

**Student Success in AP Biology: Expanding the STEM College Readiness of High-Need
Students (SSAP-Bio)**

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II. Competitive Preference Priorities

CPP 10 – Technology:

The *SSAP-Bio* project provides real-time, affordable, efficient, and highly accessible online support that will reach the students and teachers who need it most. Built on a foundation of assessment data collected through technology, online student- and classroom-level feedback will identify individualized academic challenge areas and provide remedial learning resources for students, as well as links to classroom materials and professional development resources to assist teachers in differentiating instruction. The *SSAP-Bio* system is delivered online, flexible (not prescriptive), user-friendly, and efficient. Most importantly, the role of technology in delivering guidance to teachers and students in this project makes improved learning affordable, accessible for high-need students, and easily scalable.

II.A. Need for the Project

II.A.1. *SSAP-Bio*'s exceptional approach to Absolute Priority 3: *SSAP-Bio* will increase high-need student achievement in Advanced Placement (AP) Biology through development and refinement of an innovative, online set of student- and classroom-level feedback reports that will utilize data generated by the College Board's recently developed online interim assessments, one of the key components of the integrated *AP Innovation* teacher effectiveness system (described in II.B and Appendix J.1). *SSAP-Bio* focuses on high-need student achievement gaps in AP, a program cited in the i3 guidelines as an example of academic rigor. The College Board will be able to quickly expand *SSAP-Bio* to the more than 172,500 AP Biology students nationwide, as well as implement the model in other STEM and humanities subject areas.

SSAP-Bio includes two major components, both rooted in research regarding effective student- and classroom-level feedback:

- a) **Directly supporting students to increase college readiness:** *SSAP-Bio* provides students with online tools that will enable them to manage their own progress toward mastery of the most challenging aspects of the AP Biology course. Depending on the individual student’s level of understanding (as determined by interim assessments), the online individualized student-level feedback report will link them directly and seamlessly to online instructional resources for targeted remediation and enrichment activities.
- b) **Directly supporting teachers to identify struggling students and differentiate instruction in the AP classroom:** *SSAP-Bio* provides teachers with online tools – specifically feedback reports on student progress along the learning path of the most challenging aspects of the AP Biology course – to help them identify struggling students, group them for targeted differentiated instruction, and identify appropriate professional development and instructional resources to help them differentiate instruction.

SSAP-Bio focuses on the recently redesigned AP Biology course, which is the most commonly taken AP science exam and the first redesigned science course to be launched in the classroom. Created in collaboration with the National Science Foundation and colleges and universities across the country, the new AP Biology course embodies the National Research Council’s goal of “deep conceptual understanding of the content and unifying concepts of a scientific discipline” (NRC, 2002). The redesigned course framework and learning objectives have been hailed by educators and in publications including *Science Magazine* and *The New York Times* (Drew, 2011; Wood, 2009).

Alignment with relevant state standards: Based on the content and curriculum development process, states and districts can implement the AP program with confidence that the courses and exams **meet and exceed state standards**, as AP courses and exams are designed to represent the level of a first-year college course. When designing the AP curriculum and assessment frameworks, rigorous national standards were consulted, including the College Board Standards for College Success™ (CBSCS). Alignment analyses indicate that there is strong content correspondence between the CBSCS and state standards and that the CBSCS exceed the rigor of most state standards. College Board analyses of the NRC Science Framework, which will serve as the foundation for the Next Generation Science Standards, also indicate that the emerging new national science standards will closely align to the CBSCS and AP Biology framework.

II.A.2. SSAP-Bio's Focus on Unmet Needs: AP educators and researchers have identified three areas of unmet need to address in the proposed *SSAP-Bio* project. These include (1) achievement gaps that persist even with high-need students whose academic records indicate an equal level of preparation for the AP experience; (2) lack of relevant, instructionally actionable feedback that assists students and teachers to address specific academic challenge areas; and (3) inequitable access of high-need students to high-quality STEM education.

(1) Achievement gaps in the AP classroom: Despite efforts by policymakers and educators, Black, Hispanic, American Indian/Alaska Native (AI/AN), and low-socioeconomic status (low-SES) students remain under-represented in the nation's AP classrooms, and are not achieving success in these academically rigorous programs at the same rate as their peers (College Board, 2011-a). Some causes of these achievement gaps are attributable to lack of adequate rigor and quality in the coursework prior to AP; much work is underway by the College Board and others

to address this need. But even when under-represented students enter AP classrooms with a similar statistical probability of success on the AP Exam— as predicted by performance on sections of the PSAT/NMSQT[®]—they fail to earn AP Exam scores of 3 or better at the same rate as their peers (see Table 1).

Table 1: Percentage of Students Scoring 3+ on AP Biology Exam among students who met a minimum PSAT/NMSQT score threshold; Source: College Board, (2010-a).

	Black	Hispanic	AI/AN	White	Low-SES	Non-Low-SES	Ntl Avg
AP Biology	45	48	51	65	45	66	65

Black, Hispanic, AI/AN and low-SES students consistently fall 10 to 20 percentage points below their peers in achieving AP Exam scores of 3 or better; AP Biology is no exception. Therefore, the College Board is defining traditionally under-represented Black, Hispanic, AI/AN, and low-SES students as **high-need** for the purposes of the *SSAP-Bio* project. In 2010, AP classrooms included in their ranks some 549,356 high-need students, or 30% of all AP students compared to 22% in 2004 (College Board, 2011-a; 2004). In particular, 53.6% of students from the Hillsborough, Northside and NEFEC LEAs who will be participating in *SSAP-Bio* are low-SES; 55% are Black, Hispanic or AI/AN (College Board, 2011-b). *SSAP-Bio* is designed to **improve the AP performance of high-need students** as other efforts continue to democratize AP by expanding access and improving preparation for AP for high-need students in earlier grades.

(2) Lack of instructionally relevant, actionable feedback to help students learn and teachers adapt instruction: Without the frequent use of high quality feedback, teachers and students are often unaware of disruptions to the learning process and thus, unable to progress toward attaining the learning goals. While the use of feedback has been shown to distinguish

between ‘accomplished’ teachers who attained national certification and those that did not, research indicates that the use of feedback in classrooms is still very low (Bond, Smith, Baker, & Hattie, 2000). When feedback is given it often focuses on providing praise, punishment, or grades, which have been shown to negatively impact student performance (Black & Wiliam, 1998; Hattie & Timperley, 2007).

(3) Lack of access to quality STEM education: Research indicates that success in the STEM sequence is based on adequate academic preparation for college level work in STEM (Museus, Palmer & Davis, 2011). High-need students are particularly impacted by inequities in access to STEM education because “low-income, minority, and inner-city students have fewer opportunities to learn science and mathematics. They have considerably less access to science and mathematics knowledge at school, fewer material resources, less-engaging learning activities in their classrooms, and less-qualified teachers” (Oakes, 1990; Museus, Palmer & Davis, 2011).

II.A.3. The extent to which *SSAP-Bio* likely will have a positive impact:

Impact of the Advanced Placement Program: Research demonstrates that success on AP Exams is closely linked to improvements in college outcomes for students of all races, ethnicities and income levels. AP is a rigorous academic program built on a foundation of high quality assessments that have been adopted across the country as a model for high standards. Today, the AP Program encompasses 1.8 million students and over 125,000 teachers across all fifty states (College Board, 2010-b; 2009-a). Participation in AP provides students with the opportunities to take a college-level course at their high school and to earn advanced placement and/or credit in college by obtaining a qualifying score (typically 3 or higher on a 5-point scale) on the AP Exam. AP courses and exams are developed jointly by high school and college faculty, and reflect the subject-specific knowledge and skills that college students are expected to develop

during their first year. Research has shown that acquisition of the knowledge and skills taught in an AP classroom is correlated with both academic achievement in college (e.g., Keng & Dodd, 2008) and college graduation (e.g., Dougherty, Mellor, & Jian, 2006). In addition, AP Exam performance has been shown to be a strong predictor of first-year, second-year, and overall college GPA and credit hours, AP subject-area GPA and credit hours, and subsequent course grades (Burnham & Hewitt, 1971; Morgan & Crone, 1993; Morgan & Ramist, 1998; Geiser & Santelices, 2004; Keng & Dodd, 2008). AP Exam performance also is a strong predictor of college graduation in five years or less, even after controlling for academic ability, socio-economic status, and school-level demographic variables (Dougherty, Mellor, & Jian, 2006).

Numerous recent, large-scale studies with robust controls consistently demonstrate that these benefits of AP are realized equally well by low-income and minority students who succeed on the AP Exam, regardless of other factors (Dougherty, Mellor, & Jian, 2006). Table 2 illustrates that low-income and other traditionally underserved students enrolled in AP achieve higher college graduation rates than their matched peers even when they do not take or pass the AP exam. (College Board, 2011-c).

Table 2: 5-year College Graduation Rate Differences of Matched AP & Non-AP Students.

Student Group	Passed AP Exam	Took, Did Not Pass AP Exam	Took AP Course, No AP Exam
Black	28% Higher	22% Higher	16% Higher
Hispanic 28%	Higher	12% Higher	10% Higher
Low-Income	26% Higher	17% Higher	12 % Higher

(1) Impact on achievement gaps in the AP classroom through (2) instructionally relevant, actionable feedback to help students learn and teachers adapt instruction: SSAP-Bio provides student- and classroom-level feedback reports based on interim assessments of AP

Biology’s most challenging topics, as provided within the *AP Innovation* teacher effectiveness system. Research indicates that teachers need high-quality and timely feedback on student learning in order to tailor instruction to specific student needs before a summative examination finalizes grades (Black & Wiliam, 1998; Kulik & Kulik, 1988; McManus, 2008; Nicol & MacFarlane-Dick, 2006; Sadler, 1989; Thompson & Wiliam, 2008)). Feedback that is relevant to learning goals, provides information on misconceptions without praise or critique, and guides students and teachers toward more efficient learning can have dramatic positive effects on achievement (Hattie & Timperley, 2007). Murphy (2010) concluded that the feedback to students needs to be relevant, specific, and understandable and that the timing of feedback is crucial to its success. Mason and Bruning (2001) also found that low-achieving students benefited more from immediate and specific feedback.

Seminal meta-analyses on the effects of feedback on student achievement produced average effect sizes ranging from .40 to .79 (Black & Wiliam, 1998; Hattie & Timperley, 2007; Kluger & Denisi, 1996). Feedback effects have been shown to be higher than the effects of socioeconomic influences, assigning homework, and reducing class size on student achievement (Hattie, 1999). Since studies have shown that feedback produces “the most powerful single effect on achievement” (Hattie, 1987), and the effect is especially positive for low-achieving students, *SSAP-Bio* will be a critical component within the larger *AP Innovation* system in closing the achievement gap.

(3) Impact on access to quality STEM education: AP courses represents the national standard for academic rigor, and the newly redesigned AP Biology course has been acclaimed as incorporating 21st century principles of pedagogy and scientific practice including inquiry-based learning opportunities (Wood, 2009). *SSAP-Bio* will improve high-need student success in AP,

which has been shown to have a strong indicator of the likelihood of pursuit of a STEM career: “students who took AP math or science exams were more likely than non-AP students to earn degrees in particular physical science, engineering and life science disciplines – the fields leading to the cutting edge careers that can help restore America’s competitiveness” (Tai, Liu, Almarode & Fan, 2010).

II.A.4. Significance and Magnitude of Effect: *SSAP-Bio* is a critical component of the overall *AP Innovation* system. All components will be made available in an integrated fashion, and therefore it is not appropriate to provide effect size estimates for *SSAP-Bio* in isolation. Instead, based on an analysis of the effect sizes cited in the relevant research above, *AP Innovation* can be expected to produce a long term effect size of 0.30 to 0.50 for mean AP grades on the Summative Exam between the treatment and control groups (see Section II.C. for details of the independent evaluation). *AP Innovation* is expected to disproportionately support high-need students and thus in setting targets, a 0.50 effect size is applied to high-need students and a 0.30 effect size to non-high-need students. An examination of the 2009 AP grade distributions sets this estimate into a practical context (College Board, 2009-b). For example, the mean AP grade of high-need students in partner LEAs for the 2009 administration of the AP Biology Exam was 1.87 ($SD = 1.26$). An effect size of 0.50 would increase the mean AP Biology grade to 2.49 among high-need students in our partner LEAs. Translating this shift in mean score to a shift in the percentage of high-need students scoring 3 or higher implies an estimated shift from 26% to 40% of high-need students scoring 3 or higher (an AP Exam score of 3 is the benchmark most consistently found to be predictive of improved college outcomes). It should be noted here that the anticipated effect sizes described above represent long term effect sizes. The expected impact described below represent anticipated one year changes, not long term impacts.

II.B. QUALITY OF THE PROJECT DESIGN

II.B.1. The SSAP-Bio Goal, Objectives and Outcomes:

<p>Goal: The <i>SSAP-Bio</i> goal is to improve college readiness for high-need students by developing and evaluating online student- and classroom-level feedback reports that will help students of diverse backgrounds to succeed in rigorous, college-level AP Biology.</p>	
<p>Objective 1: Increase the STEM college readiness of high-need students through success in AP Biology</p>	<p>Outcome: The percentage of high-need AP students in partner LEAs scoring a 3 or higher on the AP Biology Exam will show an increase from 26% in the baseline year (2012-13) to 29% in the first full year of implementation (2013-14).¹</p>
<p>Objective 2: Increase the STEM college readiness of all students through success in AP Biology</p>	<p>Outcome: The percentage of all AP students in partner LEAs scoring a 3 or higher on the AP Biology Exam will show an increase from 28% in baseline year (2012-13) to 30% in the first full year of implementation (2013-14).</p>
<p>Objective 3: Increase participating teachers' ability to adapt instruction in response to feedback on student performance</p>	<p>Outcome: The percentage of participating AP teachers who effectively adapt their instruction in response to feedback reports will show an increase from the baseline year (2012/13) to the first full year of implementation (2013/14). (Year 1: Baseline; Yr 2: 40% of teachers)</p>

¹ For Objectives 1 and 2: College Board, 2010-c. Analysis of research base to estimate effect sizes and partner LEA AP exam data in 2009 to apply effect sizes to specific student populations and subjects. Unpublished data.

<p>Objective 4: Develop, pilot, and evaluate an online student- and classroom-level feedback report system</p>	<p>Outcome: Completion of all project activities as defined in Section II.B.2.</p>
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In keeping with Absolute Priority 3, *SSAP-Bio* will improve the performance of high-need students through an innovative set of online student- and classroom-level reports that provide individualized, instructionally relevant and actionable feedback that assist students to address obstacles to achieving their learning goals and link to professional development (PD) resources to assist teachers in translating these results into classroom practices. The *SSAP-Bio* intervention is critical in translating feedback collected through the *AP Innovation* interim assessment system into the format that research demonstrates is most effective for improving student outcomes.

The *AP Innovation* Model: *SSAP-Bio* draws on the data generated by the College Board’s *AP Innovation* system, an integrated, research-based teacher effectiveness system including formative and interim assessments that provides teachers more frequent feedback on student learning, enabling teachers to tailor classroom instruction to their unique student populations; and online PD and online communities targeting the most challenging areas of content, pedagogy, and differentiated instruction. See Appendix J.1. for a detailed description of the *AP Innovation* model and supporting research. The *AP Innovation* initial elements of mutually reinforcing assessments and PD grounded in AP’s rigorous standards will be implemented in pilot districts in AP Biology beginning in the 2011-2012 school year, followed by AP Calculus AB and AP U.S. History in subsequent years. If funded, the *SSAP-Bio* feedback reports will be added according to the project plan specified below and in Section II.D.2.

II.B.2. SSAP-Bio Activities

Activity 1: Design online, dynamic real-time classroom-level feedback reports that aggregate data from the interim assessments, display the information in a visually compelling format to enable rapid interpretation by the teacher, and group students based on performance along the learning path of the most challenging aspects of the AP Biology course. These groupings will be used by teachers as a basis for differentiated instruction. Each grouping will include a summary of the abilities demonstrated by those students, areas of struggle, and a set of instructional strategies that can be used by the teachers for remediation or enrichment.

Activity 2: Design online dynamic real-time student-level feedback reports that are intuitive and easy for students to use. These reports will use the results of interim assessments to determine progress made by the student on the most challenging aspects of the AP Biology course, outline the learning path, show each student's individual progress along this path, and indicate specific next steps for each student.

Activity 3: Integrate classroom-level reports into an online test administration system that will enable dynamic update of the reports reflecting the latest interim assessment scores. These reports will be accessible by teachers and administrators within the school and will be used to support data-driven instructional practices and differentiated instruction.

Activity 4: Integrate student-level reports into an online test administration system that will be accessible by students in real-time following the administration of interim assessments in the classroom. Each student will assess their own progress toward mastery of each challenge area. The student can then take ownership for their learning by selecting remediation or enrichment activities as recommended by their individualized reports.

Activity 5: Develop online integration between the student-level feedback reports and the instructional materials that will be used by each student for remediation/enrichment. This activity will involve the development of algorithms that will determine in an automated way which instructional materials/activities/simulations/etc are appropriate for each student based on that student's score on the interim assessment. This activity will also involve developing a content management system and a website to store and display all the instructional materials that will be used by the students.

Activity 6: Development of the online integration between the classroom-level feedback and the instructional resources and PD that will be used by the teachers to differentiate instruction in the classroom based on the interim assessment scores. This activity will also involve developing a content management system and a website to store and display all the instructional resources and online PD that will be used by the teachers. The result will be an intuitive, easy-to-use website with seamless navigation between the interim assessment feedback report and these instructional materials.

Activity 7: Evaluation of the impact of these feedback reports on student performance and teacher ability to adapt instruction.

Activity 8: Project Dissemination. *SSAP-Bio* is embedded within the *AP Innovation* system and the nationwide AP Program. It will be presented to teachers and administrators at College Board conferences reaching over 10,000 educators annually. Comprehensive information about *SSAP-Bio* will also be distributed through the College Board website, www.collegeboard.com, which receives over 35,000 visitors to the Educators section each day.

II.B.3. Estimated Cost of the Proposed Project: The total cost of the *SSAP-Bio* project is \$3.45 million to develop, pilot, and evaluate the system over a 3-year period. Of these costs, the

College Board is requesting \$3 million of i3 funding and will fund \$450,000 itself, providing the required 15% private sector match. (See the Budget Narrative for details.) Outside of the grant and match funding, the College Board will assume an additional \$2 million in costs for content development costs, staff, and technology integration.

The *SSAP-Bio* project will include within the evaluation all teachers and students in AP Biology classrooms in partner LEAs, including an estimated 3,000 unique AP students. Applying the costs solely to partner LEA students included in the project evaluation generates a cost per student of [REDACTED]. Because the majority of the funding in the *SSAP-Bio* grant proposal funds the development and evaluation of the project, the long-term implementation costs are significantly reduced and consist only of license costs to use the Wireless Generation platform ([REDACTED] per student), content revisions, technology platform enhancements and maintenance, customer service and staffing. Therefore, the College Board estimates that the per student costs of the *SSAP-Bio* system at 100,000, 250,000, and 500,000 unique, cumulative students served will drop to [REDACTED], [REDACTED], and [REDACTED] respectively.

The costs associated with the *SSAP-Bio* project are reasonable and appropriate for the scope of planned activity. The integration of two licensed platforms costs almost twice as much as the College Board is requesting for *SSAP-Bio*. Most additional costs for the platform integration are for internal College Board staff time, and the time of external experts. The non-profit College Board will provide these significant additional funds beyond those required for the 15% match in order to complete the required work. *SSAP-Bio* content and technology will be instantly relevant and rapidly expandable to the 172,500+ unique AP Biology students and approximately 10,000 AP Biology teachers each year.

II.B.4. Incorporating *SSAP-Bio* project activities in the ongoing work of the College Board and its partners:

The *SSAP-Bio* proposal has received enthusiastic support from the LEA partners’ school boards and teachers’ unions, as well as the state education authorities in Florida and Texas. Commissioner of Education for Florida John L. Winn writes “This project... closely aligns with the educational priorities of our state.... We look forward to sustaining this long term partnership.” See Appendix G.2 for representative letters of support.

This project is integral to the College Board’s mission to “connect students to college success and opportunity.” *SSAP-Bio* will be a component of the *AP Innovation* system, which is itself projected to become a self-sustaining program over time; for the past 50 years, the AP Program has proven to be a sustainable model for the College Board and school districts. AP Exam fees (currently \$87 per exam, with fee reductions for students with financial need sponsored by AP and virtually all states) cover AP’s operating costs and investment needs—including supporting the scale-up of *AP Innovation* and *SSAP-Bio*.

II.D. INDEPENDENT EVALUATION OF *SSAP-Bio*

The independent evaluation will be conducted by the American Institutes for Research (AIR), a not-for-profit corporation founded in 1946 which is known as a leader in the use of rigorous research to evaluate policies and practices in education, conducting complex, mixed-method, multi-year studies as well as short-term data collection and analysis tasks.

The evaluation will be carried out in two phases, consistent with the stages of development and deployment proposed for the *SSAP-Bio* intervention. During the first phase, the evaluation will concentrate on providing formative data that can inform the refinement of the *SSAP-Bio* feedback reports. During the second phase, the evaluation will examine the impact on student achievement of the full *AP Innovation* intervention, which includes *SSAP-Bio* feedback reports

for 18 biology challenge areas as well as other complimentary components of a holistic system of teacher training for AP Biology teachers. In addition, the phase-2 evaluation will examine changes in teachers' pedagogic content knowledge (PCK) and instructional practice, and it will document patterns of usage for feedback reports and other system components.

(1) Research Questions:

Phase 1: Formative Evaluation

1. How do teachers understand and use the *SSAP-Bio* feedback reports? How can the feedback reports be modified to enhance usability?

Phase 2: Impact Evaluation

2. What are the impacts of *AP Innovation* on student achievement in terms of the increase in high-need AP students and all AP students achieving scores of 3 or higher on the AP Biology Exam?
3. What are the changes in biology PCK for teachers who have had one year's access to *SSAP-Bio* pilot modules or one year's access to the full *AP Innovation* system? Based on teacher self-report, how has access to *SSAP-Bio* pilot modules or the full *AP Innovation* system changed instructional practice related to the 18 challenge areas?
4. How and to what extent do teachers use each component of the *AP Innovation* system (interim examinations, feedback reports, on-line PD)?

Appendix J.3 provides a simplified logic model for *SSAP-Bio* and *AP Innovation*, illustrating how the system is expected to influence student and teacher outcomes. The primary outcome for the evaluation is achievement on the AP Biology Exam for all students and, in particular, for high-need students. The two proximate outcomes expected to be influenced by the intervention are teacher PCK and instructional practice. The theory of action posits that the impact of the

intervention on student achievement outcomes is mediated by changes in these proximate outcomes.

(2) Formative Evaluation:

During the 2012-2013 school year, the College Board will deploy pilot versions of *SSAP-Bio* modules for 6 challenge areas among all AP biology teachers in the three partner LEAs. AIR will rely primarily on a combination of cognitive lab (think-aloud) protocols and semi-structured interviews to examine how teachers understand the student- and class-level *SSAP-Bio* feedback reports and how teachers modify, or plan to modify classroom practice based on the reports. Data will be collected from all teachers in the pilot study, using a combination of in-person and telephone cognitive labs plus interviews. In addition, transaction records generated by the *AP Innovation* system will be analyzed to track patterns of system usage. The focus will be on obtaining actionable information that will help the College Board refine the feedback reports and the manner in which the feedback reports are integrated into the larger *AP Innovation* system.

(3) Impact Evaluation:

During the 2013-2014 school year, the feedback reports for all 18 biology challenge areas that are being developed as part of *SSAP-Bio* will be deployed in the partner districts as part of a holistic system of teacher training, called *AP Innovation*, that includes not only student and classroom feedback reports, but also formative assessment strategies, teacher professional development, and online professional communities. As discussed in the research review (Appendix D), this holistic system of teacher training has been demonstrated to be the most effective intervention and most impactful on student performance (Hattie & Timperley, 2007; Perie, Marion, & Gong, 2009). Correspondingly, the evaluation completed in phase 2 will not only include a continued examination of the use of the feedback reports, but will also examine

the impact on student performance and the changes in teacher PCK and instructional practice associated with roll-out of the full *AP Innovation* intervention.

Impact on Student Achievement Outcomes: The *AP Innovation* system is expected to be deployed district-wide in each of the partner LEAs. Consequently, a randomized design is not possible. To provide the strongest possible evidence absent a randomized design, the impact of the intervention on students' performance on the AP Biology Exam will be evaluated using a comparative interrupted time series design. Relying on data from successive cohorts of examinees, changes in the percentage of students scoring 3 or higher on the AP Biology Exam across a time point of “interruption” in the treatment schools will be compared with the corresponding changes in the matched comparison schools.² Because teachers in the partner districts will have had some limited exposure to *SSAP-Bio/AP Innovation* during the pilot year, two points of interruption will be studied—one occurring in the 2012-2013 pilot year, and one occurring in the 2013-2014 full implementation year.

A changes in the percentage scoring 3 or higher in the treatment schools that is significantly greater than the change in the percentage scoring 3 or higher in the comparison schools will provide evidence that the *AP Innovation* intervention has promise for improving student achievement. The inclusion of a matched comparison group guards against the possibility that some other new program or change in the district or state context is the reason behind the

² The criterion of percentage of students scoring 3 or higher was chosen because research has consistently shown that students who score a 3 or higher on AP Exams are more likely to experience success in college and more likely to graduate on time. (See, for example, Dougherty, Mellor, & Jian, 2005; and Hargrove, Godin, & Dodd, 2008.)

improvement in the treatment schools, and thus strengthens the internal validity of the impact evaluation (Shadish, Cook, & Campbell, 2002).

For each treatment school, AIR plans to identify three comparison schools within the same state through matching on a variety of baseline school and student characteristics (such as, the demographics, pre-AP achievement, and AP participation rates for pre-interruption cohorts of AP examinees, as well as school size, community type, and other school characteristics). Data used for matching will come both from the College Board and from state data systems or other sources of school demographics.

In total, the study sample will include approximately 176 schools (44 treatment schools and 132 comparison schools). Power analyses indicated that the proposed sample will have sufficient power to detect an effect size as small as 0.22 among all AP examinees and 0.26 among high-need AP examinees.³

Given the nested data structure and the dichotomous nature of the student outcome, a three-level hierarchical generalized linear model (HGLM) model will be used for the comparative interrupted time series analyses, where students (level 1) are nested within cohorts (level 2) and cohorts are nested within schools (level 3). The analyses will include three student cohorts prior

³ Power analyses for program impact on all AP examinees assume 25 students per cohort per school, expected comparison group mean of 30%, and 95% plausible interval (i.e., the range covering 95% of the schools) of 10% to 50% for school means. Power analyses for program impact on Black/Hispanic/AI/AN AP examinees assume 9 students per cohort per school, expected comparison group mean of 25%, and 95% plausible interval of 10% to 40%. All power analyses assume 80% power and an alpha of 0.05 for a two-tailed test.

to the adoption of the *SSAP-Bio/AP Innovation* system and two cohorts subsequent to adoption (pilot year cohort and full implementation year cohort). Data for the outcome and covariates used in these analyses will come from the College Board and state data systems.

One important covariate for the impact analyses is the percentage of students in treatment and comparison schools who take the AP Biology Exam. Although schools will be matched for AP Biology Exam participation at baseline, they may diverge as a consequence of the treatment or for some other reason. Significant differences in the proportions of students participating in the AP Biology Exam could affect the distribution of scores among examinees. Impacts (regression adjusted differences in outcomes between treatment and comparison schools) will be estimated for all students and separately for all high-need students among AP examinees.

Changes in teacher PCK and instructional practice and relationship among outcomes:

The extent to which teacher PCK improves will be examined by comparing the scores of AP biology teachers in the impact study LEAs at three points in time: prior to the pilot year (summer 2012), prior to the full implementation year (summer 2013), and after one year of full implementation (near the end of the 2013-2014 school year). The test instrument will be developed by the College Board, building on preliminary work that has already begun to create PCK measures in biology that are aligned to AP course objectives. Changes in instructional practice will be evaluated using a teacher survey administered near the end of the 2012-2013 and 2013-2014 school years. The study sample for these analyses is expected to include approximately 44 AP Biology teachers, and power analyses indicate that the smallest change in teacher PCK (in standard deviation units) that can be detected with this sample is between 0.29 and 0.36, assuming a pretest-posttest correlation between 0.70 and 0.80.

Evidence of program effectiveness will be strengthened if the evaluation finds evidence for the expected relationship between proximate outcomes and student achievement—i.e., evidence that students taught by AP teachers with stronger PCK and more frequent reported use of the targeted instructional practices are more likely to score 3 or higher on the AP Biology Exam (conditional on student prior achievement and other background characteristics), compared to students taught by AP teachers with weaker PCK and more limited reported use of the targeted instructional practices. The relationship between proximal outcomes and student achievement for high-need students will also be examined.

(4) Providing High-Quality Data to Inform Implementation and Performance Feedback:

The evaluator will collect data to describe the implementation of *SSAP-Bio/AP Innovation* in sufficient detail to allow the program and its outcomes to be replicated at other sites. The nature of the student and classroom level feedback reports, PD, formative assessment, and interim assessment tools provided to partner districts under the initiative will be monitored. Teachers' participation in the various PD components will be measured through a combination of computer-generated records and teacher self-report. This will allow establishment of dosage measures and separate analysis of outcomes for teachers who received substantial/adequate dosages of PD.

Computer-generated records produced automatically by the interim assessment system will also be used to measure the number and timing of the interim assessments administered, while teacher self-report data will be used to describe the ways that teachers choose to incorporate interim assessments into their classrooms.

Data will be analyzed during regular Implementation Team planning and status meetings (see Section II.D.) to enable continuous assessment of progress toward the intended outcomes. A

detailed discussion not only of outcomes to date, but also of the implementation and contextual findings will be included in each annual report of the evaluation. This will allow the College Board and the partner LEAs to place their progress toward program goals in the context of the quality of their implementation.

II.D. QUALITY OF THE MANAGEMENT PLAN AND PERSONNEL

II.D.1. SSAP-Bio Management Plan: *SSAP-Bio* will be led by a Leadership and Implementation Team comprised of College Board staff and LEA District Project Directors. See below for information about the roles of the College Board members of the Leadership Team, which includes coordination with technology vendors, AIR, and the External Advisors. Each District Project Director leads an Operating Team to oversee *SSAP-Bio* as it is put into practice at the classroom level, including Program Managers, Data Specialists, and clerical support from the LEA, as well as embedded College Board staff to ensure clear, frequent communication between participants and project leadership. See Budget Narrative for an organizational chart and further detail about the Leadership Team and planning meetings.

I3 funding, with additional support from the College Board, will be used to develop, evaluate and refine the *SSAP-Bio* intervention. Because it is technology based, the completed *SSAP-Bio* intervention will be instantly scalable to the 172,500+ unique AP Biology students and approximately 10,000 AP Biology teachers each year. As noted in Section II.B.4., *SSAP-Bio* and the larger *AP Innovation* project are integral to the College Board's mission. Post-grant funding, *SSAP-Bio* will be sustained by the non-profit College Board's operating budget.

II.D.2. Project Milestones:

Category	Milestone	Responsible Party	Timing
Detailed	Implementation plan co-developed with	LEA Impl. Lead	Jan-12, 2012

Category	Milestone	Responsible Party	Timing
Project Plan	LEAs		
Research & Design	High-level design of classroom and student feedback reports and links to instructional materials and professional development; based on efficacy research on what is proven to improve student performance; benchmarking of best practices nationally and internationally; convening of an Advisory Panel of experts to guide effort	AP Online Products Lead R&D Lead External experts	April – 12
	Detailed design and development of classroom-level feedback reports and links to instructional resources and professional development resources	AP Online Products Lead	Sept – 12
	Detailed design and development of student-level feedback reports and links to instructional materials	AP Online Products Lead	Sept – 12
	Evaluation Phase 1: Usability evaluation and input from LEA teachers and students on detailed designs	Evaluation Manager	Jan 13, 2013
Implementation	Vendor selection and contracting complete	AP Online Products Lead	Jan 13
	Technical implementation of classroom Technology	Lead	Aug 13

Category	Milestone	Responsible Party	Timing
	and student level reports in online test administration platform	and Partner	
	Testing and refinement complete Technology	Lead	Aug 13
	Implementation plans in LEAs finalized / refined	LEA Impl. Lead	Aug 13
Pilot	Face-to-Face Professional Development kick-off of pilot; training on use of interim assessments and feedback to support struggling students and differentiate instruction	LEA Impl. Lead	Aug 13
	100% of participating teachers complete pilot	District Project Director	May 14
	100% of participating administrators review data	District Project Director	May 14
Evaluation	Evaluation Phase 1: Usability evaluation and input from LEA teachers and students on detailed designs	Evaluation Manager	Jan 13, 2014
	Evaluation baseline data collection complete Evaluation	Manager	May 13
	Year end evaluation data collection complete Evaluation	Manager	May 14

Category	Milestone	Responsible Party	Timing
	Evaluator annual summary report	Evaluation Manager	Dec 14
	Completed final efficacy analysis Evaluation	Manager	Dec 14
Dissemination of findings	Publication of findings and dissemination to education community	Evaluation Manager	Feb 15, 2015
Scale-up plans	Refinements completed based on pilot results	Project Lead	May 15
	Internal review and preliminary plans for scale up of program to other AP STEM subjects	Project Lead	May 15
Intern	al review and decision on expansion plan start date	Project Lead	Aug 15 – Aug 16

II.D.3. Key project personnel: See Appendix F for all résumés. Team structures and

information about other positions may be found in the Budget Narrative.

Project Co-Directors Trevor Packer and Wayne Camara will be responsible for overall project oversight. They will head the **Leadership Team**, which guides the overall project and also includes the Project Lead and the District Project Directors. Each will provide 2-3% FTE to the *SSAP-Bio* project throughout the course of the grant.

- **Trevor Packer** is Senior Vice President of AP and College Readiness at the College Board. In addition to his successful leadership of the AP Program, Trevor is also responsible for the strategic planning and ongoing development and operations of the College Readiness division. He has presided over numerous large-scale efforts such as the use of technology to

deliver professional development and exam results directly to educators regardless of their geographic location and the implementation of the AP Course Audit.

- **Dr. Wayne Camara**, is the Vice President of Research and Development at the College Board. Wayne is president of the National Council of Measurement Professionals, past president of the American Psychological Association's Division of Evaluation, Measurement and Statistics, and past chair and current treasurer of the Association of Test Publishers.
- **Potoula Chresomales, Project Lead**, an Executive Director for the AP Program, is responsible for refining *AP Innovation* to meet the needs of its users and to ensure efficacy and scalability.

Other SSAP-Bio Leadership Team members include:

- **Andrew Wiley**, Executive Director for Research and Development at the College Board, is a psychometrician responsible for ensuring the reliability, validity and fairness of College Board assessments. He has conducted research on test development, college readiness and first generation college students.
- **Lila Schallert-Wygal**, Executive Director for AP Online Product Strategy and Management at the College Board, has led design and development of the AP Innovation pilot and will lead the cross-functional team responsible for collecting teacher and student feedback, leveraging research and best practices, and designing and implementing the new classroom and student feedback reports.
- **Terry Redican, Technology Lead**, is a Vice President of Business Technology at the College Board. Terry provides executive IT leadership and overall accountability for the technology work stream of Advanced Placement and College Readiness Division strategic

projects. He oversees project engagements focused on providing enhanced support for AP teachers and students through technology.

- **District Project Directors (DPD), Eric Bergholm, Sara McAndrew, and Marie-Ellyn Zeigler**, will be responsible for driving all implementation activities in their respective LEAs. Each DPD leads an **Operating Team** to oversee *SSAP-Bio* as it is put into practice at the classroom level, and will contribute 10-20% FTE to the project. The DPDs will be supported by **Program Managers** (80-90% FTE), **Data Specialists** (50-90% FTE) and **clerical support** (50% FTE) from each of the partner LEAs, as well as embedded College Board staff to ensure clear, frequent communication between participants and project leadership.
- **Eric Bergholm, Hillsborough DPD**, is the General Director of Advanced Academic Access in Hillsborough. He is also EXCEerator district coach for Hillsborough. Eric spent seven years as high school principal, seven years as an assistant principal, and 10 years as a teacher.
- **Dr. Sara McAndrew, Northside DPD**, is the Executive Director of Secondary Instruction and oversees teaching and learning in all middle and high schools in Northside. Sara has 40 years of experience as an English Teacher, Academic Dean, and school co-founder.
- **Marie-Ellyn Zeigler, NEFEC DPD**, is the College and Career Readiness Specialist for NEFEC; she works directly with colleges and school districts to improve K-20 alignment and facilitate communication and collaboration. Ms. Zeigler is an experienced educator with twenty-five years of experience; she has been a classroom teacher, school counselor, Pre-K Director, Saturday School Director, Director of Curriculum and Instruction P-12, Assistant Superintendent, and Superintendent.

External Evaluation:

- **Fran Stancavage, Managing Research Scientist** at the American Institutes for Research (AIR); will serve as principal investigator for the *SSAP-Bio* external evaluation. Fran's current responsibilities include directing the independent evaluations of the College Board's College Board Schools and EXCEerator programs, both of which utilized comparative interrupted time series designs. For the past 16 years, Ms. Stancavage has served as project director for the National Assessment of Educational Progress (NAEP) Validity Studies Project and the IES-funded Middle School Mathematics Professional Development Impact Study.
- **Deborah Holtzman, Senior Researcher** at AIR will serve as project director. Deborah is currently serving as deputy project director for the independent evaluations of the College Board's College Board Schools and EXCEerator programs as well as survey lead for an evaluation of a Gates Foundation initiative aimed at enhancing teacher quality.

External advisors: A board of external advisors will advise on assessment and PD design and also review and interpret data from the project efficacy evaluation. The following international experts have committed to serve on *SSAP-Bio*'s advisory board:

- **Dr. Dylan Wiliam**, Deputy Director (US equivalent: Provost) and Professor of Educational Assessment, at the Institute of Education, University of London.
- **Dr. Greg Cizek**, Professor of Educational Measurement and Evaluation at the University of North Carolina at Chapel Hill.
- **Margaret Heritage**, Assistant Director for PD at the National Center for Research on Evaluation, Standards and Student Testing at University of California at Los Angeles.