The California State University (CSU) Consortium is requesting NGLC follow-on funding to expand the CSUN-Consortium’s Wave I Hybrid Model for student success in introductory mathematics courses. Over the course of the next five years, the new CSU-Consortium will seek to scale the model to reach students in entry-level math and “gateway” science courses at 80% of the CSU campuses and at 40% of the Los Angeles-area community colleges. This will be accomplished via a partnership of the CSU Chancellor’s Office, the CSU Council of Math Chairs, and the Faculty Inquiry Team (FIT) of the California Community Colleges System (CCCS). The project has three phases:

Phase I was funded by the Wave I NGLC grant during the academic year 2011-2012 and is completed. It expanded the model beyond CSU Northridge (CSUN) to three other collaborating campuses.

Phase II would be funded by a follow-on NGLC grant for the period between January 1, 2013 and December 31, 2014. It will expand the model from the core consortium campuses to a quarter of the CSU campuses and 15% of the L.A. County community colleges.

Phase III will seek to complete the goal stated above during the academic years 2015-2017, transferring “ownership” of the project from the campuses to the systems.

The CSU has 420,000 students enrolled on its 23 campuses statewide, and the CCCS has nine campuses in the L.A. district enrolling 250,000 students. A successful follow-on project will have an impact on approximately 68,000 students annually in the CSU and 20,000 students annually in the CCCS.

1. **EVIDENCE AND PURPOSE**
   a. **Key accomplishments of Phase I under Wave I Funding:**
   
   Higher education in the United States is facing a failure-rate crisis in entry-level mathematics courses, and influential reports published during the past eight years have presented evidence that the number of U.S. graduates in natural science and engineering fields will fall far short of the trained professionals needed to replace the large number of projected retirees over the next 20 years. The CSU-Consortium has developed an innovative, technology-enhanced hybrid course model that has significantly improved course completion and content mastery outcomes in entry-level mathematics courses. The model relies on five primary components that are carefully articulated to create a reliable “flow of learning” for students. The approach has proven both cost effective and scalable to other courses and institutions. (See figure at left and Educause Quarterly article: [http://www.educause.edu/EDUCAUSE+Quarterly/EDUCAUSEQuarterlyMagazineVolume/CreatingALearningFlowAHybridCo/242680](http://www.educause.edu/EDUCAUSE+Quarterly/EDUCAUSEQuarterlyMagazineVolume/CreatingALearningFlowAHybridCo/242680).)

   - It targets high failure rate, multi-section, gateway courses in which prerequisite knowledge is a key to success. To date applications have been in math, but in Phase II we expand to chemistry and will be looking for other subject areas that fit the above criterion.

   - Assessment studies of work that our original consortium members have done this year show that more than two-thirds of the students in our 2011-2012 courses achieved course mastery and deeper learning, and 93% persisted from Fall 2011 to Spring 2012 in college studies, thereby increasing their chances of college **degree completion** (see Supplemental Materials, Section B, SRI Data). Moreover, these numbers dropped by only one or two percentage points when we looked at low-income students. Additionally, longitudinal studies at CSUN and CSU Long Beach (CSULB) put the benefits of the lab model in perspective: At CSUN, Business Math (Math 103) went from two-thirds of students having to repeat the course prior to the model’s introduction, to 70% getting C or better post-reform. This dramatic reduction in the number of students repeating the class produces a net savings of $5000 per semester. In addition, variability in final exam
scores between the 12+ sections of Business Math decreased drastically under the model, providing consistency of student experience. Similarly, as can be seen in the graph to the right, the model as implemented under the Wave I funding substantially decreased the number of repeaters and improved the number of students receiving A’s and B’s in Math 115 (Calculus for Business) at CSULB.

Among the other key accomplishments of our Wave I project was the establishment of a consortium of three CSUs plus one community college working collaboratively to solve the entry-level math crisis using the Hybrid Model. This collaboration successfully spanned diverse campus organizational structures, and has developed the supportive infrastructures necessary to share and adapt materials and expertise with unprecedented openness and effectiveness. This collaboration has resulted in the implementation of the Hybrid Model in many lower-division math courses at consortium campuses. At CSUN all lower-division math classes from college algebra through the calculus sequence now employ the model’s structure; several courses also now use the model at CSULB, Humboldt State University (HSU), and Los Angeles Pierce College (LAPC). Student academic achievement in model math courses increased significantly, as did retention and enrollment in follow-on courses, as instructor, campus institutional research and SRI evaluations for Fall 2011 and Spring 2012 demonstrated (see Supplemental Materials, Sections A and B). Notably, discussions between math and chemistry faculty at CSULB indicated that the model would be successfully applied in General Chemistry (Chem111), where students struggling with the math content benefited from the added lab section. General Chemistry courses too often act as “gateways,” affecting degree completion and access to STEM majors and future careers. In Phase II, this will be our first expansion beyond mathematics.

In addition to implementing the model in specific courses, this newly formed consortium completed two consortium-wide efforts to develop assessment tools and training programs for scale-ups, learning valuable lessons that pointed toward even more effective practices. First, we have come to understand that the management of project data is essential, so having one person who has the education and capability to oversee all of our campuses is critical. Our project data expert, Michael Crosswhite, who holds an MA in Statistics and teaches mathematics at CSUN. He has set up a database for collecting campus institutional research, exam results, homework, and remediation data. Under the guidance of our informal advisor, Dr. James Stigler, we are also developing analysis tools for comparing the effects of model components across the consortium. Dr. Stigler, an expert in Improvement Science, chairs the Developmental Psychology Department at UCLA; he has trained Crosswhite as a data specialist for course redesign projects. This collaboration will improve staff training and data collection and assessment tools on all of our campuses. CSUN’s Hybrid Model Math 103 class serves as a case study for Dr. Stigler’s “Complicated Educational Structures” graduate course in psychology and education.

The second lesson learned was the importance of training programs in scaling up. In Summer 2011 we developed a Web-based training video (see link to video in Educause Quarterly article above.) Embedded in a Moodle Training Site, this video was used at CSUN to train instructional staff in Fall 2011 and Spring 2012, and was deemed helpful in providing the instructors with a clear initial idea of the model. It forms the basis for the Training Template developed from Wave I.

b. With NGLC follow-on funding for Phase II the CSU-Consortium will employ a two-pronged strategy to expand and amplify the accomplishments begun in Phase I under the Wave I grant: (1) by scaling out our Hybrid Model to other CSU and CCCS; and (2) increasing the Hybrid Model’s positive impact on student success and persistence (see Supplemental Materials, Section A, Data Analysis from Original Wave I Funding) by adding more courses (including courses in chemistry and other sciences); providing more instructor training and more classroom facilities; improving assessment; providing professional and student staff salaries; and improving data collection and analysis. More specific campus plans for Year 1 funding requests are in the Scope of Work in the Supplemental Materials section (Section C), but activities will be focused on:

- Implementing the Hybrid Model at all consortium campuses.
- Recruiting new consortium member campuses from within the CSU and CCCS by leveraging the influence of the chancellors’ offices and the Council of Math Chairs. This will build upon the community of professionals established in Wave I that is dedicated to improving student learning in entry-level math and science by sharing and improving the model’s components.

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2. SCALING STRATEGIES

a. The CSU-Consortium will seek to scale the model to reach students in science and math courses at 80% of the CSU campuses and at 40% of the Los Angeles-area community colleges over the next five years. In Phase II of the project we will add two additional campuses in 2012-2013, **CSU Monterey Bay (CSUMB)** and **CSU Channel Islands (CSUCI)**, and recruit four new CSU and CCC campuses, probably two in 2013-2014 and two in 2014-15. We confidently project that the grant funding will directly support courses enrolling approximately 10,000 students in 2012-2013, more than doubling the current number of 4473 supported by Wave I. In Phase III (2015-2017), the project will be moved to the system-wide offices to achieve the final goals.

Supporting the scaling effort, the **structure of the project** will leverage the bully pulpit of the system-wide chancellors’ offices of the CSU and CCCS while taking advantage of the natural web of communication between faculty in departments with similar challenges and resources. CSUN will hold the grant, and a grant manager will be hired with funds provided by the grant. The grant manager will oversee projects with the oversight of an Advisory Board made up of the grant manager, a representative from the chancellors’ offices (CO), two representatives of the Council of Math Chairs, an external reviewer, and a data specialist. This board will oversee the consortium-wide projects, will direct personnel and material resources to projects that need assistance (e.g., with data collection or training), and will determine the projects starting in January 2013. In 2014, one of the representatives from the Council of Math Chairs will be replaced by a representative from the Council of Chemistry Chairs.

It is tempting to simply mandate that a model that has worked on one or several campuses be implemented throughout a university system; however, such action ignores both practical and institutional obstacles. From a practical standpoint, mandating solutions tends to underutilize local talent and empower resistance. A solution that works well for a class on one campus will have been finely tuned to the personnel, culture, and infrastructure of that campus and department. Moving it elsewhere requires a careful retuning of the components and materials, such that all stakeholders in the new environment (students, staff, and instructors) see it as easier to follow the model to success than to continue with unsuccessful but familiar strategies. However, the process requires that a course coordinator—one who also has the clout to ensure buy-in by all faculty colleagues—devote time and talent on a scale beyond most adjunct faculty. Thus, involving tenured faculty is essential to success, which can be achieved only by building consensus around ideas and evidence, not by mandating external solutions.

On the institutional level, the campuses within the CSU and the CCCS have a policy of faculty governance. Their respective chancellors’ offices set campus budgets and determine policy on system-wide issues such as student remediation requirements, when that remediation must be complete, and what happens to students who fail to complete it. Similarly, the central offices set regulations and restrictions to guide general education requirements. However, the central offices do not directly mandate how these academic programs are realized on given campuses, and thus do not mandate solutions. Nevertheless, there are many mechanisms that central offices employ to encourage and promote solutions that have proven effective.
Strong support for scaling-up the model from the CSU and CCCS is more than token. The CSU Chancellor’s office believes that propagating the hybrid model to other CSU campuses will help solve a chronic problem with gateway and bottleneck courses, that is, those that are: high volume, multi-section, high failure rate courses. Levers the system office will use to promote this will include:

- Promoting the expansion of the Hybrid Model in business math classes across the CSU by presenting it to a meeting at the Council of Business Deans.
- Beginning advocacy and recruitment at the fall meetings of presidents and provosts.
- Using the hybrid model as the tool of “best practice” when addressing the growing state concern over cost of instruction and student graduation rates. Through Access to Success (locally branded as the “Graduation Initiative”) the central office is in regular contact with all CSU campuses, and will explore the hybrid model with those that have the most to gain.

In the CCCS, the recruitment of additional campuses will be focused on the L.A. Community College District. A Faculty Inquiry Team (FIT), composed of representatives from each L.A. community college, will manage this activity. FIT was established under the leadership of Vice Chancellor Yasmin Delahoussaye and has the goal of improving the developmental math program. LAPC campus lead Katherine Yoshiwara is on this team and will lead recruitment in coordination with FIT.

b. The assessment studies of work that our original consortium members have done in 2011-2012, referenced in Section 1.a., indicate the high level of students’ course mastery and deeper learning, as well as persistence in college studies—even for low-income students—thereby increasing their chances of college degree completion. We expect our proposed additional work to have a like effect on the students in our expanded consortium by enabling their access to such learning experiences, significantly increasing the college completion rates of our large numbers of underrepresented minority and economically disadvantaged students.

c. Our proposed additional work will vastly expand the scale of our innovation to realize NGLC’s goals. Students in our publicly funded consortium campuses are diverse and are often the first in their families to attend college. All of our original and expansion campuses are federally classified as Hispanic Serving Institutions (HSIs), a designation that also indicates the high financial needs of most students. Students enrolled in our consortium campuses who enter with math learning deficits will spend less time in remediation, and progress rapidly to meeting degree requirements. These students will graduate sooner, lowering total educational costs to themselves and to their financially stressed families. Our Hybrid Model course offerings are also cost-efficient for educational providers: Increased student success in these courses reduces the number of students repeating classes, realizing substantial institutional savings from offering fewer course sections. Such savings will contribute to the sustainability of the Hybrid Model and incentivize further scaling up: By lowering the number of math courses that institutions need to offer for remediation, institutional funds are freed up for implementation of more Hybrid Model courses, without recourse to external grant awards.

3. FINANCIAL VIABILITY AND SUSTAINABILITY

a. As mentioned in section 1a, when fully implemented at CSUN this model has produced savings of thousands of dollars by cutting in half the number of repeating students. Moreover, our institutions are investing in fulfilling the goals of the project and the NGLC grant program. As an example, at CSUN $750,000 has been poured into the Live Oak Mathematics Center, which will create the flexible classroom space to accommodate both the learning flow characteristic of the model as well as the great increase in student population generated by increased use of the model in math classes—this despite the well publicized CSU budget crunch. PI Stevenson hopes that the naming opportunity for the Center will generate funds for further facility improvements. Such facilities increase student access to the learning benefits of the Hybrid Model. Successful learning outcomes in Business Math at CSUN convinced the Math Department to include in a successful NSF proposal funding to implementing the model in the calculus sequence, Students Targeting Engineering and Physical Science (STEPS, NSF Division 1104000 DUE, proposal number 0969627). At CSULB, the Math Department found funds to hire TAs for 15 one-hour lab sessions per week each semester for Calculus for Business; and the department also allocated funds for three sections of 20-person Supplementary Instruction in Fall and five in Spring, supporting students in this class and in Precalculus Algebra. Department funds paid for GAs as lab helpers for another five hours, and to work in drop-in tutoring sessions used by co-PI Newberger’s students. HSU is confident that institutional support will follow the model’s pilot effort in Fall 2012. At LAPC, the Math Department has committed an extra teaching unit to the Modeling with Algebra Project (“MAP”) sections for the hybrid lab. The Community College District has granted release time to two LAPC instructors (including co-PI Yoshiwara) to
b. **CSUN has demonstrated that once established, the model is self-sustaining**, as outlined above in 2c. We expect that given their similar financial allocation structures, the other CSU campuses in our expanded consortium will be able to adopt the model cost-effectively and sustainably without significant philanthropic support after the NGLC grant period. After the model’s successful implementation at five CSUs in year 1 of Phase II—and with the Chancellor’s Office’s current focus on improving undergraduate mathematics instruction system-wide—we foresee its wider adoption at other campuses in the massive 23-campus system, probably also in gateway science courses as well, given CSULB’s proposed General Chemistry model scale-up.

The CCC and the CSU systems have different formulas for allocating funds; however, our LAPC colleagues are confident that when they are able to demonstrate that the hybrid labs improve student success, they can successfully argue that by decreasing repeater students in pre-algebra classes, and thereby decreasing the number of sections offered, the cost savings can fund the model courses after the grant period.

4. **RELEVANCE AND IMPACT IN GENERATING SYSTEMIC CHANGE**

    a. **Our anticipated as well as actual project outcomes have catalyzed important adjustments in our consortium campuses.** Lead campus CSUN has changed the entire mathematics learning delivery system, by designing pathways for students tailored to their individual needs, and the other consortium campuses are following suit. The Consortium’s campus-wide committees responsible for undergraduate curricula have endorsed the Hybrid Model for redesigning math classes at all of our current campuses. Mathematics department chairs are overwhelmingly supportive of course redesign employing hybrid lab sections with technology enhancements. The facilities changes (Section 3a) are part of this response. As noted, at CSUN the model’s course structure is adopted for the entire lower-division math sequence. CSULB co-PI Newberger has found that the model’s structure aids in analyzing program effectiveness and indicating course corrections, and that ALEKS has proven critical. ALEKS is used for initial assessment of students’ math knowledge, and is used to guide revision of topics and exam scheduling based on students’ performance on homework sets. At-risk students have particularly benefited from this close scrutiny. ALEKS is also used effectively in academic advisement at CSULB.

    LAPC reports that the administration there is now more open to data-based reform efforts, thanks to participation in both our consortium and in the Achieving the Dream program (which provides no funding for course redesign but encourages seeking grants). LAPC has designed “just-in-time” materials for math remediation, and math instructors are using computer-aided instruction with xyzhomework (rather than ALEKS).

    Our two new campuses, CSUCI and CSUMB, are making the systemic changes that foster successful scale-ups of the hybrid lab model, and later to CCCS through outreach activities. The CSUCI Math Department has experimented with adding lab sections for some courses to improve student success. CSUCI has received major Department of Education (VISTA HIS, ACCESO HIS STEM) grants targeting low-income and minority students on its campus, in local high schools and community colleges that aim to attract, prepare and academically support them, especially in STEM disciplines. CSUMB, too, is well positioned as a successful scale-up site for the hybrid lab model. It has received grants from the Lumina Foundation and from the Association of American Colleges and Universities’ national effort (“Give Students a Compass”) linking universities with community college partners that strive to decrease time spent in remediation classes by underserved students through employing engaging educational activities combining English composition and Pre-Calculus.

    b. **Our work has already influenced national discussion and interest in adopting technology-enabled innovation, such as our model promotes.** The *Educause* article cited above has generated many contacts with PI Stevenson. She was invited to speak about the Wave I project at the Gates Foundation’s 4th Annual Postsecondary Success Grantee Convening and in October will speak at the Sloan-C International Conference on Online Learning in collaboration with Nancy Millichap and Pratibha Varma-Nelson. Support from the CSU and CCCS chancellors’ offices is noted above. The CSU Chancellor’s Office has begun awarding COMPASS grants to some campuses to spur lower-division math course redesign, along the lines of CSUN’s Math 103 as detailed in the *Educause* article. PI Stevenson was invited to speak at the CSUMB’s Conference on Collaborative Alliance for Postsecondary Success (CAPS). The proposed CSUMB co-PI was urged by the Chancellor’s Office to join our consortium (see letter of support in Supplemental Materials, Section F, Support Letter), which evidences system-wide recognition of the Hybrid Model’s potential to reform lower-division mathematics teaching.