Application for

Early-Phase Grant

under the

Office of Innovation and Improvement
Education Innovation and Research Program (EIR)

Project Title:	Advanced Placement (AP) STEM Access Program for Rural, High-Poverty Mississippi Public School Districts
Applicant:	Mississippi Public School Consortium for Educational Access
Lead Applicant:	Scott County, MS School District
Funding Opportunity Number:	ED-GRANTS-020119-003
Funding Opportunity Title:	Office of Elementary and Secondary Education (OESE): Education Innovation and Research (EIR) Program: Early-phase Grants CFDA Number 84.411C

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- Dr. Tony McGee, Superintendent, Scott County School District (Primary Applicant Contact for "Lead Applicant")
- Dr. James Henderson, Superintendent, Holmes County Consolidated School District (Consortium member school district)
- Dr. David Rock, Dean of the School of Education, University of Mississippi (Advisor to the Consortium)
- Dr. Meg Urry, Professor of Physics, Yale University (AP Physics 1 Lead Instructor)
- Dr. Devon Brenner, Special Assistant to the VP for Education Initiatives, Office of Research and Economic Development, Mississippi State University (IHE Program Director for the Consortium)
- Mr. Dane Peagler, AP Physics teacher, Starkville HS (MS) (Supervisory Instructor for AP Physics 1 for the Consortium)
- Dr. Sarah Mason, Director, Center for Research Evaluation, University of Mississippi (PI for Program Evaluation)
- [redacted]

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- Senator Roger Wicker (R-MS)
- Senator Cindy Hyde-Smith (R-MS) (*letter to be delivered to the Secretary directly)
- Representative Bennie Thompson (D-MS 2nd District)
- Dr. Robert Luckett, Jackson State University, Professor of Civil Rights History
- Dr. James Henderson, Superintendent, Holmes County Consolidated School District (Director, Consortium member school district)
- Brian Dolan, Yale University Class of 2020, B.S candidate in Physics, AP Physics Tutor for the Consortium (2017 – present)
- Nicholas (Braeden) Yarbrough, Lake High School, Class of 2019, AP Physics student with the Consortium (2017-18)

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INTRODUCTION AND RESPONSE TO PRIORITIES

The Mississippi Public School Consortium for Educational Access (Consortium), a consortium of public school districts serving rural, high-poverty areas, proposes an Early-Phase Education Innovation and Research (EIR) project (Project) that builds upon the innovative and successful AP Access Program the Consortium has implemented to provide promising, "high-need" secondary students in rural, high-poverty communities access to the advanced STEM courses they need to achieve their full potential, but which their schools otherwise cannot offer, due both to limited resources and a severe, and worsening, shortage of qualified teachers.

The Project addresses **Absolute Priority 1** through its blended AP delivery model, which demonstrates a rationale informed by high-quality research linking blended learning and the utilization of AP curricula with improved student outcomes. In addition, the Project represents an exceptional response to **Absolute Priority 3** by implementing an innovative, scalable, field-initiated, blended instructional model to provide "high-need" students access to Advanced Placement® (AP) STEM curricula, including Computer Science, addressing the enrollment and achievement gap for underrepresented students, and expanding access to STEM education in rural areas through partnerships with rural school districts. The Project also meets the **Competitive Preference Priority** by providing traditionally underrepresented students access to rigorous AP Computer Science curricula, and by helping them develop the computational thinking and interdisciplinary problem-solving skills necessary to use computation effectively.

For purposes of the Project, "**high-need**" students are defined as Mississippi public high school students (i) whose grade point averages are in their schools' top quartile, and (ii) who attend schools in Local Education Authorities (LEAs) that are eligible for the U.S. Department of Education's (USDE) Rural and Low-Income School (RLIS) or Small, Rural School Achievement

(SRSA) programs. All 11 districts participating in the Consortium are rural, and all are high-poverty—in some cases, extremely so: Consortium districts serve counties that, according to recent Census data, had the highest overall poverty rate and the highest child poverty rate of Mississippi's 82 counties, in both cases *more than triple* the respective national rates. (SAIPE 2016) Yet the Consortium districts also are highly diverse. Members include districts located within the bounds of the Delta Regional Authority that have student populations that are over 99 percent black, as well as districts within the bounds of the Appalachian Regional Commission that are overwhelmingly white. (USDOE Office of Civil Rights Data) In the aggregate, most students participating in the Consortium's AP access initiative are black, and most are female.

In the face of constrained resources and staffing, the Consortium has addressed the disparate access of its high-need students to rigorous courses by developing an innovative, blended instructional model based on relevant research, expert input, and field observations. The College Board, which has observed the Consortium's work in on-site visits, has stated it is not aware of a similarly comprehensive model for rural communities elsewhere. In October 2018, Secretary DeVos visited the Consortium's AP Physics 1 class at Holmes Central High School, and praised its "creative approaches to connecting students with talented teachers and mentors."

The Project will dramatically raise AP STEM participation rates among Mississippi public high school students from rural, high-poverty areas, and establish baseline cohort scores that, once set, will be steadily increased. Students also will achieve the improved longitudinal outcomes that are concomitants of increased AP participation and performance. The establishment of high-achieving cohorts also will catalyze broader achievement within participating schools, as students seek to emulate high-achieving peers, an outcome aided by the social dynamics of rural communities and the noncognitive factors the Program will promote.

A. SIGNIFICANCE

(1) Potential contribution of the Project to increased knowledge or understanding of educational problems, issues, or effective strategies

The Project will be nationally significant because it will make a **profound contribution to increased knowledge** and understanding of a critical impediment to the educational achievement of promising secondary students from rural, high-poverty communities—the lack of access to rigorous courses. The unique severity of disparate access to AP courses in Mississippi, and the unique attributes of the school districts and students the Consortium serves, will, when subjected to the thorough analysis detailed in Section D, yield a trove of data and insights that will fill acknowledged gaps in the relevant literature. The unique attributes of the Program—the many impactful components of its blended instruction model, the vast expertise among its network of educators at both the Institution of Higher Learning (IHE) and secondary level, the IHE-based residential programs, the in-class teacher supports, college STEM major tutors, and the extensive learning resources made available to its students—also **will help illuminate, and aid the development of, effective strategies** to address those disparities. Moreover, the Project will bring a much-needed focus on how to provide advanced STEM courses despite pervasive teacher shortages in rural, high-poverty districts that demand new and effective strategies.

Schools across the U.S. struggle to teach advanced STEM subject matter to rural, minority, and low-income students. In Mississippi, those categories converge—it has the third highest percentage of students in rural districts (Rural Matters 2017), the highest percentage of African-American residents, and the highest poverty rate. (Census 2018) Thus, though the disparate access to advanced STEM courses for rural and low-income students is a problem that is national in scope, it is most acute in Mississippi—and, in fact, the state has the nation's lowest

AP participation rates and performance levels. (College Board *Report to the Nation* 2014) Severe teacher shortages and limited resources deny all but a few Mississippi students the opportunity to take rigorous STEM courses. In 2018, of the state's approximately 130,000 public school students, just 357 took the AP Physics 1 exam, and fewer still, 167, took the AP Computer Science Principles test; *just 3* took AP Computer Science A exam.

That disparity in AP access has very real, and detrimental, consequences for underserved students from rural Mississippi—talents of students with the aptitude to excel in STEM are squandered, and the longitudinal benefits STEM curricula confer are forfeited. According to USDE, "the academic intensity of the student's high school curriculum still counts *more than anything else* in precollegiate history in providing momentum toward completing a bachelor's degree." (Emphasis added.) (USDE *Toolbox* 2006) Students who took an AP exam are more likely to major in their AP subject or a related discipline, particularly in STEM subjects. (College Board, 2016) The consequences of disparate access are particularly dramatic for First-Generation college students, who are 42 percent more likely to complete college in 4 years if they took an AP exam. (DeAngelo, et al., 2011; College Board 2013)

The teacher shortage is particularly acute in the high-poverty districts that participate in the Consortium—according to a 2015 MDE analysis, half of districts participating in the Consortium constitute "Geographic Shortage Areas". (MDE 2015). STEM subjects were characterized as "Critical Subject Shortage Areas", with Physics noted as highly problematic.

Though existing literature and available data quantify the disparate access to AP courses in Mississippi, studies have not been able to assess solutions that are relevant to Consortium participants and other rural, high-poverty districts. As detailed in Section A(2), to date, AP access initiatives have focused on incremental measures that presume the existence of factors

often not in place at Consortium schools. The Consortium, by necessity, offers a far more comprehensive solution—also detailed in Section A(2)—that provides elements of, but goes far beyond, the limited efforts undertaken to date. The efficacy of such a comprehensive approach has not been assessed because it has not been previously been attempted. The College Board has observed the Consortium's work at both an IHE-based residential program and at a member school, reviewed extensive Consortium materials, and participated in many meetings and calls regarding the Consortium's efforts, and its Senior Director of Rural Initiatives stated that the Consortium's program was, to his knowledge, unique in scope. A unique program will produce unique data and, after application of the rigorous analysis described in Section D, unique insights into areas that relevant literature acknowledges require further investigation. A 2010 USDE Meta-Analysis of online and blended learning (OBL) programs found that, in "studies showing an advantage for blended learning, *the online and classroom conditions differed in terms of time spent, curriculum and pedagogy.* It was the *combination* of elements in the treatment conditions…that produced the observed learning advantages." (USDE Meta-Analysis 2010) (Emphasis in original) That study also noted the paucity of studies on point, and the limited sample sizes and other methodological limitations of the studies that did exist. The Program would permit assessments of a wide variety of elements of an OBL program, and thus help determine how those elements may be most effectively combined. Similarly, a 2017 review of 24 studies of OBL courses identified key media attributes that led to effective learning, yet it also found that gaps in the literature "exposed that further scrutiny" was necessary. (Amaka & Goeman 2017) More generally, data is lacking regarding the relative efficacy of alternative means to teach advanced STEM content to underserved secondary students because, by definition, those students have received very little instruction in those subjects.

(2) Extent to which the Project involves the development or demonstration of promising new strategies that build on, or are alternatives to, existing strategies

The Project involves the development and demonstration of promising new strategies that build on the Consortium's successes to date. The Project also presents innovative alternatives to existing strategies by crafting solutions to critical problems endemic among schools that are *both* rural *and* high-poverty schools that existing strategies do not acknowledge, let alone address. The gap between what is required and what is available is vast, and may not be effectively bridged by invoking *only* the most common existing strategies—more vigorous teacher recruitment, teacher training, and the provision of largely online instructional materials. The Consortium, informed by relevant research detailed in Section B(2) and guided by expert advisors, has created an innovative, scalable, blended instructional model that is responsive to the specific needs of rural, high-poverty schools seeking to offer AP STEM courses.

The Consortium's inaugural course, launched in the 2017-2018 academic year, is AP Physics 1, a choice prompted by recognition of both the importance of the subject matter and the near-impossibility of hiring a qualified instructor: prior to this initiative, a Consortium member with three high schools lacked teachers for even a single Physics class of any type—AP, honors, or regular. Also, AP Physics 1, though challenging, is Algebra-based, and the math courses the College Board suggests be taken prior to or concurrent with AP Physics 1—Geometry and Algebra II—are commonly offered at Consortium schools. In addition, prior to commencing the course, the Consortium was able to secure commitments from faculty and students at Yale, UVA, and Stanford to support the Physics class. Students are selected for the course by the schools based on academic achievement and promise, and enrollment is limited to help ensure

effective learning—a typical class size is 3-7, with none larger than 10—though, as the Program is refined, it is contemplated that average class size may increase modestly.

The Consortium's blended instructional model includes several components:

- The **lead instructor** is a subject matter expert who is also an accomplished teacher. For AP Physics 1, the lead instructor is Professor Meg Urry, director of the Yale Center for Astronomy and Astrophysics and a member of the National Academy of Sciences. Though she provides instruction primarily via asynchronous video, she also has visited Mississippi to work with students in-person, and taught by live videoconference.
- An **on-site teacher** presides over the classroom, implements lesson plans and supervises assignments. That teacher, though not certified in the subject, is an experienced instructor who has a STEM knowledge base and the skills required to implement the class, including, in the case of AP Physics 1, a strong math foundation.
- A Mississippi-based, **AP-certified supervisory teacher** created the course's online platform, and a second Mississippi-based, AP-certified supervisory teacher prepares weekly lesson plans and provides pedagogical support to on-site teachers.
- **College STEM majors** tutor each class, often twice each week, by videoconference.
- **Physical textbooks and workbooks**, as well as access to very substantial **online resources**, are provided to each student.
- Students and in-class teachers attend thrice-yearly **IHE-based residential programs**.

The Program will expand the Consortium's course offerings over the grant period to include AP Computer Science Principles, AP Computer Science A, and AP Physics 2, each of which will implement the same course components that have proven effective for AP Physics 1.

In fact, the Consortium's AP access initiative already has convincingly demonstrated its ability to expand educational opportunity and improve student outcomes for high-need students:

- In its first year, the Consortium succeeded in increasing the number of Mississippi public schools offering its inaugural course, AP Physics 1, by 30 percent.
- Students from participating schools took the AP Physics 1 exam in 2018, the first time anyone at their schools had ever done so; those examinees were among the 0.3 percent of all Mississippi public high school students who took the test last year, and individual Consortium students achieved scores in both top quartiles of that elite cohort.
- Mississippi State University reported that students who attended the Consortium's 2018 summer residential program "achieved dramatic gains in substantive understanding of course content, according to nationally recognized pre- and post-program assessments utilized by the American Association of Physics Teachers." (MSU 2018)
- The *Hechinger Report,* a publication based at Columbia University that "cover[s] inequality and innovation in education", identified the AP access initiative as the top "must-read" story in Mississippi education in 2018, stating, "A hybrid AP course that brings Ivy League professors to rural Mississippi classrooms became a model for the rest of the country." (Hechinger Report Dec. 2018)
- In March 28, 2019, testimony before the U.S. Senate Education Appropriations Subcommittee, the Secretary lauded the Consortium's program as "a Win-Win for everyone involved. Being able to work flexibly and creatively in that way are some of the ways in which we can help rural communities meet the needs of their students."

The beneficial effects of the Consortium's AP access initiative also already have been evident in the students' schools and communities, which have taken great pride in their work.

B. QUALITY OF THE PROJECT DESIGN

(1) The extent to which the goals, objectives, and outcomes to be achieved by the Project are clearly specified and measurable

The Project's **goal** is to significantly expand access for high-need students—that is, promising public high school students from rural, high-poverty communities—to rigorous AP STEM curricula, and to help them succeed in those courses, so they may achieve their full potential and realize the positive outcomes that are concomitants of participation in AP classes and strong performance on AP exams.

The Project's key **objectives** are to increase AP participation and performance among the Consortium students in the four AP courses that will be offered through the Project—AP Physics 1, AP Physics 2, Computer Science A, and Computer Science Principles. The Project's objectives are specific, measurable, achievable, relevant, and time-bound:

Specific: The Project's key objectives are highly specific—they relate to the two widely reported metrics associated with AP exams—participation and performance. Both metrics are compiled by the College Board, which administers the exam, both are shared with students and schools, and both are reported publicly in aggregated formats that are readily accessible.

Measurable: The Project's key objectives, as well as the baselines to which they relate, may be measured with precision. The College Board reports exactly how many students take the AP exam in each subject, the distribution of scores on each exam, and the breakdown of that data for each state by ethnicity, gender, grade, and public vs. private school. Though such granularity is not available with respect to aggregated participation and performance information for particular high schools, each school participating in the Consortium will be asked, as a condition of participation, to consent to the sharing of such aggregated information.

Achievable: The Project has posited AP participation goals that are achievable. Mississippi has slightly over 130,000 high school students, of whom 43.7 percent attend schools in rural districts. (Rural Matters 2017) High-need students constitute, by definition, the top quartile of their classes; if that cohort is further limited to juniors and seniors, who account for the vast majority of AP examinees, the potential pool of high-need students to be served by the Project is approximately 7,000 annually. Although the Consortium contemplates that the number of schools and students participating in the Project will increase substantially over the grant period, at its peak, it still will be far less than 10 percent of the total pool of high-need students. The performance objectives are similarly achievable. Though all participating students will be strongly encouraged to take AP exams—doing so fosters rigor, promotes accountability, and establishes a baseline—the performance objectives assume only 90 percent of students will do so. The performance objectives further recognize that students participating in the Project likely will not initially be at the same level as Mississippi peers who attend schools in relatively affluent and populous areas, where existing AP programs are overwhelmingly concentrated. Thus, the objectives contemplate that the high-need students will achieve qualifying scores at 60 percent of the statewide rate in Year 1, 80 percent in Year 2, and 100 percent in Year 3.

Relevant: Performance objectives quantifying AP participation and performance are directly relevant to an initiative seeking to increase both those metrics.

Time-Bound: The timetable for compiling AP participation and performance data is rigid—by necessity, that data is compiled on a fixed date each year which may not be moved. Preparation for the AP exam will begin in the summer before the AP course is offered, when prospective AP students will attend an IHE-based residential preparatory program. The course will continue through the academic year and end on the exam date. The personnel who will be

primarily responsible for ensuring that preparation for the exam proceeds at an appropriate pace are the AP-certified Supervisory Teacher and the on-site teachers.

In addition to AP participation and performance data, the Consortium will track and consider other data that illuminate various aspects of the Program, and may enhance its design, such as noncognitive factors (see Farrington et al.) and test results that show individual student progress over the course of a year. However, the Consortium will not establish performance objectives, or define success, relative to those additional metrics.

(2) The extent to which there is a conceptual framework underlying the proposed research or demonstration activities and the quality of that framework

The Program implements a blended delivery model for AP content that is based upon a conceptual framework that, in turn, is informed by high-quality research, expert and stakeholder input, and field observations made in the course of the Consortium's AP access initiative. The Project seeks to promote favorable outcomes by providing high-need students the means to excel in STEM subject matter. Numerous studies have found that providing access to AP STEM has a clear positive effect upon student outcomes and post-secondary success. (See Section A(1))

The Program has several key components—its blended instructional model provides AP STEM courses to high-need students by utilizing on-site teachers, remote instruction by subject matter experts, extensive online resources, regular tutoring by college STEM majors, physical textbooks, customized lesson plans, pedagogical support from AP-certified and supervisory teachers, and immersive residential STEM programs at leading IHEs. (See Logic Model below and Appendix G). Each Project component addresses a specific set of considerations, and each is based on a rationale that is informed by relevant research and other inputs.

The Program is animated by the conviction that there are bright students everywhere who are capable of high academic achievement *if* they are provided with sufficient academic supports and high-quality teaching. Ample research affirms what seems to be self-evident—"among school-related factors, teachers matter most." (Rand 2012) However, when qualified teachers are neither on staff nor available to be hired, schools must adapt. In rural, high-poverty schools, additional teacher training is unlikely, in itself, to provide current teachers the substantive foundation to teach AP STEM because of both their subject matter baselines and the propensity of teachers who do become highly trained to move. Yet teachers with strong classroom management skills and some STEM background may succeed in well-defined roles in given substantial backing, both subject matter expertise and pedagogical support. The Project will provide both—through distance instruction by IHE-based subject matter experts, Mississippi-based AP-certified supervisory teachers, and college STEM major tutors from leading colleges.

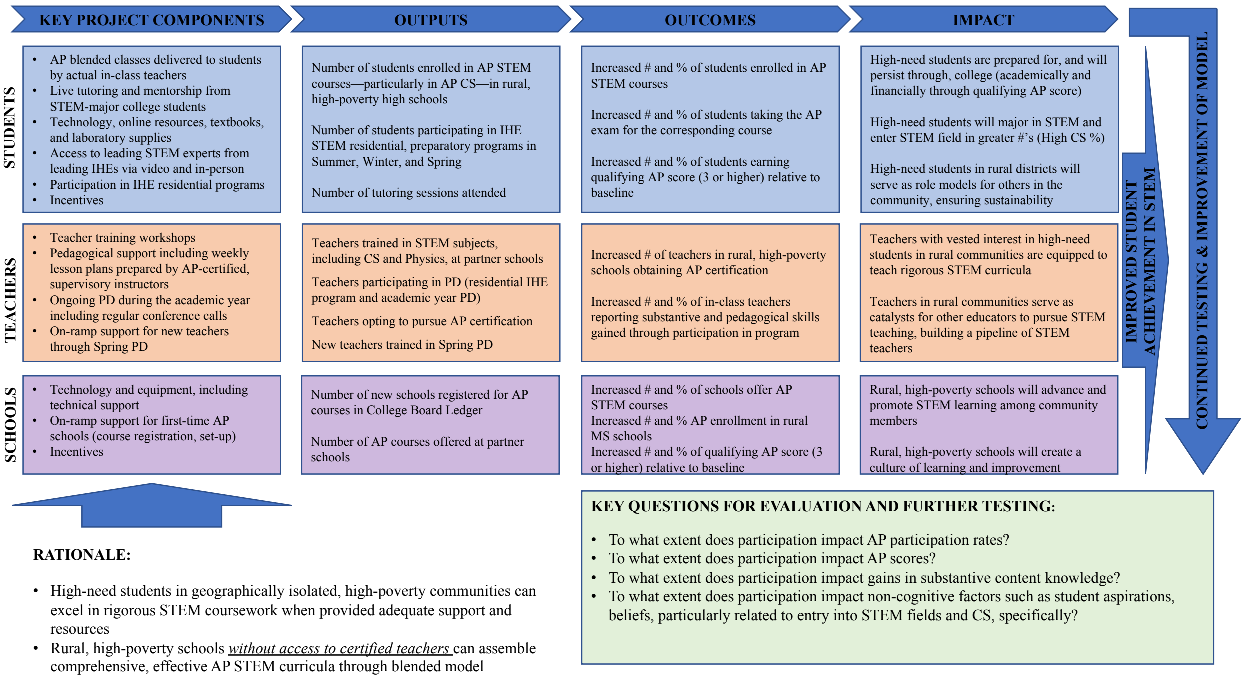
Additional studies have found that a blended instructional model, with both in-person and online components, is an effective means of teaching relative to alternatives that rely upon in-person or online instruction exclusively. (USDE Meta-Analysis 2010) Those studies further affirm that providing some elements of remote instruction—either through synchronous videoconferences or asynchronous video—may be effective if those elements are properly integrated into the overall class design. However, the Consortium recognizes that, to be effective, that blended model must address considerations unique to their districts, schools, and students. Most fundamentally, online instruction is of little use for students with uncertain internet access at school, and none at home. Thus, in addition to expansive online resources, the Program provides physical textbooks and workbooks from leading publishers.

The Program further acknowledges the reality that, in rural, high-poverty districts, even the brightest students typically lack the substantive foundation required to deal with rigorous material, and must receive further preparation before commencing AP courses to succeed. (See Dolan Appendix C) Also, the Project must address the essential need for promising students in rural, *high-poverty* areas to regard themselves as actively engaged in a high-achieving cohort that necessarily is largely of students from other schools. A seminal 2013 study by Caroline Hoxby and Christopher Avery found that a key determinant of the academic paths pursued by high-achieving, low-income students is whether they act in an "achievement–typical" rather than an "income-typical" manner—that is, whether they share the ambitions of students with similar academic profiles rather than those with similar household incomes. Even talented students are strongly predisposed to limit their aspirations to those of other students to whom they are exposed. Yet high-achieving peers whom other talented students may look to as examples tend to be most scarce in places where low-population density and high-poverty rates converge, such as Mississippi. Hoxby and Avery calculate that while "Only 21 percent of achievement-typical students live in a nonurban area…47 percent of income-typical students live in a nonurban area." Conversely, income-typical students tend to come from smaller, more rural schools.

The Project, working closely with IHEs, will utilize various means to encourage high-achieving, low-income students to strengthen their substantive foundations, and, in doing so, to identify with accomplished students beyond their own schools. The Consortium's AP access initiative, upon with the Project will build, brings together—both physically and virtually—groups of promising students from multiple schools to create high-achieving peer groups. Through summer, winter, and spring IHE-based residential programs, students from rural schools where high-achievers may be anomalous and isolated are gathered in a common location to

learn, socialize, and identify with exceptional students from similar schools. Such programs have been held at Mississippi State and the University of Mississippi, the state's flagship universities, Jackson State, one of the nation's largest HBCUs, and Millsaps College, a prestigious private liberal arts college, each of whom has been eager to support the program. The students also work in-person with high-achieving college STEM major tutors at the residential programs, and continue to do so remotely throughout the year through regular videoconference sessions. Those IHE-based residential programs have proven highly successful in both teaching substantive content and catalyzing achievement typical behaviors among the students. Mississippi State University conducted assessments of students who attended the Consortium's 2018 summer program using the Force Concept Inventory, a widely used metric of student readiness for rigorous high school or introductory college Physics courses, and found that "students at the outset of the summer program were, on average, less prepared than most high school students commencing a rigorous first-year Physics course. At the end of the program, the summer program participants were more prepared than most other such students." (MSU 2018). Furthermore, the impact of interactions at those residential programs with exemplary tutors who are proximate in age to the AP students can be transformational. One 2017 summer program participant wrote, unsolicited, "At this camp were two counselors who attend two very prestigious universities: Stanford and Yale…These two brilliant young men have given me appropriate role models to strive to match in success. In fact, I am considering following in their footsteps and diving deeper into the concepts of physics." (Appendix C-5). Those bonds, and the community of achievement those ties create, promote achievement-typical behavior.

Figure 1: Logic Model



(3) The adequacy of procedures for ensuring feedback and continuous improvement in the operation of the Project

Continuous improvement and iterative development are key components of the Consortium's AP STEM Access Program. In order to quickly adapt and make revisions to its model—and to ensure continuous improvement even before a full-scale evaluation—the Consortium will implement a Continuous Improvement Plan which involves the following:

Data-driven approach to adjust Program components: The Consortium utilizes a robust online educational platform on which each student's academic performance is tracked and recorded. This data will enable the Consortium to identify where additional support is needed so that it may quickly deploy additional resources to ensure continuous improvement. The Consortium also analyzes participation data (enrollment, class and tutoring session participation) to assist schools that require additional support.

Formal and informal feedback processes: The Consortium will routinely seek formal feedback from students, teachers, tutors, and other stakeholders on all program elements. The Consortium also will build in opportunities for formal and informal feedback at the residential programs, and to meet with stakeholders to discuss Project implementation and effectiveness.

Ongoing feedback and coordination with Evaluation team: The Consortium's Assistant Director and Evaluation Coordinator will work with the Evaluation team on the Evaluation Advisory Committee, which meets on a bi-annual basis to advise on data collection and on practical and logistical challenges, and engage with emerging results (See Section D, below).

Grant compliance mechanisms: The Consortium will convene monthly meetings to evaluate the status and compliance of the Project and financials. Consortium leaders, who are experienced in administering large grants, will work the IHE program director and Consortium staff to evaluate grant compliance and implement plans for adjustment and refinement as needed.

C. ADEQUACY OF THE RESOURCES AND QUALITY OF MANAGEMENT PLAN

(1) The adequacy of the Management Plan to achieve Project objectives

The Consortium's has developed a robust Management Plan, set forth below, that will achieve the Project's objectives on time and within budget, and has established clearly defined responsibilities, timelines, and milestones for accomplishing Project tasks.

Elements of the Management Plan are memorialized in a management *agreement*—that is, the Cooperative Agreement entered into by each of the Consortium member school districts, and approved by each school district's board. The Cooperative Agreement sets forth, in writing, the responsibilities of each member, and allocates specific key tasks. The Consortium's structure and mission has led to deliberate planning, financial discipline, and program accountability. Because the Cooperative Agreement expressly provides that

marginal costs incurred in connection with the AP access program must be paid for by funds raised by the Consortium from sources other than existing district funds, the Consortium has had to develop detailed plans that specified Consortium budgets, program objectives, timelines, and milestones for accomplishing project tasks, both for review by prospective donors and to ensure that the Consortium could achieve its goals without recourse to school district funds. Finite Consortium resources also have promoted spending restraint. Further, the immutability of the academic calendar and AP testing timetable, and the unequivocal nature of the AP participation and performance metrics, have required to Consortium to meet all applicable deadlines and implement its AP access initiative effectively and efficiently.

The Management Plan below reflects all those considerations, and has been further informed by feedback from administrators, faculty, students, and various stakeholders on successive iterations of its plans and objectives.

Figure 2: Management Plan

Goal	Objectives	Measures	Activities and Milestones	Owner	School Year and Quarter (Summer, Fall, Winter, Spring)
To significantly expand access to AP STEM curricula—and AP Computer Science, in particular—for high-need students in rural, high-poverty MS-public schools, realizing significant gains in participation and performance on corresponding AP exams, and **increased achievement for high-need students in STEM**	Increased student participation in AP STEM courses	College Board AP data, school enrollment data, collected annually	Implementation of blended model including: blended AP courses, tutoring, IHE residential programs	All Consortium staff, member school Directors	YR1, YR2, YR3 - Ongoing
			Recruitment of new rural, high-poverty LEAs and partner schools	ED, AD/EC	YR1, YR2, YR3 – Ongoing with focus on Spring Quarter
			Outreach activities to community members and families for following year	ED, AD/EC, IHE Director	YR1, YR2, YR3 – Ongoing with focus on Winter for on outreach and residential programming for prospective students
			On-ramp support for first-time AP schools	ED, AD/EC	YR1 (Spring) , YR2, YR3 (Summer / Spring)
	Increased performance on AP exams	College Board AP data, based on # of qualifying scores (3 or higher) relative to baseline, collected annually	Students take AP exams	Consortium staff	YR1, YR2, YR3 – Spring Quarter
			AP scores released and evaluated	ED, AD/EC	YR2, YR3 – Summer Quarter
	Substantive and pedagogical gains for in-class teachers	Site visits, informal and formal feedback sessions, increased # of teachers seeking AP certification	Teacher training workshops and IHE programs	IHE Director	YR2, YR3 – Summer Quarter
			PD including regular conference calls with AP Supervisory teachers, IHE PD	IHE Director, ED	YR1, YR2, YR3 - Ongoing
			On-ramp support for new teachers	IHE Director, ED	YR1 (Spring) YR2, YR3 (Summer / Spring)
	Continuous improvement of AP STEM Access program to meet needs of schools and students	Site visits, formal and informal feedback sessions from schools, teachers, and students, Tutor feedback	Track and measure progress from online data platforms to support schools in real-time; technical support	ED, AD/EC	YR1, YR2, YR3 - Ongoing
			Gather and analyze feedback from stakeholders (schools, teachers, students) and implement action plan	ED, AD/EC, IHE Director	YR1 (Spring) YR2, YR3 (Summer / Spring)
			Coordination with CERE Evaluation team for analysis of early findings and efficacy	AD/EC	YR1 (Spring), YR2 (Summer)
	Effectively implement AP STEM Access Program	Site visits, formal and informal feedback sessions, evaluation results	Analyze College Board data (participation and performance)	ED, AD/EC	Y2, YR3 – Summer Quarter
			Programmatic changes implemented	ED, AD/EC	YR2, YR3 – Summer and Winter Quarters
			Evaluation plan updated to reflect early findings	ED, AD/EC	YR 1 - Ongoing

(2) Qualifications, including relevant training and experience, of key personnel

The personnel most key to the Project are the **superintendents of the participating school districts**, each of whom is responsible for implementation of the Project in his or her district. The Consortium is governed by a board comprised of superintendents: **Mr. Jeff** Clay of Aberdeen, **Dr. Todd English** of Booneville, **Dr. Valmadge Towner** of Coahoma AHS, **Dr. James Henderson** of Holmes County, **Dr. Evelyn Jossell** of Quitman County, **Dr. Brock Puckett** of Pontotoc County, **Dr. Tony McGee** of Scott County, and **Dr. Tim Wilder** of South Panola. Each, except one, holds a doctorate in a relevant discipline, each has many years of experience, and each, as evidenced by their district's participation in the Consortium, is exceptionally attentive to the unique demands of high-need students. Attached at Appendix B are resumes of Dr. McGee and Dr. Henderson, who have had Consortium leadership roles.

Subject to the direction of the board, the Project will be staffed by an Executive Director, who will direct all activities of the Project to ensure its objectives are achieved; an Assistant Director/Evaluation Coordinator, who will support the executive director, oversee operations, and provide assistance to the external Evaluation Team; the IHE Program Director, who will liaise with IHE collaborators conducting residential learning programs; and Tutor Coordinators.

In addition, the following persons, whose resumes are attached at Appendix B, have been, and will continue to be, essential to the Consortium's work:

Dean David Rock, Dean of the University of Mississippi School of Education, is a key advisor to the Consortium. Dean Rock also is a key leader in developing effective strategies to address teacher shortages, and is former coordinator of Secondary Education at the University.

Professor Meg Urry, director of the Yale Center for Astronomy and Astrophysics and member of the National Academy of Sciences, is Lead Instructor of the Consortium's AP

Physics 1 course. Professor Urry has been deeply involved with the Consortium since its inception, creating the Physics course and advising on STEM pedagogy.

Dr. Devon Brenner, Head of Department for Curriculum Instruction and Special Education at Mississippi State University, works closely with school districts throughout the state to remedy educational disparities and promote educational opportunity. Dr. Brenner devised and implemented the Consortium's summer preparatory programs in 2017 and 2018, and has remained deeply engaged in planning and operations for the Consortium.

Mr. Dane Peagler is a nationally certified Science teacher and a Mississippi AP Physics-certified teacher. As Supervisory Teacher, he is primary Physics instructor at the IHE-based programs, prepares weekly lesson plans, and provides pedagogical support for in-class teachers.

Dr. Sarah Mason is Director of the Center for Research Evaluation at the University of Mississippi. Dr. Mason is the lead designer of the evaluation protocols for the Project.

[redacted]

(3) The potential for continued support of the project after Federal funding ends

The prospects for continued support of the Project after Federal funding ends are excellent. The Consortium has a proven record of effective fundraising. To date, the Consortium's costs have been covered by private sector supporters, and it already has on hand the matching funds referenced in Appendix H. Also, per-student costs will decline sharply as the Project scales—from Year 1 to Year 3, for example, projected per student costs decline 38.6 percent. Certain major Project expenses are non-recurring, and relate to assets that may be scaled for broad use at little, if any, additional cost. Other program components, such as

tutoring, may be scaled at no cost for specific classes within particular schools as class size increases, as is projected, and may be provided at only modest cost as additional schools participate in the Program. Even costs that have a more linear relation to enrollment will decline on a per capita basis as the program develops. The residential programs will realize certain economies of scale, and, as the Program expands, the IHE component of the preparatory program is expected to be more modest, with more supplemental preparatory programs conducted locally.

D. QUALITY OF THE PROJECT EVALUATION

Evaluation overview: External evaluation activities for the Consortium will be conducted by the Center for Research Evaluation (CERE), an independent evaluation center housed under the Office of Research and Sponsored Programs at the University of Mississippi. The purpose of the evaluation will be threefold: (1) to provide rigorous evidence on the impact of the initiative, (2) to provide credible, reliable—and useful—evidence on factors that facilitate replication in diverse settings, and (3) to test the theoretical linkages (components, mechanisms, mediators) that connect the Consortium's activities to expected outcomes.

Key evaluation questions: These purposes will be explored via the following questions:

1. **Impact:** To what extent does participation in the initiative influence: (a) AP participation rates, (b) AP scores, (c) Substantive content knowledge related to the relevant AP course(s), with a specific focus on computer science, and (d) Non-cognitive factors such as student aspirations, beliefs, and engagement?
2. **Mediators:** To what extent is the relationship between school participation in the initiative and AP scores mediated by influences on: (a) Non-cognitive factors, and (b) AP participation rates?

3. **Implementation:** To what extent was the initiative implemented with fidelity at participating schools? What were the facilitators and barriers to successful implementation and outcomes? What do these findings suggest for future replication and scaling up?
4. **Cost effectiveness:** How cost effective is the initiative for the diverse group of Mississippi schools participating in the project?

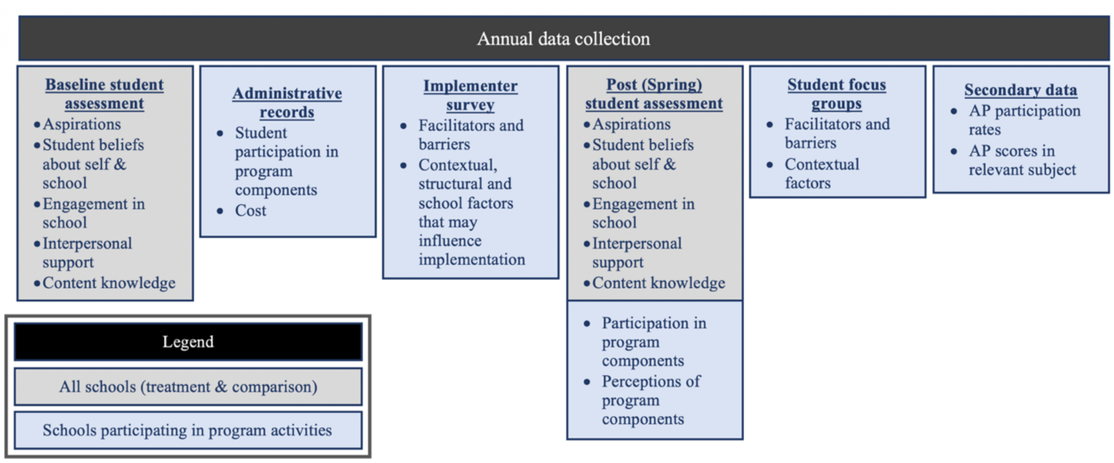
High-level design: CERE will conduct a quasi-experimental design that establishes baseline equivalence at the school level and regularly tracks student-level attrition. In addition, CERE will conduct a mixed-methods implementation evaluation utilizing surveys and interviews to explore (1) the degree to which the program has been implemented as intended and (2) the structural, contextual and practical factors that facilitate/inhibit successful implementation. These are described in more detail below:

1. ***Quasi-experimental design.*** Under this high-level approach, CERE will conduct a multi-site cluster trial in which schools (clusters) are selected as treatment schools and comparison schools are matched, using the Mahalanobis technique, to treatment schools based on school size, per cent minority students, per cent free and reduced lunch, academic performance, and AP registration. Note: The quasi-experimental design would begin in Year 2, with Year 1 being used to pilot and refine evaluation procedures in the treatment group, and to inform program development. At treatment schools, participating students will be asked to complete a pre-survey that captures data on (1) student aspirations, (2) beliefs about self and school, (3) school/STEM engagement, (4) substantive knowledge related to the relevant AP course, and (5) experiences of interpersonal support. At the end of the school year, participating students would also complete a post-survey that captures these same constructs in addition to data on their (1) participation in, and (2) perceptions of the different program components. For Year 2 and Year 3, at comparison

schools, liaison personnel will be asked to identify students who meet the same criteria that treatment schools use to select students. Selected students will also be asked to complete the same pre-survey and post-survey, excluding post-survey items relating to participation in and perceptions of program components. In addition, treatment and comparison schools will be asked to provide data on school-level AP participation rates and AP scores for those students who completed the relevant AP exams. In addition, treatment and comparison schools will be asked to provide data on school-level AP participation rates and AP scores for those students who completed the relevant AP exams.

2. ***Implementation evaluation.*** Additionally, CERE would conduct (1) a brief implementer survey to understand factors that helped and hindered program implementation and quality, (2) student focus groups to explore these issues from a student perspective, and (3) analysis of administrative records relating to student participation in program components, obtained from program implementers on a quarterly basis. Cost estimates would also be obtained from administrative records. See Figure 3 for an overview of the high-level design.

Figure 3: High-level evaluation design.



Analysis: Impact questions will be analyzed annually using Mixed-design Analysis of Variance with students nested in schools. In Years 2 and 3, treatment students would be compared to those

in comparison schools, with dosage (i.e. # years exposure) added into the analysis. Additional interaction terms would be would be included to examine sub-group differences. Questions relating to mechanisms would be assessed using Structural Equation Modelling. Cost-effectiveness would be addressed by calculating a cost-effectiveness ratio for each year.

Evaluation Management: CERE would also establish an evaluation advisory committee, comprised of representatives from the Consortium and a small number of treatment and comparison schools, who would meet on a bi-annual basis to advise on data collection, advise on practical and logistical challenges, and engage with emerging results.

(1) The extent to which methods of evaluation will, if well implemented, produce evidence about Project's effectiveness meeting What Works Clearinghouse standards

The proposed evaluation meets the What Works Clearinghouse standards in the following ways: (1) For Year 2 and Year 3, students in treatment and comparison groups would be assessed at baseline on student aspirations, beliefs about self and school, school/STEM engagement, substantive knowledge, and experiences of interpersonal support so that baseline equivalence can be established. Given the relatively unique group of individuals likely to be taking part in the Initiative, students at comparison schools would be over-sampled at baseline in an effort to ensure an appropriately equivalent comparison group could be identified. (2) Cluster-level data on AP participation and any prior AP scores would also be obtained so that baseline equivalence could be established at the cluster-level. (3) Memorandums of Understanding outlining participation and evaluation-related commitments would also be signed with each school at the beginning of each year in an effort to make commitments explicit and minimize attrition. (4) The Initiative would also offer both school-level and student-level incentives in an effort to minimize

attrition and ensure representative samples at post-test. (5) Measures consistent with WWC guidelines would also be used to track overall and differential attrition during the project.

(2) **The extent to which the evaluation will provide guidance about effective strategies suitable for replication or testing in other settings**

Evaluation question 3 is intentionally designed to provide guidance on strategies for replication in other settings. By collecting data on project components, as well as structural and contextual factors (e.g. school support, community engagement, prior education) through the implementation evaluation, CERE would develop tentative hypotheses about factors that support replication during the first and second year of the project. These tentative hypotheses would then be subjected to confirmatory tests in Year 3, using Structural Equation Modelling with the new cohort of participating students and schools.

(3) **The extent to which the methods of evaluation will provide valid and reliable performance data on relevant outcomes**

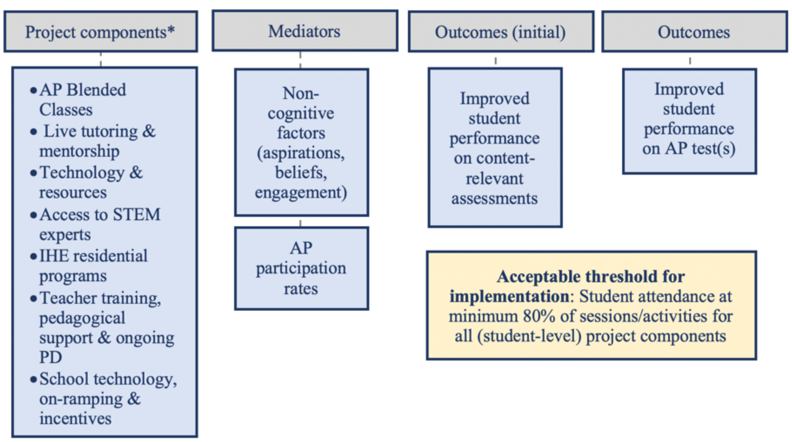
Where possible, measures would be sourced from previously validated scales. Specifically: non-cognitive factors would be assessed using the **Research Assessment Package for Schools** (RAPS), a set of tools that have been extensively studied across a diverse array of student populations, with results demonstrating strong reliability (>.70) and predictive validity with respect to student performance (Fredricks et al., 2011). Substantive content knowledge would similarly be measured by the **Force Concept Inventory** (for Physics), which has been given a "gold star" validation rating and has been used in more than 50 studies, capturing data on over 35,000 students (e.g. see Hestenes et al., 1992). Substantive content knowledge for Computer Science would be measured using the **FSC1** measure, an instrument measuring knowledge of introductory computer science principles that has been shown to have predictive

validity with respect to performance on the AP CSI1 exam (Tew & Guzdial, 2011). Substantive content knowledge for other AP classes would use similar, previously validated assessments. If prior measures were not publicly available, CERE would develop these in partnership with the Consortium, with a pilot phase to test for reliability and structure during the Project's first year.

(4) The extent to which the evaluation plan clearly articulates key Project components, mediators, and outcomes, as well as a measurable threshold for acceptable implementation

Project components, mediators and outcomes are identified in the figure below.

Figure 4: Project Components, Mediators, and Outcomes



The Consortium also recognizes that the **<u>dissemination of evaluation findings</u>** is essential to continuous improvement. Thus, the Consortium will make evaluation findings relating to the Project public through the Consortium's website, peer-reviewed publications, conferences (*e.g.*, College Board forum, MASS), workshops, and public forums. The Project Budget provides for travel of appropriate personnel for such purposes. The Consortium will also provide regular updates to member schools regarding evaluation findings.

CONCLUSION

The Program will significantly expand AP access and achievement among high-need students.

BIBLIOGRAPHY

Amaka, I.H.; Goeman, K.; "Selecting Media for Effective Learning in Online and Blended Courses: A Review Study", *Journal of Educational Multimedia and Hypermedia*, January 2017.

Chetty, R.; Friedman, J.; Saez, E.; Turner, N. & Yagan, D.; Mobility Report Cards: *The Role of Colleges in Intergenerational Mobility* (July 2017).

College Board, *Annual AP Program Participation 1956-2017.*

College Board, *AP Physics 1: Algebra-Based Course Overview* (accessed April 1, 2019).

College Board, *AP Program Participation and Performance Data 2018*.

College Board, *AP Student Success at the College Level: Key Research* (2016).

College Board, *The 10th Annual AP Report to the Nation* (February 11, 2014).

DeAngelo, Linda; Franke, Ray; Hurtado, Sylvia; & Pryor, John; *Completing College: Assessing Graduation Rates at Four-Year Institutions* (Higher Education Research Institute, Graduate School of Education & Information Studies, University of California at Los Angeles)(2011).

Economic Innovation Group, *Distressed Communities Index* (accessed April 1, 2018).

Education Commission of the States, *Advanced Placement Access and Success: How do rural schools stack up?* (2017).

Equity and Excellence Commission, "For Each and Every Child: A Strategy for Education Equity and Excellence" (*Report to the U.S. Secretary of Education, February 2, 2013*).

Farrington, C., Johnson, D., Allensworth, E., Nagaoka, J., Roderick, M., Beechum, N.W. & Keyes, T; "Teaching Adolescents to Become Learners" UChicagoConsotrium on School Research (June 2012).

Fredricks, J., McColskey, W., Meli, J., Mordica, J., Montrosse, B., & Mooney, K.; Measuring Student Engagement in Upper Elementary through High School: A Description of 21 Instruments. Issues & Answers. REL 2011-No. 098. *Regional Educational Laboratory Southeast* (2011).

Gagnon, D. & Mattingly, M.; "*Limited Access to AP Courses for Students in Smaller and More Isolated Rural School Districts* " (University of New Hampshire Carsey School of Public Policy, Winter 2015).

Gewertz, Catherine; "Federal Data Show Unequal Access to Challenging Math and Science Courses" (*Education Week*, June 7, 2016).

Government Accountability Office, *K-12 Education: Better Use of Information Could Help Agencies Identify Disparities and Address Racial Discrimination* (GAO-16-345, April 2016).

Harris, Bracey; "Mississippi School for Math and Science cuts enrollment, cites funding" (*The Clarion-Ledger*, June 1, 2016).

Harvard University, *Opportunity Atlas (*accessed February 19, 2019).

Hestenes, D., Wells, M., & Swackhamer, G.; Force concept inventory. *The physics teacher*, (1992).

Hoxby, C.; & Avery, C.; "The Missing 'One-Offs': The Hidden Supply of High-Achieving, Low-Income Students", Brookings Papers on Economic Activity (2013).

Mattern, K.; Marini, J. & Shaw, E.; *Are AP® Students More Likely to Graduate from College on Time?* (College Board Research Report 2013-5).

Mississippi Department of Education, *Advanced Placement in Mississippi: State Board of Education Presentation* (September 17, 2015).

Mississippi Department of Education Enrollment Data (2017-2018).

Mississippi Department of Employment Security, *Mississippi Per Capita Income By County 2016*.

Mississippi State University, "Students in AP preparatory program show dramatic progress" (September 6, 2018).

Neuhauser, Ian, "Students Want STEM, but Schools Can't Find the Teachers" (*U.S. News & World Report*, May 19, 2016).

Rand Corporation, *Teachers Matter: Understanding Teachers' Impact on Student Achievement* Corporation (2012).

Reginal, Travis; "Reflections on the Road to Yale: A First Generation Student Striving to Inspire Black Youth" (*New York Times*, July 30, 2013).

Shaw, E., Marini, J.; & Mattern, K.; *Considering Practical Uses of Advanced Placement Information in College Admission* (College Board Research Note 2014-1).

Stewart, Shea; "Students Study Physics During UM Spring Break Visit" (University of Mississippi News, April 4, 2018).

Showalter, D.; Klein, R.; Johnson, J. & Hartman, S.; *Why Rural Matters 2015-2016* (Report of the Rural School and Committee Trust, June 2017).

Tew, A. E., Guzdial, M. The FCS1: a language independent assessment of CS1 knowledge. In *Proceedings of the 42nd ACM technical symposium on Computer science education* . ACM. (2011, March).

University of Mississippi, *Credit by Examination: Advanced Placement (AP)* (accessed February 12, 2018).

U.S. Census Bureau, *QuickFacts: Mississippi* (2019).

U.S. Census Bureau, Small Area Income and Poverty Estimates: 2016 (*Current Population Reports*, P30-02, November 2017).

U.S. Census Bureau, *Small Area Income and Poverty Estimates, 2016: Ages 5 to 17 in Families in Poverty: Mississippi School Districts*.

U.S. Department of Agriculture, Economic Research Service, *State and County Percent of total population living in poverty, 2016: Mississippi*.

U.S. Department of Education, National Center for Education Statistics, Rural Education in America; Table A.1.a.-1: Number of public school districts, by district urban-centric 12-category locale and state or jurisdiction: 2012-23.

U.S. Department of Education, Office for Civil Rights, *Data Snapshot: College and Career Readiness* (Issue Brief No. 3; March 2014).

U.S. Department of Education, *The Toolbox Revisited: Paths to Degree Completion From High School Through College* (2006).

U.S. Department of Education Office of Civil Rights, *High School Math and Science Enrollment; Advanced Placement Course and Test Taking (2013).*

Walton Family Foundation, *Delta Quality of Life Survey Report* (2018).