­ MA Department of Elementary and Secondary Education

Evaluation of the Statewide STEM Advanced Placement Program

Year 1 Interim Report

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# Introduction

The Massachusetts Department of Elementary and Secondary Education (ESE) is engaged in numerous initiatives to increase the college and career readiness of students in the Commonwealth, to reduce proficiency gaps and improve academic achievement for all population groups, and to enhance the “STEM pipeline” of students who are interested in and well prepared for postsecondary education and careers in science, technology, mathematics, and engineering.

One of these initiatives is the Advancing STEM through an Advanced Placement® Science and Mathematics program (hereafter “the program” or the “Advancing STEM AP program”). The goals of the program are to:

* 1. Increase AP science and mathematics course availability, particularly at schools with limited AP science and mathematics offerings and high percentages of low-income and minority students;
  2. Increase access to and participation in AP science and mathematics courses, particularly for students from ethnic, racial, gender, English proficiency, and socioeconomic groups that have been traditionally underserved, so the demographics of these courses better reflect the diversity of the student population of the school and district;
  3. Increase student achievement in AP science and mathematics courses, particularly to close Massachusetts academic achievement gaps;
  4. Increase readiness for college-level study in STEM fields;
  5. Improve science and mathematics teacher effectiveness, including content knowledge and pedagogical skills; and
  6. Increase student interest in pursuing a STEM degree or a STEM-related career after high school.

In order to meet these program goals and track efforts to improve student achievement, ESE contracted with the Mass Insight Education’s Mass Math + Science Initiative (MMSI) as a vendor to implement tasks and responsibilities aligned with the purposes of the program. The implementation of the statewide Advancing STEM AP program involves four key central tasks to be implemented in 61 partner schools:

* 1. Increase participation in AP science and mathematics courses, particularly among underserved populations;
  2. Increase performance in AP science and mathematics courses, particularly among underserved populations;
  3. Increase the number of new and/or additional AP science and mathematics courses offered by the partner districts and schools;
  4. Work in conjunction with statewide Race to the Top (RTTT) pre-AP teacher training program to align efforts of both programs in those districts participating in both programs.

In their work to complete these tasks, MMSI was responsible for a variety of activities including: maintaining partnerships with schools with high percentages of minority and low income students, encouraging recruitment of minority and low income students into AP science and mathematics classes, educating stakeholders about the benefits of the AP program and STEM careers, assisting districts in eliminating barriers to STEM AP courses faced by typically underserved students, conducting extracurricular study sessions and test preparation sessions, providing exam fee subsidies to low income students, supporting professional development for STEM AP teachers, supporting teacher attendance at the College Board’s AP summer institute, encouraging curriculum alignment, providing guidance and funds for equipment in new or expanded STEM AP courses, monitoring teacher effectiveness and fidelity to the implementation of the program, and assisting vertical teams of grade 6–10 pre-AP trained science and mathematics teachers and STEM AP teachers.

ESE contracted with the University of Massachusetts Donahue Institute (UMDI) to conduct the first year of a potential three year evaluation of the Advancing STEM AP program. The goals of the first year evaluation are to inform immediate programming and to prepare for two following years of data collection and evaluation in the event that additional funding is available to continue the research.

Analysis of the data collected during this first year is intended to yield findings regarding:

* Professional development and support offered to new and existing teachers of science, mathematics, and English at schools that participate in the Advancing STEM AP program, as well as intended increases in knowledge and pedagogical skills among these teachers;
* Strategies used to increase science and mathematics AP course availability, and to identify and encourage participation of typically underserved students in these courses.

This interim report describes findings from the initial evaluation activities that were conducted during the first year of the project: interviews with ESE and MMSI personnel, a teacher survey, and analysis of MMSI teacher training participation data. In doing so, it reviews the achievements made by the program toward meeting its initial goals and identifies successful practices and barriers encountered.

# Methodology

**Evaluation Design**

This evaluation study uses a mixed-method design that focuses on quantitative information gathered through a teacher survey and teacher training participation data provided by the vendor, as well as qualitative data drawn from interviews of key personnel and open-ended survey items. Specifically, the findings generated from the first year of data collection and analysis are meant to inform the following research questions:

* What support has been provided for district efforts to offer additional AP courses?
* What professional development has been offered to current and newly recruited AP teachers?
* Have STEM teachers who received professional development increased their knowledge and pedagogical skills relevant to increasing student success in AP courses and exams?
* What strategies have been used to increase AP course availability, identify underrepresented students, and encourage them to take AP courses?

These research questions are based on the logic model depicted in Figure 1.

**Figure 1. Advancing STEM AP Logic Model**

**Provide PD** to current and newly recruited Advanced Placement teachers

**Identify and encourage** underrepresented studentsfor

Advanced Placement courses

**Increased underrepresented student participation in AP courses**

**Improved teacher knowledge and skills**

**Increased AP course availability**

**More students from underrepresented groups successfully completing ELA, mathematics, and science AP exams coursework**

*Core Activities*Support district efforts to **offer** **additional** Advanced Placementcourses

*Intermediate Outcomes*

*Overall Outcome*

**Data Collection Activities**

This evaluation used the following data collection methods and analytical measures to inform the research questions listed above.

**ESE and Vendor Interviews**

Interviews were conducted with key personnel at ESE and the professional development vendor (MMSI) to gain information regarding the following: professional development and support that has been provided to districts; their knowledge of school and district strategies utilized to increase AP course availability; identification of underrepresented students and encouragement to take AP courses; and other emergent issues. Additionally, interviews with the ESE staff person and the president of MMSI were used to guide the development of the teacher survey. The interviews were conducted with the following key personnel from ESE and MMSI:

* **Roxane Johnson De Lear** – *Science Assistance Coordinator and Project Manager for Pre-AP Teacher Training Program, ESE*
* **Morton Orlov II** – President, MMSI
* **John Smolenski** – Senior Field Director, MMSI

**Teacher Survey**

The teacher survey provides data regarding: professional development and support received; strategies utilized to increase AP course availability, encourage traditionally underrepresented students to take AP courses, support the success of these students in coursework and exams, and gauge teachers’ improvements in knowledge and pedagogical skills relevant to the program through self-reporting and other emergent issues relevant to ESE and the program vendor. The survey was developed by UMDI researchers with iterative feedback from relevant ESE and MMSI personnel. A link to the online teacher survey was sent to teachers who were included on an Advancing STEM AP participant roster provided by MMSI.

**Training Participation Database**

MMSI provided a database of all teachers who participated in two program training events held in 2012. This information provides an initial quantitative indicator of the extent of teacher and school participation in the Advancing STEM AP program.

**Data Analysis**

Data collected in the online teacher survey were entered into a database in a statistical software package (SPSS). The data were analyzed using descriptive statistics. Also, in order to compare STEM AP teachers’ responses to the responses of AP English teachers, a Chi Square analysis was employed to test whether differences between the STEM teacher responses and English teacher responses are statistically significant.

Data from interviews and open-ended survey items were analyzed to document characteristics of program implementation from the perspectives of teachers, the program vendor, and ESE program managers. These data were analyzed using a standard qualitative technique that involved multiple reviews and readings of the data. Themes and concepts were developed around emergent and recurring ideas that informed the research questions.

# Results

This section of the report contains the results and findings from the analysis of semi-structured key informant interviews with ESE and MMSI personnel, the online teacher survey, and teacher training data. It is organized into the following sections:

* + Interviews with ESE and MMSI Personnel
  + Teacher Survey
  + Participation in MMSI Teacher Training

## Interviews with ESE and MMSI Personnel

The interviews with key personnel from ESE and MMSI provided the opportunity to inform the formative research questions articulated above. In addition to speaking to topics included in the research questions, the interviewees also provided information regarding the program’s design, elements of which were used in the creation of the teacher survey. It should also be noted that in addition to the more formal interviews, interviewees provided recommendations in an iterative process of drafting the survey.

The section below outlines some key aspects of the Advancing STEM AP program, according to the interviewees, relevant to identifying and recruiting students targeted by this program as well as the supports, professional development opportunities, and strategies meant to promote student success.

**Purpose of Program, Targeted Schools, and Students**

MMSI was founded in 2007 with funding provided through a national initiative to create an AP training and incentive program. The program was created to address AP enrollment and success of traditionally underserved students in STEM fields. According to MMSI, the population of “underserved students” is broadly defined and includes Latino, African-American, and low-income students.

Since its first cohort of ten schools in 2007, MMSI has identified schools with a high percentage of minority and low-income students. There has been particular interest in recruiting schools in urban areas, though MMSI has begun to direct its attention to schools in non-urban districts, such as Athol Public Schools. The process of selecting schools is strategic as well as competitive. Participating schools must sign a letter of agreement that outlines the responsibilities of MMSI and the school regarding program elements such as teacher and student awards, professional development and training for teachers, and outreach efforts. Currently the program extends to 61 schools with the intention of continuing the practice of adding new cohorts of schools in future years.

According to Johnson De Lear, in providing funding to the Advancing STEM AP program and working with MMSI, ESE has set out to prove that if you give students “opportunity and respect” and classes taught by teachers with quality training, they will perform. Smolenski agreed with this approach and said that the success of students in AP courses depends on providing them with trained teachers, and then providing both students and teachers with the supports they need.

**Support Provided for District Efforts to Offer Additional AP Courses**

MMSI interviewees explained that one of the initial steps in helping schools to add STEM AP courses to their curriculum is convincing schools that additional courses are warranted. According to the MMSI interviewees, this often involves expanding teachers’ and administrators’ perception of potential AP students. Once schools realize that there is a much larger pool of potential AP scholars, the need for additional courses and sections becomes more distinct. Smolenski called this process “opening up the pyramid.” In his experience, teachers often only encourage high achieving students to take AP classes. By opening up AP classes to non-honors students, making other adjustments to AP prerequisites, and recruiting typically underrepresented students, schools can discover a much larger pool of prospective AP students.

Orlov echoed this philosophy, saying that AP students should not be selected from just the top performing students, and that many students, with the right supports, can succeed completing more rigorous coursework. He summed up the difference in these approaches as “developing” rather than “picking” talent.

Part of changing this preconception of a potential AP student involves aligning pre-AP curriculum with the AP curriculum so that students are ready for these rigorous high school courses. The Advancing STEM AP program encourages vertical team meetings, where middle school and high school teachers can come together to develop a common language and overlapping trajectories within their content areas. By tying grades 6–10 curriculum with AP coursework, schools are able to improve the “feeder system” of the lower grades and start to prepare students for demanding coursework in their academic careers.

Vertical team meetings are considered important to this type of coordination because middle school and high school teachers do not often have the opportunity to talk to each other and establish collaborations. MMSI actively works with schools to improve course sequences that will support student success on the STEM AP exams. The Chelsea district was offered as a strong example of this improved sequencing: the high school now offers biology in ninth grade so that if students enroll in AP Biology in tenth grade, they have had two years of biology instruction before they take the AP exam. Smolenski said that the curricular sequencing support offered by MMSI is important in regard to making sure students have the right academic experience before facing the challenges of AP courses and exams.

MMSI is also able to facilitate the addition of AP courses and sections by defraying the cost of purchasing equipment and supplies needed for these classes. These courses often require specific and expensive items that might deter schools from including them in their course offerings. Per the ESE/MMSI work plan and MMSI’s own “Program Elements of Success,” schools are assisted in purchasing items such as textbooks, spectrophotometers, and graphing calculators for new and expanded AP science and mathematics courses.

**Professional Development Offered to Current and Newly Recruited AP Teachers**

The professional development and other assistance provided to teachers in the Advancing STEM AP Program are described as intentional “layers of support.” There are formal professional development sessions, geographically-based teacher “clusters,” and personnel at various levels who can provide resources and guidance for STEM AP and English teachers who participate in the program.

More formal opportunities include the MMSI AP Summer Institute, the Two-Day Workshops, and pre-AP training. Each of these forms of teacher support are MMSI “Program Elements of Success.” MMSI puts considerable stock in the importance of these opportunities. Ideally, teachers in the program will do at least two AP Summer Institutes and a Two-Day Workshop. Notably, workshops are differentiated to meet the needs of new as well as current AP teachers. MMSI interviewees noted that it is important to get new teachers into a Summer Institute as soon as possible before providing instruction to AP students. According to Smolenski, it takes about three years for a teacher to develop into an AP instructor.

There are content directors - subject matter experts - who provide professional development and coordinate the operation of the Saturday study sessions offered to students. They also provide instructional guidance, lesson plans, logistical assistance, and other resources to schools and teachers. These individuals are usually retired “master teachers,” with extensive teaching experience in their content area. According to Smolenski, these personnel are “responsible for the success” of the Advancing STEM AP program.

Participating districts and schools are organized into several “clusters” which serve various functions to support teachers and students. Each cluster provides Saturday sessions to students in the districts belonging to that cluster. The sessions are held on a rotating basis at the cluster’s high schools. The sessions typically consist of four modules taught by four different teachers drawn from the cluster’s districts. These sessions also function as professional development opportunities for the teachers presenting the modules: In addition to instructing the students, they are also essentially presenting their teaching skills and approaches in front of their peers in attendance. These presenters are financially compensated by MMSI.

Each cluster also has lead teachers (one per content area) who are responsible for setting up and running the Saturday sessions as well as providing lesson plans and other materials to teachers in their cluster. The lead teachers facilitate a community of teachers who work together to provide support in terms of resources, instruction, and promoting students’ success.

**Increases in participating teachers’ knowledge and pedagogical skills relevant to increasing student success in AP courses and exams**

Again, the MMSI interviewees indicated that the Summer AP Institutes and two-day workshops were important to improving teachers’ professional capacities, particularly in regard to teachers who were new to teaching AP courses. The cluster model was praised in that it provided a community of educators who could lend each other mutual support.

It is important to note that the program intentionally provides financial rewards to teachers who can develop students who are successful on AP exams. Participating AP teachers receive a financial benefit ($100) for each qualifying score earned by their students, therefore they have a concrete incentive to improve their own professional capacity and help students succeed. Ensuring the implementation of these teacher rewards is not always easy. Sometimes teacher labor associations balk at the idea of merit-based pay. However, MMSI has briefed faculty and teacher associations and has been successful in forging agreements regarding the awards. There was reportedly some “anxiety” over this issue when the program began; however, there is less concern now.

Smolenski contends that districts experience added benefits due to these professional development opportunities given to AP teachers in the program. He argues that increases in MCAS scores in some of the participating schools is the result of a “trickledown effect.” More specifically, AP teachers take part in the Advancing STEM AP program’s professional development opportunities, the knowledge and pedagogical skills they acquire not only improve their AP students’ scores on AP exams – they also benefit the AP students’ MCAS scores and the MCAS scores of students they teach in non-AP classes. It is also possible that program participants pass along the information and skills they gain in the professional development to teachers in their districts who do not participate in the program.

**Strategies used in the program to increase underrepresented students’ enrollment and success in AP course and exams**

**Increases in AP course availability and identification of underrepresented students**

After changing schools’ preconceptions of who potential AP scholars are, the next step in expanding the pool of AP students is to make more of them eligible for AP courses by removing barriers and promoting open access. MMSI asks schools to only require that students meet *literal* prerequisites such as having been promoted to the appropriate grade or having taken the correct course sequence (i.e., pre-calculus before AP calculus) in order to take an AP course. Orlov explained that the shift to open access should not be minimal, saying, “We are not looking for *marginal* change. I want to see 100 percent change over a few years.” Schools are held accountable for opening up courses to more students. Each school has a designated administrator who is required to report the increases in the number of students who are enrolled in STEM AP courses. Designated administrators are also eligible for financial rewards based on enrollment numbers.

**Encouragement of underrepresented students to take AP courses**

The MMSI interviewees reported that many schools have made the transition to a broader definition of potential AP students and providing open access to AP courses. This openness is sometimes reflected in the schools’ recruitment strategies; for example Worcester was described as having a “world class” outreach to minority students.

MMSI is sometimes involved in the variety of ways schools use to recruit students for STEM AP classes. First, MMSI holds a “kickoff event” in each school that joins the program. This can help create awareness and excitement. Also, the English content director, Sally Guadagno, often visits schools to sell the course to students. According to Smolenski, she is very effective and interesting when recruiting students and that her visits can be “transformational” in terms of how students view taking part in AP classes.

Defraying costs of taking AP courses is another way the program attracts students to AP course work. The existence of exam fees may be off-putting to low-income students who may not be able to afford these added expenses. However, students who demonstrate need are able to apply for fee waivers. These waivers used to cover half the cost, but now cover about a fourth of the exam fees. Students are also offered financial rewards for earning qualifying scores on their AP exams. If a student earns a 3, 4, or 5 on the exam, they receive $100 through the MMSI program. In addition to the monetary awards, schools hold “celebrations” to mark the achievements of students on their AP exams.

For many low-income students future college costs are of considerable concern. Teachers and program personnel explain how taking AP courses can cut the amount they spend on college. By earning qualifying scores while in high school students can obtain academic credits that they will not have to pay for later in college. Smolenski reported that an effective approach to recruiting students to point out that taking AP classes in high school gets some of the work out of the way before attending a college or university. Additionally, teachers and MMSI personnel explain to students how rigorous AP course work can prepare them for difficult college curriculum.

In particular, Smolenski underscored the use of AP English courses (specifically Language and Composition) as a gateway course for many potential STEM AP students. Reportedly, encouraging students to take AP English is effective in both increasing enrollment and promoting student success in STEM AP courses. He explained that for students to succeed in the STEM AP courses, they need to be able to read college level textbooks, think analytically, and be able to synthesize information. AP English prepares them for these difficult tasks. Also, while taking AP English and gaining these AP-level English language skills, students build their confidence and come to see themselves as AP students. Once they view themselves as AP scholars, students are more likely to then enroll in STEM AP classes. Everything, according to Smolenski, “dovetails” from the AP Language and Composition course.

**Successful Outcomes**

The three interviewees were positive about the how the program’s success in fulfilling the overall goal of having more underrepresented students succeeding in STEM AP courses. Johnson De Lear pointed to the fact that about 11,000 low-income students took STEM AP courses last year as evidence of the present success of the program.

Another promising outcome of the program according to Smolenski is that when districts see the success of the Advancing STEM AP program at the high school level, they often want to expand similar programming to lower grades. Smolenski reports that more schools have become interested in pre-AP training for grades 6–10. Additionally, some schools that are coming to the end of their participation in the formal program are interested in retaining MMSI’s assistance and services. MMSI could sustain their training and assistance in these schools on a fee-for-service basis.

The program’s reputation for success extends beyond the borders of high schools and educators. Purportedly, state legislators and mayors want to see the program implemented for their constituents. They have told him that MMSI and the Advancing STEM AP program need to be in their schools.

**Barriers or Difficulties Encountered in the Implementation of the Program**

The interviewees identified a handful of barriers or concerns with regard to program implementation and meeting the desired outcomes. The consequences of reduced funding, teachers’ unwillingness to facilitate open access to STEM AP courses, and the lack of assistance provided to students who fail to earn a qualifying score on their AP exams were raised as current or potential implementation issues.

The fact that the funding sources are different and reduced was voiced as a concern. The funding that was provided by Exxon is no longer available, and now the program is reliant on state and other private funding. In order to sustain its programming, MMSI has started to impose fees on participating schools. More specifically, MMSI now charges schools $40 per student, per session for the Saturday sessions.

According to MMSI, the money that is currently allocated for next year’s programming will not allow MMSI to include all of the schools that want to join the Advancing STEM AP program, which he calls a “lost opportunity.” He said that a consequence of not expanding the program is that potential STEM AP students cannot benefit from this coursework, and so segments of the future STEM-related workforce are lost.

As previously noted, there has been some reluctance by teachers to recruit students who are not already very high achieving scholars. Orlov also expressed interest in finding out the extent to which teachers are reluctant to create open access exists among teachers as well as their reasons for reluctance. He wondered if teachers may be more concerned about the percentage of students passing AP exams, not the absolute number. The purpose of the Advancing STEM AP program is to expand participation and create open access; therefore the goal is to increase the total *number* of students passing not the *rate* of students passing. Teachers could be resistant to a program that may increase the number of recruited students and passing scores but also reduce the percentage of students earning qualifying scores.

Johnson De Lear was curious about the follow-up offered to students who do not have initial success in the AP courses and particularly on AP exams. She was interested to know what, if any, interventions these students receive from their schools and teachers if they fail to earn a qualifying score. The potential lack of follow-up with these students could be a possible gap in the program particularly in regard to promoting student success. It underscores the importance of examining whether these students receive additional attention and assistance or if the support ends after they fail to earn a qualifying score when taking the exam for the first time.

## Teacher Survey

A key component of the first year of the Advancing STEM AP evaluation is obtaining the perspectives of teachers who participated in MMSI’s Advancing STEM AP program. In late spring, UMDI emailed an online survey link to STEM AP and AP English teachers from 61 high schools in 50 districts that were part of this program. In total, 347 individuals responded to the survey, representing about 63 percent of identified participants. There was at least one respondent from each district and school participating in the Advancing STEM AP program.

### Respondent Profile

Respondents to the survey included 233 (67 percent) teachers who teach STEM AP courses and 144 (33 percent) teachers who teach AP English courses. These proportions represented by the survey respondents are consistent with the STEM/English teacher breakdown of the total population of the program. See Table 1 for all responses.

| Table 1. Respondents’ School Districts  **N: STEM AP Teacher = 233, AP English Teacher = 114** | | |
| --- | --- | --- |
| **School District** | **Number of Responses** | |
| **STEM AP Teacher** | **AP English Teacher** |
| Agawam Public Schools | 4 | 2 |
| Athol-Royalston Public Schools | 4 | 1 |
| Attleboro Public Schools | 5 | 4 |
| Auburn Public Schools | 6 | 2 |
| Barnstable Public Schools | 5 | 1 |
| Bellingham Public Schools | 3 | 3 |
| Boston Collegiate Charter School | 3 | 0 |
| Boston Public Schools | 21 | 10 |
| Chelsea Public Schools | 6 | 2 |
| Chicopee Public Schools | 5 | 4 |
| Danvers Public Schools | 2 | 1 |
| Dedham Public Schools | 6 | 3 |
| Douglas Public Schools | 5 | 2 |
| Dracut Public Schools | 3 | 2 |
| East Bridgewater Public Schools | 2 | 1 |
| Easthampton Public Schools | 2 | 1 |
| Fall River Public Schools | 8 | 4 |
| Fitchburg Public Schools | 3 | 2 |
| Frontier Regional Public Schools | 2 | 0 |
| Gardner Public Schools | 3 | 2 |
| Gill-Montague Public Schools | 4 | 1 |
| Greenfield Public Schools | 2 | 2 |
| Lee Public Schools | 2 | 2 |
| Leicester Public Schools | 5 | 0 |
| Ludlow Public Schools | 5 | 2 |
|  |  |  |
| Malden Public Schools | 5 | 3 |
| Marlborough Public Schools | 8 | 5 |
| Mashpee Public Schools | 2 | 1 |
| Mendon-Upton Regional School District | 4 | 2 |
| Methuen Public Schools | 7 | 4 |
| Middleborough Public Schools | 7 | 2 |
| Narragansett Regional School District | 3 | 0 |
| North Adams Public Schools | 4 | 3 |
| Northampton Public Schools | 5 | 3 |
| Northbridge Public Schools | 6 | 1 |
| Norton Public Schools | 6 | 2 |
| Palmer Public Schools | 2 | 2 |
| Peabody Public Schools | 5 | 3 |
| Quaboag Regional School District | 2 | 2 |
| Randolph Public Schools | 4 | 1 |
| Salem Academy Charter School | 0 | 1 |
| Salem Public Schools | 5 | 1 |
| South Hadley Public Schools | 4 | 4 |
| Springfield Public Schools | 8 | 7 |
| Uxbridge Public Schools | 4 | 1 |
| Ware Public Schools | 2 | 1 |
| West Springfield Public Schools | 3 | 2 |
| Whitman-Hanson Regional School District | 5 | 1 |
| Winthrop Public Schools | 1 | 1 |
| Worcester Public Schools | 15 | 7 |
| **Total** | 233 | 114 |
| **347** | |

Respondents to the participant survey were asked to indicate which AP course(s) they taught in the most recent school year (SY2012–2013) as well as which courses they taught within the past five years. Mostly, the percentage of respondents who indicated that they taught a given AP course in SY13 was the same or very similar to the percentage who reported that they taught the same AP course over the previous five years. Notably, however, the proportion of respondents who said they taught AP English in SY13 (23 percent) was five percentage points higher than the proportion of respondents who indicated that they taught an AP English class within the past five years (18 percent).

About two-thirds of the respondents (67 percent) indicated that they taught an STEM AP course during SY13. Likewise, two-thirds of the respondents (66 percent) said that they taught at least one kind of STEM AP course within the past five years. Calculus teachers accounted for a considerable segment (16 percent) of those who taught a STEM AP course in SY13 and/or within the past five years.

Of those who indicated that they taught an AP course in SY13, the smallest proportion said that they had taught AP computer science (2 percent). Again, just 2 percent reported that they were the instructor for an AP computer science class the past five years. Table 2 below contains the full results.

| Table 2. Type of AP Courses Taught by Respondents  **N = 347\*** | | |
| --- | --- | --- |
| **AP Course** | **Percentage of AP Teacher Respondents\*** | |
| **Taught Course in SY13** | **Taught Course Within Past 5 Years** |
| Biology | 11% | 12% |
| Calculus | 16% | 16% |
| Chemistry | 9% | 10% |
| Computer Science | 2% | 2% |
| Environmental Science | 10% | 9% |
| English | 23% | 18% |
| Physics | 6% | 7% |
| Statistics | 13% | 10% |
| ***\*****The total percentage for each column does not equal 100%. Some respondents did not indicate which course(s) they taught in SY13 and/or within the past five years.* | | |

Many of the respondents indicated that they were fairly new to teaching AP classes—particularly STEM AP teachers. Almost three-fourths of the STEM AP respondents and over a third of AP English respondents indicated that they had taught AP courses between one to five years. Also, twelve percent of AP English teachers had taught an AP course for less than a year. Relatively small proportions said they have taught AP courses for over ten years. Responses are shown in Table 3.

This relative inexperience in teaching AP courses may underscore the need for AP-related professional development and other supports provided to teachers through the Advancing STEM AP program. MMSI reported that some teachers involved in the program are new to teaching AP courses. He commented that there are always new people to be trained due to teacher turnover in the districts. Because of this turnover and the regular presence of new AP teachers in the program, he said it is important to get these individuals into the MMSI Summer Institute as soon as possible. Moreover, according to Smolenski, teacher training and professional development is key because it takes about three years for someone to develop into an AP teacher.

| Table 3. Years Teaching STEM AP or AP English Courses  **N: STEM AP Teacher = 233, AP English Teacher = 114** | | |
| --- | --- | --- |
| **Years** | **Percentage of Respondents** | |
| **STEM AP Teacher** | **AP English Teacher** |
| No Response | <1% | 23% |
| <1 years | 0% | 12% |
| 1 – 5 years | 73% | 38% |
| 6 – 10 years | 15% | 18% |
| 11 – 15 years | 8% | 2% |
| 16 – 20 years | 1% | 3% |
| 21+ years | 2% | 5% |

### MMSI AP Program Professional Development Opportunities and Supports

According to the respondents, the MMSI professional development events were widely available (Table 4). Most teachers indicated that they were offered the chance to take part in the MMSI AP Summer Institute and/or the MMSI two-day workshop. Considerable majorities of STEM AP and AP English teachers responded that the four vertical team meetings were made available to them. The MMSI sponsored Pre-AP Training Institute was the exception among these events with only about a third of STEM AP teachers and a third of AP English teachers reporting that they had been given the opportunity to attend. All of these opportunities and supports are “Program Elements of Success” in the MMSI-provided program. It appears that these intended aspects of the program are in fact available to a broad swath of participating teachers.

Also, while majorities of STEM AP and AP English respondents indicated that their schools’ lead teachers had provided information, materials, and resources, considerably fewer respondents reported logistical support to maximize the use of technology, materials, and resources. A handful of respondents explained that they received support from their content directors in regard to teaching and lesson suggestions and strategies for planning vertical team meetings. However, one teacher noted that while they received test preparation materials, they did not get support in terms of actually implementing these resources. Notably, a “logistical support” component is the only assistance to teachers not explicitly listed in MMSI’s “Program Elements of Success.” It is unsurprising that this component—which may only be an implied part of the program—is reportedly the least available to respondents. It is also possible that logistical and implementation help is already part of the formal professional development opportunities. If further evidence suggests that teachers desire or need more of this type of support; perhaps the addition of logistical and implementation assistance from MMSI may be warranted.

| Table 4. Professional Development Opportunities and Supports Offered to Teachers in the MMSI AP Program  **N: STEM AP Teacher = 223, AP English Teacher = 114** | | |
| --- | --- | --- |
| **Professional Development Opportunity or Support** | **STEM AP Teacher** | **AP English Teacher** |
| MMSI AP Summer Institute (5 days) | 96% | 97% |
| MMSI Workshop (2 days) | 98% | 98% |
| MMSI-sponsored Pre-AP Training Institute (4 days) | 34% | 33% |
| Four vertical team meetings for AP teachers during each year of the grant | 84% | 86% |
| Information, materials, and resources provided by my school’s Advancing STEM AP lead teachers | 61% | 70% |
| Logistical support to maximize the use of technology, materials, and resources | 42% | 35% |

In addition to these opportunities, teachers were asked whether they were offered a variety of supports by their content directors[[1]](#footnote-1) in order to increase student enrollment and success (Table 5). In regard to most of these supports, the majority of both types of teachers did not indicate that they were offered the given type assistance. It should be noted that these content directors are “subject matter experts” who are part of MMSI’s articulated “Program Elements of Success.” Smolenski spoke highly of the content directors and said that they are “responsible for the success” of the program. While majorities of respondents might not indicate that they were offered the supports listed in the survey, it is possible that the content directors offer other kinds of help. It is also possible that the teachers that do receive support from content directors are the ones who need assistance the most.

An exception to this finding were the responses concerning content directors’ support in planning student study sessions; over half of STEM AP as well as AP English respondents indicated that they were offered help in this regard. Study sessions are a part of the “Program Elements of Success” and were mentioned in the interviews as main aspects of the program.

Additionally, 58 percent of AP English respondents reported that they were offered content-specific professional development that was focused on AP instruction. During his interview, Smolenski noted the particular strength of MMSI English content director Sally Guadagno. Her reported strength as a content director may have contributed to AP English respondents’ perceived availability of instruction-related professional development. Notably, a smaller proportion of STEM AP respondents (40 percent) also said they were presented with content-specific professional development opportunities from their content director.

Greater proportions of STEM AP respondents than AP English respondents reported the availability of other types of instructional support – such as classroom observation and modeled lessons – from their content directors. For example, while almost 40 percent of STEM AP respondents indicated that content directors would observe their classroom and provide feedback and guidance, only 25 percent of English respondents said the same. However, in greater proportions of AP English respondents than STEM AP respondents reported that they had been offered assistance from their content director in regard to assessment- or testing-related supports.

Smaller percentages of both types of respondents reported that they were offered support in regard to problem-solving and strategizing on program and student-related issues. About 30 percent of AP English respondents said that their content director had offered help in regard to addressing ways to increase enrollment in AP classes and a slightly smaller proportion of STEM AP respondents (28 percent) said the same. In terms of strategizing around issues of student motivation, 29 percent of STEM AP respondents said that they were offered help from their content directors; however, this aspect was where the smallest proportion of AP English reported support (20 percent).

| Table 5. Supports from MMSI Content Directors Offered to Teachers in the MMSI AP Program  **N: STEM AP Teacher = 233, AP English Teacher = 114** | | |
| --- | --- | --- |
| **Supports from MMSI Content Directors** | **STEM AP Teacher** | **AP English Teacher** |
| Observing my classroom and providing feedback and instructional guidance | 39% | 25% |
| Modeling by teaching an AP lesson while I observed | 30% | 15% |
| Content-specific professional development focused on AP instruction | 40% | 58% |
| Support in planning and logistics for the student study sessions | 51% | 52% |
| Assisting with other test preparation activities | 33% | 44% |
| Assisting with student assessment | 20% | 28% |
| Strategizing or problem-solving on ways to increase student enrollment in AP courses | 28% | 30% |
| Strategizing or problem-solving on ways to increase student motivation | 29% | 20% |
| Strategizing or problem-solving on other issues (e.g. time constraints, scheduling, other) | 38% | 25% |

### Other Supports Offered from MMSI Content Directors

Respondents were asked to indicate other forms of support they received from MMSI content directors in regard to increasing student enrollment and success in STEM AP courses. A few respondents elaborated regarding the ways in which content directors offered assistance. This section presents a summary of the categories that received at least two responses.

**Supports**

* **Provision of teaching suggestions and resources** by the content directors was mentioned by respondents. These respondents indicated that they had received lesson plans, tips on planning a vertical team, and test preparation activities (4 responses).
* **Assistance tailored to a teacher’s emerging need** was mentioned by two respondents. When one teacher had to be out of the classroom due to health reasons, the content director checked in with the substitute teacher and even taught some of the classes. When course enrollment in another teacher’s course skyrocketed due to the new STEM AP program and keeping up with grading became difficult, MMSI paid for an assistant to help grade the students’ essays (2 responses).
* **Appreciation and general support** afforded by the content director was indicated by respondents. They felt fully and well supported. One teacher commented that the content director did not micromanage but instead “coaches, listens, and leads” (2 responses).

### Improvement in Professional Capacity

In general, the respondents’ perceptions of the Advancing STEM AP program’s impact on their professional capacities were quite positive,[[2]](#footnote-2) especially in relation to how the program improved their content knowledge and their pedagogical skills in their AP discipline. Somewhat smaller majorities of STEM AP and AP English respondents offered positive responses regarding to the degree to which the program has improved their ability to support the success of students who are traditionally underrepresented in STEM AP courses. Responses are shown in Table 6.

These findings suggests that while the Advancing STEM AP program is contributing to positive improvement for a considerable majority of respondents, it is having a somewhat less far-reaching impact as to how these teachers think they can support the success of students in AP courses. Based on this finding, ESE and MMSI may consider placing additional emphasis on the program components that focus on improving teachers’ capacity to provide support to students in AP courses.

In particular, STEM AP and AP English respondents reported the most positive improvement in regard to their content knowledge in their discipline. Eighty percent of AP English respondents and 77 percent of STEM AP respondents reported positive development in terms of content knowledge.

Also, both types of respondents were largely positive about how the Advancing STEM AP program improved their pedagogical skills. About three-fourths of STEM AP as well as AP English respondents reported positive improvement in this respect.

As previously noted, STEM AP and AP English respondents were to somewhat less positive about how the program improved their ability to support the success of traditionally underrepresented students. Still, majorities of STEM AP and AP English respondents said they experienced positive improvement in their capacity to support these students. AP English respondents were slightly more positive; 66 percent reported improvement compared to 63 percent of STEM AP respondents who indicated the same.

Arguably, teachers’ perceived improvement in their ability to support student success in AP coursework is worthy of attention because helping students to succeed in these courses is the intended overall outcome of the program. The number of respondents who indicated positive progress in their ability to support student success is not overwhelming; however the fact that a majority reported improvement is still encouraging. Also, a pertinent comment was provided by Smolenski: It takes time for teachers to develop as AP teachers. It is possible that teachers first perceive improvements in their knowledge and pedagogical skills and then later observe improvement in their ability to support students as their participation in the program and associated professional development opportunities continue. The currently available data do not make it possible to determine the length of each respondent’s participation in the program; however, the relationship between teachers’ tenure in the program to their ability to support student success may be of interest in later evaluation activities.

| Table 6. Improvement in Professional Capacities Due to Participation in MMSI AP Program  **N: STEM AP Teacher = 233, AP English Teacher = 114** | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Dimension** | **Substantially** | | **Moderately** | | **Minimally** | | **Not At All** | |
| **STEM AP Teacher** | **AP English Teacher** | **STEM AP Teacher** | **AP English Teacher** | **STEM AP Teacher** | **AP English Teacher** | **STEM AP Teacher** | **AP English Teacher** |
| Improvement in content knowledge in your AP discipline | 42% | 44% | 35% | 36% | 15% | 13% | 7% | 7% |
| Improvement in pedagogical skills in your AP discipline | 29% | 38% | 47% | 37% | 17% | 18% | 5% | 6% |
| Improvement in ability to support the success of traditionally underrepresented students | 29% | 35% | 34% | 31% | 22% | 23% | 11% | 10% |
| *\*Please note, the total of the percentages for STEM AP as well as AP English do not equal 100%. Some teachers did not respond to these questions.* | | | | | | | | |

### Schools’ Use of Strategies to Encourage Enrollment of Traditionally Underrepresented Students in STEM AP Courses and Exams

Overall, moderate and sometimes substantial proportions of respondents indicated that their schools used strategies designed for encouraging the enrollment of typically underrepresented students in STEM AP courses. With two exceptions, at least half of the respondents indicated that their schools employed a given strategy to promote enrollment. Additionally, for most of the strategies asked about in the survey, a majority of respondents agreed that their school’s utilization of the strategy had increased as a result of participating in the Advancing STEM AP program.

Providing exam fee waivers to students in financial need was the most widely reported strategy schools used to encourage enrollment of typically underrepresented students (78 percent of respondents). Half of the respondents indicated that their schools’ provision of exam fee waivers increased as a result of participating in the Advancing STEM AP program. It is important to note that while the provision of fee waivers was widely reported by the respondents, only about half said that their school helped students complete and submit any forms that were required to obtain a waiver. A relatively small proportion (29 percent) indicated that the practice of helping students fill out fee waiver forms had increased because of their schools’ participation in the program. In light of the fact that the provision of waivers is seemingly extensive, it is possible that this is a reflection of the fact that students simply do not need help and/or these forms are fairly straight forward and simple to complete.

Whereas only about half of respondents reported that their school assisted students with fee waiver forms, a substantial proportion (71 percent) agreed that their school helped students to fill out AP exam registration forms. It is possible that AP exam registration forms are more complicated than the fee waiver forms and require assistance. Notably, a relatively smaller percentage (38 percent) said that helping students complete AP exam registration forms had increased as a result of participation in the Advancing STEM AP program. This may have been a pre-program participation practice in many of the respondents’ schools.

There were other strategies reportedly used in a considerable percentage of respondents’ schools where the utilization of the strategy increased as a result of participating in the program. A substantial percentage of respondents (71 percent) reported that their schools increased the number of AP science and mathematics courses and well over half of respondents (62 percent) reported that the use of this strategy has increased as a result of participating in the program. Notably, a smaller percentage (57 percent) agreed that their school has increased the number of *section*s of STEM AP courses offered and a little over half (51 percent) agreed that offering more sections had increased after joining the Advancing STEM AP program.

A considerable majority of respondents (70 percent) agreed that their schools provided outreach to students in order to encourage enrollment and 63 percent indicated that the use of student outreach strategies had increased since their participation in the Advancing STEM AP program. Though student outreach was widely used according to respondents, a much smaller percentage of respondents (43 percent) agreed that schools provided outreach to students’ *families.* Just over a third of respondents indicated that providing outreach to families increased as a result of participating in the program.

About two-thirds of the respondents (65 percent) agreed that their school had adjusted AP and pre-AP registration policies such as eliminating prerequisites or a minimum GPA, and 56 percent said that adjusting these policies had increased after participating in the Advancing STEM AP program. Promoting “open access” to AP courses is a MMSI program element of success. Also, MMSI interviewees emphasized the importance of “paving the way” and reducing requirements and barriers so that students can enroll in the STEM AP courses. Given that this is apparently a key aspect of the program, it is unsurprising that a sizable proportion of respondents indicate that their schools use the strategy in their schools and over half report that adjustment to registration policies has increased post-participation.

A somewhat more moderate proportion of respondents (59 percent) indicated that their schools notified students that they will receive awards if they obtain qualifying scores on their AP exams. Half of the respondents said that the practice notifying students about the potential awards had increased as a result of their participation in the program. The existence of student awards is also one of the articulated “Program Elements of Success,” though the notification regarding the potential awards is not.

A relatively smaller segment of respondents (43 percent) indicated that their school used the College Board’s “AP Potential” program to identify prospective students for enrollment in AP classes; just a third said that the usage of this College Board tool had increased as a result of participating in the Advancing STEM AP program. The fact that this is a relatively less commonly reported strategy could be due to several possible factors. It is possible that the AP Potential tool is simply unhelpful in identifying students—particularly typically underrepresented who are the targets of this program.

There is also the possibility that MMSI and participating schools have a broader definition of potential AP students. In fact, Smolenski spoke about schools “opening the pyramid” of students eligible and encouraged to take AP courses. He noted that some schools and teachers do not want to open up the classes. Teachers may be used to teaching students who are already high-achieving or honors students. However, a narrower view of a potential AP candidate is not consistent with the Advancing STEM AP program. Instead, the approach, according to MMSI, is to “find as many kids as you can and put them in front of skilled teachers.” This approach, combined with additional support for students and teachers, is what should lead to student success in the context of the MMSI strategy. Table 7 contains all results.

Also, there is evidence that schools and teachers are actively recruiting many students. When replying to open-response questions about increasing enrollment, respondents mentioned a multitude of outreach activities that were aimed at a wide variety of students including AP fairs, AP days, direct peer appeal, and one-on-one recruitment by teachers. A couple even mentioned that taking AP courses had become the norm for most students at their school.

| Table 7. Schools’ Use of Strategies to Encourage Enrollment of Traditionally Underrepresented Students in STEM AP Courses and Exams  **N = 347\*** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Strategy** | **Our school uses this strategy** | | | **Our school’s use of this strategy has increased as a result of our participation in the Advancing STEM AP Program** | | |
| **Agree** | **Disagree** | **Don’t Know** | **Agree** | **Disagree** | **Don’t Know** |
| Providing outreach to students to promote increased participation in AP courses | 70% | 10% | 13% | 63% | 8% | 19% |
| Providing outreach to families to promote increased participation in AP courses | 43% | 19% | 31% | 36% | 14% | 37% |
| Notifying students that they will receive awards for qualifying exam scores | 59% | 19% | 14% | 50% | 16% | 22% |
| Providing AP exam fee waivers for students with demonstrated financial need | 78% | 5% | 11% | 50% | 13% | 25% |
| Helping students complete and submit any forms required for fee waivers | 51% | 7% | 35% | 29% | 14% | 43% |
| Helping students complete forms required to register for AP exams | 71% | 5% | 17% | 38% | 16% | 33% |
| Using the College Board’s “AP Potential” program to identify students for enrollment in AP courses | 43% | 12% | 37% | 33% | 12% | 42% |
| Increasing the number of AP science and mathematics courses offered\*\* | 71% | 7% | 14% | 62% | 6% | 20% |
| Increasing the number of sections of AP science and mathematics courses offered\*\* | 57% | 16% | 19% | 51% | 12% | 23% |
| Adjusting AP and Pre-AP course registration policies (e.g., eliminating requirements such as min. GPA or taking honors level prerequisite courses) | 65% | 12% | 16% | 56% | 13% | 21% |
| *\*Please note that for some strategies, the total of the percentages do not equal 100%. Some teachers did not respond to these questions.*  *\*\*A Chi Square analysis was used to test the difference between the responses of STEM AP and AP English teachers’ responses. The difference between STEM AP and AP English teachers’ responses was statistically significant for these strategies indicated in the table.* | | | | | | |

### Other Strategies Used by Schools to Encourage Enrollment in STEM AP Courses by Traditionally Underrepresented Students

Respondents were asked to indicate other strategies were used by their schools to encourage traditionally underrepresented students to take STEM AP courses and exams. This section presents a summary of the categories that received at least two responses regarding these other strategies.

**Supports**

* **Special AP events** were mentioned by several respondents as a way their school recruited traditionally underrepresented students for AP courses. Four of these respondents specifically indicated that there were AP fairs. Other events included AP days, AP nights, and pep-rallies (9 responses).
* **Appeal by current AP students** was a means of encouraging underrepresented students to take AP courses. While some of this recruitment by current AP scholars happens informally, other schools’ efforts are more deliberate: one school’s students wear t-shirts that say “Ask me about my AP course,” and another school’s students produced a “Spotlight” program that ran on the in-house television station (8 responses).
* **A personal, one-on-one invitation by an AP** **teacher** was cited by some respondents as a way of encouraging underrepresented students to enroll. For a couple teachers this was the primary or most important way of boosting enrollment. Others noted that it was key to engage in face-to-face interaction or “prodding” (7 responses).
* **Offering out of class tutoring or extra help** aided in boosting enrollment of underrepresented students for some schools. The kind of extra help mentioned by respondents included AP boot camps, AP enhancement blocks, and afterschool support groups(6 responses).
* **Classroom visits to explain AP courses** was a method of attracting students to AP courses according to a few respondents. Teachers and current AP students would visit other non-AP classes to explain various AP courses and talk about their experiences. Teachers and sometimes MMSI personnel recruit students in English classes because all students are required to take English in every year of high school. This strategy offers the opportunity to appeal to a wide variety of students (4 responses).
* **Underscoring useful or career-related skills acquired in AP courses** was a means of attracting traditionally underrepresented students to the AP program(3 responses).
* **Enrollment in AP classes is the norm for all students** in their schools according to a couple of respondents. Each student is seen as or expected to be part of the AP program (2 responses).
* **Informing students that there will be academic support** was mentioned as a means of encouraging enrollment**.** One respondent noted that teachers made sure that students taking an AP course for the first time were aware of extra help opportunities (2 responses)**.**
* **Recruiting students in earlier grades** was mentioned by a couple respondents as a way to enroll more underrepresented students. (2 responses).

It also should be noted that two respondents took the opportunity in the open response to bring up issues or problems they had encountered in regard to getting these students to take AP classes. One respondent mentioned that when their school lowered their standards or prerequisites for taking an AP class, the newly eligible cohort was too big to accommodate. Another respondent noted that their school encountered funding issues and some students had indicated that they did not receive monetary rewards or exam fee waivers.

### Schools’ Use of Strategies to Support the Success of Traditionally Underrepresented Students in STEM AP Courses and Exams

In addition to providing information about their schools’ use of strategies to encourage enrollment of traditionally underrepresented students, respondents also indicated whether their schools used various means to support the success of these students taking AP courses and exams. Again, respondents also reported whether their schools’ use of the strategies had increased as a result of their participation in the Advancing STEM AP program.

The utilization of the various strategies asked about in the survey was mixed according to respondents. While the strategies of offering study sessions and providing transportation to the sessions were widely employed according to respondents, considerably smaller proportions of respondents indicated that their schools collaborate with curriculum leaders and middle schools to address preparation of grades 6–8 students for AP classes, encourage students to retake AP exams, and provide additional study support to students retaking the exam.

The largest percentage of respondents (88 percent) agreed that their school used the strategy of offering study sessions—an element of success of the Advancing STEM AP program. Moreover, over three-fourths of respondents also agreed that offering study sessions increased as a result of their schools’ participation in the Advancing STEM AP program. These findings suggest that providing study sessions is widespread and the extent of its utilization across participating schools was influenced by the program. This increased use of study sessions is consistent with the fact that about half of AP English and STEM AP respondents indicated that they received assistance from their content directors in planning study sessions.[[3]](#footnote-3) The apparently broad implementation of the study sessions may be due, at least in part, to participation in the program and the support of MMSI content directors.

A substantial proportion of respondents (70 percent) agreed that their schools provided transportation for students to study sessions if transportation was not available. Again, a majority of respondents reported that their schools’ use of this strategy had increased since participating in the program. It appears that schools are developing additional supports to encourage attendance at the study sessions.

A more moderate proportion of respondents (37 percent) agreed that their school collaborated with curriculum leaders and feeder middle schools to address the preparation of grades 6–8 students for future AP classes. A little less than a third of respondents agreed that this collaboration had increased post-program participation. While this is not an overwhelming proportion of respondents, it does suggest that this strategy may be gaining modest traction at some schools.

A relatively smaller percentage (29 percent) of respondents agreed that their school encouraged students to retake an AP exam if they had scored less than a “3,” and only a quarter reported that the strategy of urging students to retake exams had increased as a result of participating in the program. Relatedly, an even smaller proportion of respondents (24 percent) indicated that their schools provided extra study support to students retaking AP exams, and just 19 percent said the practice had increased as a result of the school participating in the Advancing STEM AP program. Table 10 provides these full results.

It is important to note that there was a significant difference in the percentage of AP English respondents and the percentage of STEM AP respondents who agreed that their schools encouraged students to retake AP exams. Likewise, there was a significant difference between the proportion of AP English and STEM AP respondents who replied that their schools offered additional study support to those students retaking an AP exam. While 50 percent of English respondents said that their schools encouraged students who did not earn a “3” or higher to retake the exam, only 13 percent of STEM respondents indicated the same. Even smaller proportions of respondents said that their schools provided study sessions for retakers: 33 percent of English respondents reported that their schools provided the sessions compared to 12 percent of STEM respondents who said the same.

The relatively small percentages of respondents who reported that their schools used strategies that encouraged students to retake AP exams and/or provided additional study support for those retaking exams was echoed in the open-response answers some respondents provided. These respondents pointed out that retaking the exam was not emphasized or even a relevant option because many of the students were graduating seniors. A few also expressed that they simply did not know that retaking the exam was possible. Results are summarized in Table 8.

As previously noted, the ESE interviewee Johnson De Lear expressed her concern about what happens to students who do not pass exams. She pointed out that a potential hole in the program would be if schools and teachers did not follow up with students who failed to earn a qualifying score on the exam with interventions such as specialized study sessions. Johnson De Lear suggested that post-exam interventions and follow-up with these students may warrant further inquiry. The survey findings suggest that strategies involving encouraging and assisting students to retake the exam are not broadly utilized. Future evaluation activities could shed further light on why these strategies are not widely used. Furthermore, ESE and MMSI could consider putting additional emphasis on assistance for students who fail to earn a qualifying score.

| Table 8. Schools’ Use of Strategies to Support the Success of Traditionally Underrepresented Students in STEM AP Courses and Exams  **N = 347\*** | | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
| **Strategy** | **Our school uses this strategy** | | | **Our school’s use of this strategy has increased as a result of our participation in the Advancing STEM AP Program.** | | |
| **Agree** | **Disagree** | **No Response** | **Agree** | **Disagree** | **Don’t Know/No Response** |
| Offering the study sessions prescribed by the Advancing STEM AP program | 88% | 4% | 9% | 77% | 7% | 16% |
| Providing transportation to study sessions, if transportation is not available | 70% | 18% | 12% | 60% | 15% | 25% |
| Collaborating with curriculum leaders and feeder middle schools to address student preparation for AP courses in grades 6 to 8 | 37% | 40% | 23% | 30% | 31% | 40% |
| Encouraging students to take the AP exam again if they don’t receive a score of ‘3’ or higher\* | 29% | 44% | 27% | 25% | 30% | 45% |
| Providing additional study support to students who are re-taking an AP exam\* | 24% | 41% | 35% | 19% | 30% | 51% |
| *\*Although STEM AP and AP English respondents’ answers are not presented separately here, a Chi Square analysis was used to test the difference between the responses of these two types of teachers. The difference between STEM AP and AP English teachers’ responses was statistically significant for these strategies indicated in the table.* | | | | | | |

### Other Strategies Used by Schools to Support the Success of Traditionally Underrepresented Students in STEM AP Courses

Respondents were asked to indicate other strategies used by their schools to support the success of traditionally underrepresented students in STEM AP courses and exams. This section presents a summary of the categories that received at least 2 responses regarding other strategies utilized by schools to promote enrollment.

**Supports**

* **Offering out of class tutoring or extra help** was a support identified by several respondents as a means of supporting the success of students. Extra help for students took many forms including AP boot camps, sessions during school vacations, AP enhancement blocks, meeting for an extra period, and lab time with Harvard Medical School(10 responses).
* **Practice or mock exams and exam questions** were utilized according to three teachers who noted that the results of these tests provided students with feedback and identification of problems or gaps in their understanding of the course content(3 responses).
* **Rewarding students’ extra work or effort** was a means of promoting success according to a couple of respondents. Students received credit when they corrected missed exam questions and/or retested (2 responses).

Again, a handful of respondents chose to note some issues or barriers their schools had come across when trying to support the success of traditionally underrepresented students in AP courses. Three respondents indicated that they were not aware that AP exams could be retaken (and thus had not been able to encourage students to retake the exam if they scored less than a “3”). Relatedly, two respondents said that their schools could do a better job in regard to urging students to retake AP exams. Two others commented that they had lacked support from their schools’ administration in regard to professional development or providing extra help to students.

### Teachers’ Use of Strategies to Support the Success of Traditionally Underrepresented Students in STEM AP Courses and Exams

In addition to reporting on their schools’ use of strategies to support the success of traditionally underrepresented students, the survey also asked respondents to indicate which strategies they personally used to foster these students’ achievement in AP courses and exams (Table 9). For the most part, overwhelming majorities of respondents reported that they used some strategy to help their AP students. However, when it came to strategies regarding retaking AP exams, much smaller percentages of respondents said they used these practices. This was especially true of STEM respondents.

Student study sessions were supported by the vast majority of respondents, with 94 percent of STEM AP respondents and 90 percent of AP English respondents who said that they encouraged students to attend study sessions. Moreover, substantial proportions of STEM and English respondents (83 percent and 80 percent respectively) said that their encouragement of students to attend these sessions increased as a result of participating in the Advancing STEM AP program.

Not only did most respondents urge their students to participate in the study sessions, but the vast majority also attended the study sessions themselves; 94 percent of STEM respondents and 89 percent of English respondents agreed that they go to the sessions. Again, a considerable majority of respondents reported that this practice increased due to the Advancing STEM AP program.

In addition to generally encouraging attendance of the study sessions, considerable majorities of each type of respondents indicated that they helped enable students’ participation by providing transportation to the sessions if no transportation was available—89 percent of STEM respondents and 80 percent of English respondents reported providing transportation for their students. However, less than half of both types of respondents did not agree that providing transportation increased due to their participation in the program.

According to the survey responses, there appears to be considerable fidelity to the study session element of the Advancing STEM AP program. A substantial majority of respondents attributed increased use of study session-related strategies to participation in the program (with the exception of the providing transportation strategy). Arguably, this extensive use of study session strategies also suggests that AP teachers view this as a central and perhaps effective aspect of the Advancing STEM AP program.

Most STEM AP and AP English respondents agreed that they taught the AP curriculum to their students as outlined in the College Board guidelines. Again, the respondents to the survey appear to conform to suggested strategies, instructions, and other parameters. Ninety-three percent of STEM respondents and 88 percent of English respondents report using the guidelines. Also, over half of both types of respondents indicate that their use of the College Board’s guidelines has increased as a result of their participation in the Advancing STEM AP program.

Strategies regarding encouraging and helping students to retake AP exams were used to a much lesser extent by both types of respondents. This finding is consistent with the fact that a majority of respondents did not agree that their schools used the strategies regarding retaking AP exams. It is important to note, however, that the difference in the percentages of STEM AP and AP English respondents who said that they used these strategies was statistically significant.

While 61 percent of AP English respondents reported that they urged their students to retake the AP exam if they scored less than a “3,” just 21 percent of STEM respondents reported that they offered this encouragement. Additionally, half of the English respondents said that they increased the use of this strategy as a result of participating in the Advancing STEM AP program, while 14 percent of STEM respondents reported an increase.

Relatedly, while 45 percent of English respondents said that they provided additional study support to those students retaking the AP exam, only 21 percent of STEM respondents reported the same. Relatively smaller proportions of both types of respondents said that the use of this strategy had increased due to their participation in the program—36 percent of English and 12 percent of STEM respondents. As previously mentioned, this relative disuse of retaking strategies was identified as a potential issue by the ESE interviewee.

| Table 9. Teachers’ Personal Use of Strategies to Support the Success of Traditionally Underrepresented Students in STEM AP Courses and Exams  **N: STEM AP Teacher = 233, AP English Teacher = 114** | | | | | | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Strategy** | **I use this strategy** | | | | | | **My use of this strategy has increased as a result of my participation in the MMSI AP Program** | | | | | |
| **Agree** | | **Disagree** | | **No Response** | | **Agree** | | **Disagree** | | **No Response/Not Applicable** | |
| **STEM AP**  **Teacher** | **AP English**  **Teacher** | **STEM AP**  **Teacher** | **AP English**  **Teacher** | **STEM AP**  **Teacher** | **AP English**  **Teacher** | **STEM AP**  **Teacher** | **AP English**  **Teacher** | **STEM AP**  **Teacher** | **AP English**  **Teacher** | **STEM AP**  **Teacher** | **AP English**  **Teacher** |
| Teaching the AP curriculum as outlined in the College Board guidelines | 93% | 88% | 2% | 3% | 5% | 10% | 61% | 55% | 23% | 22% | 16% | 23% |
| Providing transportation to study sessions, if transportation is not available | 89% | 80% | 7% | 11% | 4% | 10% | 40% | 45% | 39% | 31% | 22% | 25% |
| Attending and supporting the study sessions prescribed by the Advancing STEM AP program | 94% | 89% | 2% | 1% | 4% | 11% | 84% | 80% | 3% | 4% | 13% | 15% |
| Encouraging students to attend the study sessions | 94% | 90% | 0% | 0% | 6% | 12% | 83% | 80% | 4% | 5% | 13% | 15% |
| Encouraging students to take the AP exam again if they don’t receive a score of ‘3’ or higher\* | 21% | 61% | 73% | 29% | 6% | 11% | 14% | 50% | 37% | 24% | 49% | 26% |
| Providing additional study support to students who are retaking an AP exam\* | 21% | 45% | 71% | 40% | 9% | 15% | 12% | 36% | 35% | 31% | 53% | 33% |
| *\*A Chi Square analysis was used to test the difference between the responses of the STEM AP respondents and the AP English respondents. The difference between STEM AP and AP English teachers’ responses was statistically significant for the last two strategies listed in the table.* | | | | | | | | | | | | |

### Other Strategies Used by Teachers to Encourage Enrollment in STEM AP Courses by Traditionally Underrepresented Students

Respondents were asked to indicate other strategies they used to encourage traditionally underrepresented students to take STEM AP courses and exams. This section presents a summary of the categories that received at least two responses regarding other strategies utilized by schools to promote enrollment.

**Supports**

* **Review sessions and afterschool help** were means utilized by some teachers to encourage students to take STEM AP courses and exams. In addition to the apparently extensive provision of the more formal study sessions prescribed by the Advancing STEM AP program, there also appeared to be a variety of study supports offered by respondents. The kind of out-of-class help identified was fairly diverse and included summer reading sessions at the public library, night study sessions at a restaurant, a field trip designed for intensive review, a specially created PowerPoint presentation for students to use at home, as well as regularly scheduled afterschool tutoring. In the interviews, ESE and MMSI interviewees mentioned that different types of tutoring opportunities were available on a school by school or teacher by teacher basis (6 responses).
* **Individual, one-on-one recruitment and attention to students** was a method indicated by a few teachers that they used to encourage enrollment. These teachers attributed increased enrollment and achievement to personal monitoring and attention to students (3 responses).
* **Building and connecting English skills to support STEM AP courses** was an important practice to a few teachers who said that skills gained in an English course such as logic, analysis, expression, and writing were helpful to students in STEM AP courses. In fact, the importance of taking AP English and gaining English-related skills is at the core of the program’s plan for student success. Smolenski explained that “English is the center of gravity for the entire program” (3 responses).
* **Mandatory Saturday sessions** was a component used by schools according to two teachers. One commented that if a student missed a Saturday session they had to meet with the principal and make up the time after school (2 responses).
* **Communication with students’ parents** was helpful according to two teachers in getting students to succeed in their AP classes (2 responses).

Some teachers noted some problems they came across while trying to promote enrollment of underrepresented students. Six respondents indicated that before completing this survey, they were not aware that students were able to retake AP exams. Also, four noted that they did not urge students to retake exams because most of their students were seniors who would be graduated before the next AP examination. Three noted that students were not motivated to strive to excel on the exams as they did not see the benefit of higher scores.

## Participation in MMSI Teacher Training

MMSI provided a participation database that provided attendance information regarding two teacher training events held in 2012—the MMSI AP Summer Institute and the MMSI Two-Day Workshop. This database consisted of their current training information regarding 548 teachers who are part of the program. It is meant to provide a one-year “snap shot” of participation.

A little over half of the STEM AP teachers participating in the program attended the 2012 MMSI AP Summer Institute. A somewhat lower percentage of AP English teachers were also present at the event. The MMSI Two-Day Workshop offered in the fall of 2012 had higher attendance from STEM AP and AP English teachers than the Summer Institute. Over 80 percent of STEM AP teachers attended the workshop and three-quarters of the AP English teachers attended as well. Results are displayed in Table 10.

Notably, the vast majority of the teacher survey’s respondents indicated that they were offered the opportunity to attend these events. Arguably, the availability of these training opportunities was well-known among teachers in the Advancing STEM AP program. In fact, at least one teacher from every one of the 61 participating schools attended the Two-Day Workshop. All but one of the schools in the program had at least one teacher attend the Summer Institute.

| Table 10. Attendance of Teachers in MMSI Program Events  **N: STEM AP Teacher = 353 , AP English Teacher = 195** | | | | |
| --- | --- | --- | --- | --- |
| **Event** | **STEM AP Teacher** | | **AP English Teacher** | |
| **Attended Event** | **Did NOT Attend Event** | **Attended Event** | **Did NOT Attend Event** |
| MMSI AP Summer Institute | 54% | 46% | 42% | 58% |
| MMSI Two-Day Workshop | 84% | 16% | 75% | 25% |

# Conclusion

It appears that a great deal of the Advancing STEM AP program’s components and strategies are used by participant schools and teachers. Interviewees and survey respondents report that professional development opportunities – particularly MMSI sponsored Summer Institutes and workshops – were widely available. However, support strategies from content directors seemed less consistently offered. Respondents were remarkably positive about the increases in their content knowledge and pedagogical skills due to their participation in the program.

Schools and teachers use a wide variety of methods to encourage underrepresented students including student outreach efforts, exam fee waivers, removal of course prerequisites, adjustment of registration policies, and the addition of AP courses and sections. In order to support the success of these students in STEM AP courses, most respondents report using College Board guidelines in their instruction and both interviewees and respondents report substantial use of study session related strategies. However, there seems to be less encouragement and support for students who fail to earn qualifying scores on the AP Exams. Overall, findings suggest that there is considerable fidelity to most of the Advancing STEM AP program components by schools as well as teachers. While it appears that formal professional development and training sessions are widely available, other program elements of support such as the assistance of content directors and lead teachers are less commonly distributed.

The following discussion is organized into sections which correspond to the four overarching research questions that guide the first year of the evaluation. The discussion also notes some emergent findings regarding successful practices and barriers encountered by the three interviewees and the respondents to the teacher survey.

**Support provided for district efforts to offer additional AP courses**

In order to assist in the addition of STEM AP courses and sections, MMSI first helps administrators and teachers realize the large pool of potential AP students that exist in their high schools. Once schools recognize that there is a huge swath of prospective AP students (many of whom are from typically underrepresented populations), they realize the need to enlarge the number of STEM AP courses and sections offered. Supporting and expanding the pool of potential AP students is also important. MMSI helps schools align their curriculum through activities such as vertical team meetings so that students are prepared for rigorous AP coursework in earlier grades.

Through the program, MMSI makes the addition of STEM AP classes more attractive by covering some of the costs for expensive equipment and supplies needed in these courses. Costly lab equipment, calculators, and textbooks are required in the advanced classes. Without the help of these funds, schools may be unable to properly provide for the logistical requirements of STEM AP classes.

**Professional development offered to AP teachers**

In the interviews, the MMSI personnel underscored the importance of the various forms of professional development and trainings in preparing teachers to effectively support the enrollment and success of underrepresented students. In particular, they underscored the helpfulness of the Summer Institute for teachers new to teaching AP courses. Survey respondents provided mixed answers regarding the availability of opportunities and supports that are part of MMSI’s “Program Elements of Success.” Findings indicate that there was a broad awareness as well as attendance of the MMSI Summer Institute and two-day workshops. Notably, according to training data the 2012 two-day workshop enjoyed greater attendance by STEM AP and AP English teachers than the 2012 Summer Institute. Considerably smaller percentages of both types of respondents said they had been offered the opportunity to participate in the pre-AP training.

Smolenski had stressed the importance of teachers’ participation in vertical team meetings to ensure that curriculum was aligned and students were prepared for demanding AP courses. Substantial majorities of STEM AP and AP English teachers reported that they were offered the opportunity to attend vertical team meetings. Slightly smaller majorities reported that lead teachers in their clusters offered information, materials, and resources. Logistical help was where the fewest respondents reported they had received help.

According to Smolenski, content directors play important and varied roles in the Advancing STEM AP program. They offer formal professional development opportunities, ad hoc support to individual teachers, help with classroom instruction and sometimes help in the recruitment of students into AP coursework. However, for the most part, moderate to relatively small percentages of respondents indicated they had received various types of support from their content directors. However, over half of STEM AP and over half of AP English respondents indicated that they were offered support in planning and logistics for the student sessions.

Notably, a considerably greater proportion of English respondents than STEM respondents said that their content director had offered to provide content-specific professional development for their instruction.

**STEM teachers increase in their knowledge and pedagogical skills relevant to increasing student success in AP courses and exams**

MMSI interviewees suggested that the program’s professional development and training opportunities were essential to helping teachers improve their professional capacities and support student success. In fact, most respondents indicated that the program had helped them to increase their content knowledge and pedagogical skills. Over three quarters of STEM respondents reported a positive increase in their knowledge and/or pedagogical abilities. Interestingly, an even higher percentage of English respondents indicated positive increases in this regard.

Somewhat smaller proportions of both types of respondents indicated a positive increase in their ability to support the success of underrepresented students in AP courses. Still, the majority of each type did say that they had experienced an increase in their capacity to assist these students. It may be worthwhile to explore the process by which teachers develop their capacity to support the success of students. It is possible that AP teachers first perceive increases in their knowledge and pedagogical skills before they realize the program’s benefits on their ability to help students.

Most respondents indicated that they supported the success of their AP students by teaching using the College Board’s curriculum guidelines. Considerable majorities of respondents reported that they and their schools used study sessions as a means of promoting the success of underrepresented students. Substantial proportions of respondents said that they attended themselves and encouraged their students to attend the sessions. Also, the majority of respondents reported that they and their schools provided transportation for students to these sessions if transportation was not available.

However, some strategies for supporting student success were not widely utilized. The ESE staff person interviewed for the evaluation expressed concern regarding the support students might receive if they failed to earn a qualifying score on the exam. She was curious as to the interventions these students could obtain if they did not have success on their first try. Arguably, her concern was born out in the responses to the survey. Relatively small percentages of respondents indicated that their schools and/or they personally encouraged students who did not receive a “3” on the exam to retake it later. Even smaller proportions indicated that they or their schools provided study sessions to those students who chose to retake the exam. It is important to note that significantly more AP English than STEM AP teachers indicated that they and/or their schools encouraged and supported students retaking the exam. Several survey respondents mentioned in the open response that they were not even aware of the retaking option. Increasing awareness of this opportunity may be a worthy future priority for the Advancing STEM AP program pursuant to its goals of promoting student success and increasing the number of students earning qualifying scores (even if the qualifying score is earned on a second exam).

**Strategies used by the Advancing STEM AP Program**

* **Increase AP course availability**

The strategies used in the program to increase AP course availability are mentioned earlier in this conclusion. It is important to note that a considerable majority of respondents reported that their schools had added additional STEM AP courses with almost two-thirds indicating that offering more of these classes had increased due to the participation in the Advancing STEM AP program.

* **Identify underrepresented students**

The MMSI personnel interviewed for this study were quite focused on getting schools to recognize the potential of many students – especially those from traditionally underrepresented groups – to take and succeed in STEM AP courses. They explained that administrators and teachers have to alter their thinking about who qualifies as a prospective AP student. The MMSI interviewees mentioned that some teachers are reluctant to take on less than high achieving students; however they also report that they have had success in changing how schools perceive their potential pool of AP scholars.

Notably, respondents did not report wide use of the College Board’s “AP Potential” tool. Less than half reported that their schools used this to identify potential AP students. It is possible that schools have more effective ways of understanding who are candidates for AP coursework – particularly in typically underrepresented groups.

* **Encourage underrepresented students to take AP courses**

A multitude of strategies were used to encourage underrepresented students to enroll in AP classes. Considerable proportions of schools and respondents engage in outreach efforts such as AP Fairs, AP days, one-on-one recruitment and peer appeal to convince students. About two-thirds of respondents indicated that student recruitment had increased since their school’s participation in the Advancing STEM AP program. A somewhat smaller percentage of respondents indicated that outreach efforts extended to students’ families.

A key part of encouraging students to take these classes is creating what the MMSI personnel called “open access.” This involves reducing registration requirements and prerequisites as well as increasing the number of AP courses and sections offered in the school.

Effective encouragement also includes making STEM AP courses make financial sense to students. Interviewees explained that financial rewards are given to students who achieve qualifying scores on their AP exams – although only a little over half of the survey respondents indicated that their schools notify students about these potential awards. A majority of respondents reported that exam fee waivers were available to students. According to MMSI, students can find AP classes appealing when they understand that earning college credits in high school can defray the cost of attending a college or university when they graduate.

Based on the findings presented in this interim report, there is considerable evidence that MMSI has been successful in implementing core components of the Advancing STEM AP program.

1. Content directors are MMSI personnel who are “master teachers” and who specialize in English, mathematics, or science and provide instructional, content-related, and logistical guidance to teachers in the Advancing STEM AP program. [↑](#footnote-ref-1)
2. For the purposes of this discussion, a positive impact is indicated by responses of “substantially” or “moderately.” [↑](#footnote-ref-2)
3. Refer to page 17 of this report for the findings regarding the study session planning support offered by content directors. [↑](#footnote-ref-3)