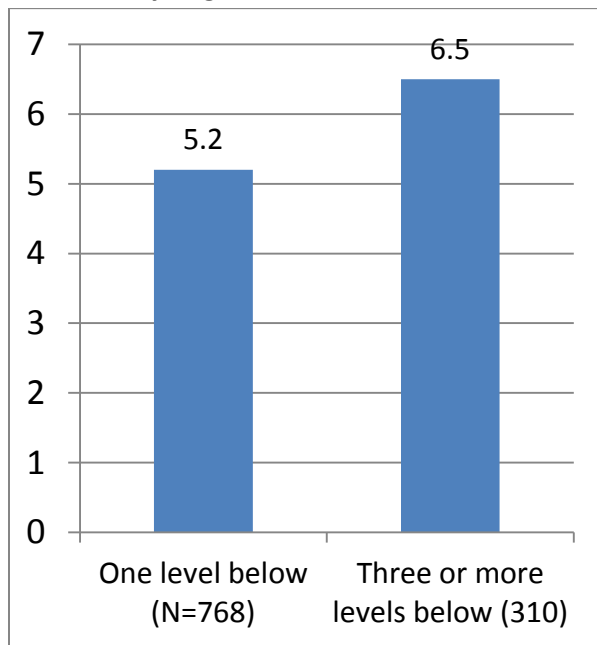
Figure 13. Estimated total number of semesters <u>saved</u> by F2012 Pathways English 1 Students by original standardized assessment
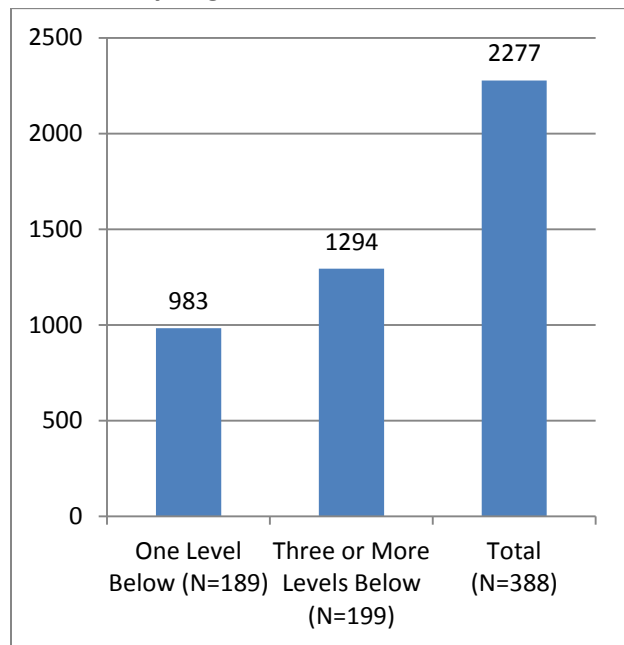
Such changes adds meaningful time to students' lifetime earning potential by helping students complete their education and enter the workforce more quickly, adding additional years of peak earning potential. Even if one values this time conservatively at the 2010 median annual of wage of $26,363, the prospective additional earning potential gained for just these 388 students represents over $30,000,000 for an intervention that costs essentially nothing other than recognizing students' real evidence-based potential.

Part III –Provision of Statewide Support and Broader Implications

Just as the implications of the college's research for the students of Long Beach City College were immediately clear, so too were what this could mean for the community college students of the state of California and potentially the entire country. From the beginning, Long Beach City College has worked diligently to share the research with educators and researchers across the state and in national forums. However, most importantly, as a follow-up to the initial research project, the research office of the college created a set of highly automated tools that any California Community College could use to build the same data sets and then replicate the research locally with their own students, right down to the creation of alternative placements for students. These tools were made available via the RP Group Annual Conference in April 2012 and immediately became the centerpiece of a statewide collaborative effort to replicate our work run in collaboration between the RP Group, the CCCCO, and a number of non-profit organizations called [the Student Transcript-Enhanced Placement Study (STEPS).](#) Working in concert with researchers across the state and Cal-PASS, the tool was further improved and automated until most researchers could complete in a few hours what had originally taken the college months to build and complete. So far, more than a dozen California Community Colleges have replicated the work locally, finding nearly identical results. In addition, one of those colleges, Merritt College in the Peralta Community College District, just recently announced that they will begin using an alternative assessment based on their replication of our research in Fall 2014.

More importantly, Butte College and Cal-PASS were recently awarded a major multi-million dollar grant from the CCCCO to develop a common assessment protocol for the entire system. A key component of that system has been built around the research developed at Long Beach City College and replicated and extended via STEPS in order to provide a robust, statewide multiple measures data warehouse that will allow all 112 California Community Colleges to deploy evidence-based, multiple measures alternatives to standardized assessment for their students.

Further, the college has regularly made its staff and leadership available to the colleges of the state and beyond. So far, the college has assisted and collaborated with community colleges and four year colleges in Washington, Oregon, Florida, North Carolina, Georgia, Colorado, and New Mexico as well as state agencies (including the California State Senate, the CCCCO, and the Little Hoover Commission), federal agencies (the US Department of Education and the Governmental Accountability Office), and numerous other non-profit organizations (the RP Group, the Career Ladders Project, the Campaign for College Opportunity, the Gates Foundation and Completion by Design, and others) to assist in other local, state, and national efforts to find better solutions to the persistent dilemmas posed by the dramatic numbers of community college students in developmental skills courses and to share with

others the real potential for long-term improvement in student achievement and life-long opportunity possible through what we've found in our research.

One important consequence of the college's research that comes up frequently is the manner in which the poorly calibrated current system of assessment and placement is likely distorting instructional pedagogy in basic skills courses and the outcomes of those courses in multiple ways. Based on the results of our research, many students who are fully college ready and who often have completed and mastered the skills being taught in developmental skills course in high school are nonetheless being placed into those courses alongside students who have not. As a result, they are very likely to relatively easily master the material presented and to do so more quickly, potentially providing a false impression to the instructor of the appropriate pace for covering the material. Further, having already completed this level of work, their papers, assignments, problem sets, and tests will provide difficult competition for grades and difficult upward comparisons for students who truly need the help those courses can provide, likely further depressing the performance of the students who most need the developmental skills courses to help prepare them for college-level work. Until colleges can improve the accuracy of their placement system, the effectiveness of the instructional assistance and support provided by developmental skills for the students who need it most will be undermined by simultaneously providing it to students who, based on the original research and the results of the college's implementation of that research, do not seem to need it very much if at all.

Finally, and perhaps more importantly, the college recently returned full circle to the original question of better understanding the relationship between high school performance and student assessment and performance in college level courses. Working with LBUSD, the college built a dataset to estimate the college-readiness of the entire student body at LBUSD rather than just for those that apply to Long Beach City College. Using the results of the Early Assessment Pilot program that tests for college readiness in 11th grade using an enhanced version of the CSTs as a baseline, we applied the parameters developed through our application of the logit link function in order to estimate the college-readiness. The EAP's assessment of the college-readiness of LBUSD students via standardized assessment represents the impact of a great deal of hard and innovative work by LBUSD to gradually improve those outcomes. Nonetheless, the lack of college readiness exhibited on standardized assessments (as can be seen in the blue bars in Figure 14) is one that is well familiar in current discussions of the state of public education and whether it is actually preparing students adequately for college, even at an internationally award-winning school district. In contrast, if one uses evidence-based assessment of college-readiness (as can be seen in the red bars of Figure 14) based on what actually predicts student performance in college, an entirely different, far brighter picture of how prepared high school students are for college, including relatively poor, urban students of color. In the end, the results of the college's research suggest nothing less than the urgent need for a re-imagination and renewed appreciation of the real accomplishments of American public education and the true preparedness of our high school students for college, by doing nothing more than simply assessing and placing students in college-level work using freely and readily available evidence of students' actual preparation and ability.

Figure 14. Percentage of Spring 2012 of LBUSD graduates who are college-ready by discipline and method of assessment (standardized vs. evidence-based, multiple measures)