

An evolving model using historical data to predict the grades of students in Advanced Placement courses in one large urban school district

September 2018

Efforts to support a large urban school district in increasing student access to Advanced Placement (AP) courses began in 2015. The collaboration between the school district and The Office of Socially Responsible Evaluation in Education (SREed) sought to improve the identification of students with the potential to succeed in AP classes. Statistical modeling has been used for three consecutive school years to predict AP course grades for students based on their school records and the records of their peers.

Previous studies found inconsistent identification and recruitment of students for AP courses

A qualitative study conducted in 2016 found inconsistent recruitment strategies for AP courses. Interviews with 38 AP teachers found differing processes for recruiting students for AP courses across eight high schools. Most often, students were recruited based on teacher recommendations or by students requesting to be placed in the course. However, the processes teachers used to make recommendations and the ways in which students demonstrated interest varied and were not universally implemented across schools. Furthermore, historical data showed that nearly half of the students taking AP at the eight high schools failed the course.

Prediction models were created to assist schools in identifying and recruiting students beginning in 2016

In an effort to offer an additional source of information to aid schools in identifying students who could succeed in AP courses, prediction models were created in 2016. Since then, the prediction models have been refined over two additional years. The statistical models were built using historical data from previous cohorts of students serving as the reference group. Various sources of student data were tested for inclusion in the prediction models each year, including academic achievement, attendance, behavior and course grades. Predictions were made for AP courses in science, math, English language arts (ELA), and social studies.

Predictions highlight those students who are likely to succeed and those who may need additional supports to succeed

This work has focused on increasing student access to AP courses in a way that promotes student success in AP. The goal of our collaborative work with the district was to identify students who would be likely to succeed in AP courses, so they could be encouraged to participate. The data about the predicted success of students also highlights those students who may need additional supports to succeed. Predictions data are not intended to discourage any students interested in taking AP courses. Staff at the schools can work with those students who were not predicted to do well based on their recent academic history to identify and access the supports necessary to help them be successful.

Over three years, prediction models evolved to improve accuracy and usefulness

Our work in collaboration with the district over time has led to various improvements. The models have been refined to improve the accuracy of the predictions and the process has evolved to allow us to provide the predictions earlier in the school year and to make the predictions more useful to school administrators and teachers. A summary table of the changes that were made each year is provided below, followed by a description of the process each year and the results.

Summary of Changes Made to Prediction Models by Year

<i>Academic Year Predictions Made For</i>	<i>Students Included in Predictions</i>	<i>Students Serving as Reference Group</i>	<i>Student Data Used for Predictions</i>	<i>When Predictions Were Provided to District</i>
2016-17	10 th graders (N=3,447)	AP course grades of previous cohorts	Final 2014-15 grades Attendance data Achievement scores Behavioral data	March 2016
2017-18	9 th & 10 th graders (N=10,413)	10 th & 11 th graders taking AP classes in the fall of 2016	Fall 2016 GPA Reading achievement scores	March 2017
2018-19	9 th & 10 th graders (N=9,080)	10 th & 11 th graders taking AP classes in the fall of 2017	Mid-fall semester grades 2017	January 2018

Predictions for the 2016-17 School Year

Prediction Process

Predictions for the 2016-17 school year were made in partnership with the Value-Added Research Center at the University of Wisconsin-Madison. For this first year of predictions, only 10th graders were included. The statistical models were built using multiple sources of data about students from the previous school year (when students were 9th graders) which resulted in fairly complex models and a large number of students being excluded due to incomplete data. These models relied on the final grades from the 2014-15 school year, along with attendance, achievement, and behavior data, to predict AP course grades for students who would be in 11th grade during the 2016-17 school year. Approximately 30% of students were removed due to missing data, leaving 3,447 students for inclusion in the predictions. Predictions were provided to the district in March of 2016 to assist them in recruiting students to enroll in AP courses that would begin the following school year.

Results

To examine the accuracy of our predictions, we compared the predicted grades to the actual grades earned for those 11th grade students who took an AP class. The results suggested that the grade predictions provided a good estimate of actual earned grades during the fall of 2016, but were less effective at making exact predictions. When compared to the 1,159 AP course grade predictions, 951 (82%) actual earned grades were within one letter grade higher or lower than the prediction. However, only 409 (35%) of the predicted grades for the 11th graders exactly matched the actual grade earned.

Predictions for the 2017-18 School Year

Prediction Process

To improve upon the prediction process from the previous year, we used more recent data for the models. By using more recent data, the models became much simpler. The models for the second year of predictions relied solely on Fall 2016 GPA for each subject except for ELA, which also included reading achievement. Using data from within the same school year combined with the simplicity of the models resulted in far fewer students being excluded due to missing data. As mentioned previously, 30% of 10th graders were excluded from the predictions the prior year whereas only 8% were excluded for the 2017-18 school year. For the first time, the predictions were expanded to include 9th graders. The district asked that 9th grade students be included to further encourage increased AP course participation. Only 10% of 9th graders were excluded due to missing data. Tenth grade and eleventh grade students taking AP courses in the previous year served as the reference group to make predictions for 10,413 students, considerably more than were made the previous year using the more complex models. As in the prior year, predictions were provided to the district in March 2017 to assist teachers in recruiting students to enroll in AP courses that would begin the following school year.

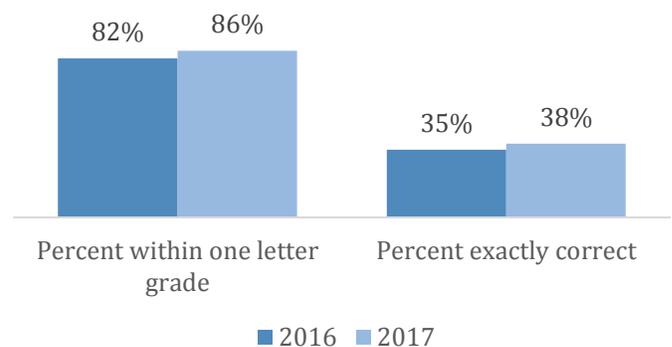
Results

We examined the accuracy of our predictions once again by comparing the predicted grades to the actual grades earned for those students who took an AP class.

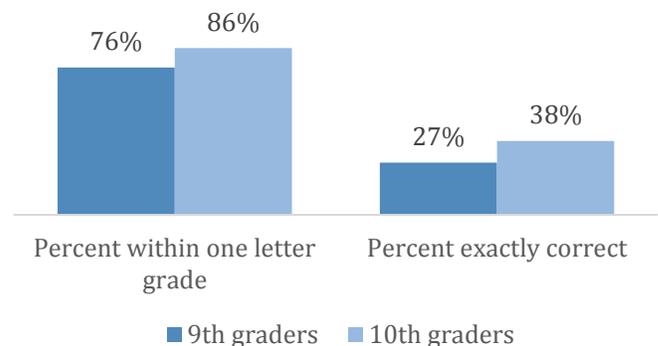
In general, the 2017 AP predictions were more accurate than 2016 AP predictions. The simpler predictive models, using more current data, both improved the overall accuracy of AP course predictions and resulted in fewer students being excluded due to missing data. By subject area, ELA AP courses were somewhat less accurate than 2016 predictions, while the other three subject areas were all more accurate than the predictions made the previous year.

Ninth-grade student predictions were less accurate than 10th grade predictions. Although 9th grade student AP predictions were less accurate than those made for 10th grade students, these were still reasonably accurate.

2017 AP predictions were more accurate than 2016



2017 AP predictions were more accurate for 10th graders



Predictions for the 2018-19 School Year

Prediction Process

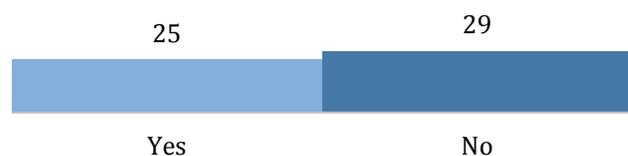
In addition to improving the number of predictions and the accuracy, we explored ways in which to improve the process of providing these predictions to the school district. We understood from district administrators that providing the predictions earlier in the school year would allow more time for AP coordinators and teachers to recruit students for AP courses and inform AP planning for the next school year. To meet this need, we shared the predictions data with the district much earlier (January) than we had in previous years (March). To allow us to provide the results sooner, we used mid-semester grades from the fall of 2017 instead of full term grades, as we did in the prior year. Although it is likely that mid-semester grades are not as predictive as full term grades, the need for receiving the data earlier outweighed the need to have more accurate predictions. It is not yet known how much less predictive mid-course grades are however. Earned grades in AP courses for these predictions will be available in early 2019. Meanwhile, AP coordinators were surveyed to determine the extent to which providing schools prediction data earlier in the year promoted its use. The results from that survey are presented below.

AP Staff Perceptions about the Usefulness of Predictions

A short online survey administered in the spring of 2018 asked AP teachers and staff from the district about their experiences with the AP predictions data provided to them a few months before. The survey asked about the use of the predictions and about perceptions related to the impact and effectiveness of the data. In total, 54 school staff completed the survey, including 38 AP teachers, six AP coordinators, four school counselors, and three school administrators from 17 of the district's 21 high schools that offer AP courses (81%). With 18 AP coordinators and 108 AP teachers at the district, the response rate among AP staff was 35%. AP teachers had an average of 6.6 years of experience, ranging from one to 24 years, and half with three or fewer years of experience. English / English language arts (ELA) was the most frequently identified subject area taught by AP teachers, followed by social studies and history. The following provides a summary of key findings.¹

Have you ever received AP prediction model data for students at your school? (54 total responses)

Fewer than half of the survey respondents (46%) reported that they had received AP prediction model data for students.



Only those respondents who reported having received AP prediction model data for students were asked the following three survey questions.

¹ For the full report, see Jones, et al. (2018). *Advanced Placement Predictions Project: 2018 Use of AP Predictions Data Teacher Survey Results*. Socially Responsible Evaluation in Education. University of Wisconsin-Milwaukee.

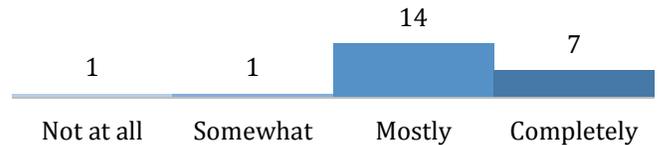
*For which year(s) did you receive AP predictions data?
(22 total responses)*

Three respondents (14%) reported receiving predictions data for all three years, 11 respondents (50%) received data for two years,² and 8 respondents (36%) received data for only one year.³ Two in five respondents (41%) indicated that they had received AP predictions data in 2016-17, while about two in three (68%, each) indicated receiving AP predictions data for 2017-18 and 2017-18. These results suggest that dissemination has improved over time, but room for improvement remains.



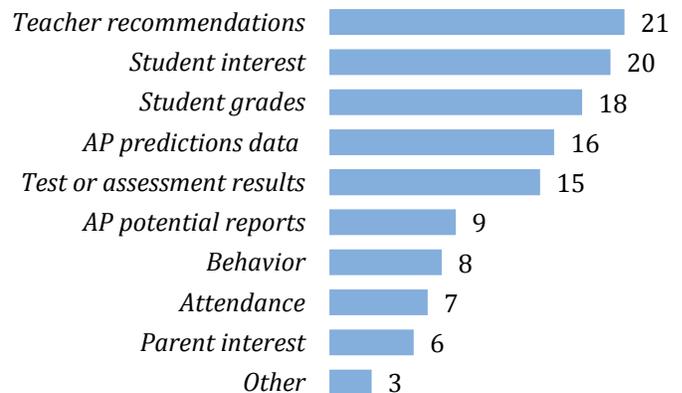
*To what degree do you understand what the AP predictions data represented?
(23 total responses)*

The majority of respondents (95%) indicated that they *mostly* or *completely* understood what the AP predictions data represented.



*What information are you using at your school this year to identify students who should consider taking AP courses?
(23 total responses)*

The AP predictions data are intended to be used in concert with other information to help schools identify students for AP courses. AP prediction data are one of several sources of information that school staff are using, with seven in ten respondents (70%) indicating that they use AP prediction model data to identify students who should consider taking AP courses. Teacher recommendations (91%) and student interest (87%) were the two most frequently reported information used to identify students.



Only those respondents who indicated that AP predictions data were used as a source of information to identify students were asked the following four questions.

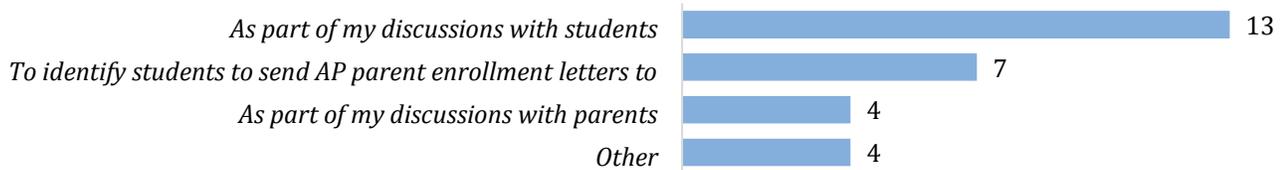
² Of these 11 respondents, 8 received data for 2017-18 and 2018-19, and 3 received data for 2016-17 and 2017-18.

³ For these 8 respondents, 3 received data for 2016-17 only, 1 one 2017-18 only, and 4 for 2018-19 only.

In which ways did you use AP predictions data?

(16 total responses)

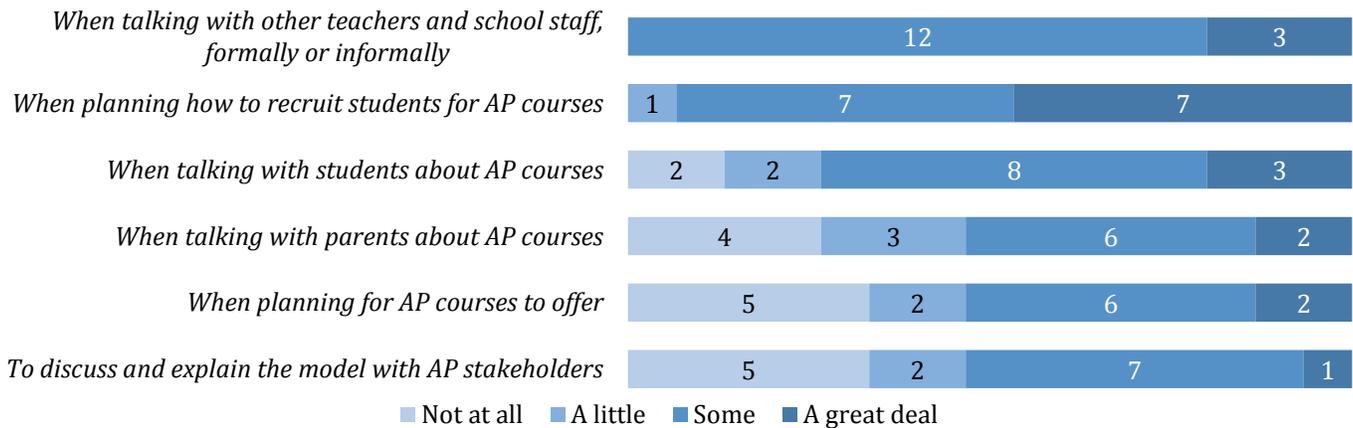
Four in five respondents who selected AP predictions data as a source of information used to identify students who should take AP courses (81%) used AP predictions data as part of discussions with students. About two in five (44%) used AP prediction model data to identify students to send parent enrollment letters to, and one in four (25%) used the data as part of discussions with parents.



To what extent have you used the AP predictions data in the following ways?

(15 total responses)

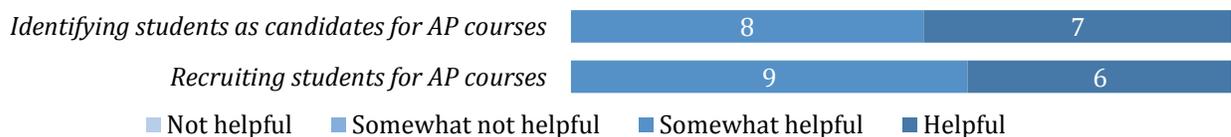
All of the respondents indicated that the prediction data were used *some* or *a great deal* when talking with other teachers and school staff. Nearly all (93%) indicated that they used the data *some* or *a great deal* when planning how to recruit students for AP courses. About three in four (73%) used AP prediction data *some* or *a great deal* when talking to students about AP courses, compared to about half (53%) when talking to parents.



How helpful or not helpful did you find the AP predictions data for identifying students as candidates for AP courses and recruiting students for AP courses?

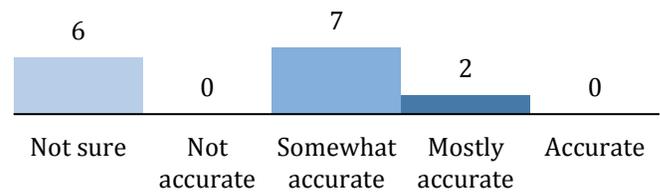
(15 total responses)

All respondents found AP predictions data to be either helpful or somewhat helpful for identifying students as candidates for AP courses and recruiting students for AP courses.



How accurate were the AP predictions with actual student performance in AP courses? (15 total responses)

Two in five respondents (40%) were not sure how accurate the predictions were in relation to actual student performance. About half (47%) found them to be *somewhat accurate*, and 13% indicated *mostly accurate*. No respondents reported either *not accurate* or *accurate*.



The AP predictions models have evolved to be simpler and include predictions for more students

By working in collaboration with the school district to understand their needs for identifying and recruiting students for AP courses, statistical models predicting student performance in AP courses have been improved and refined over three consecutive school years. The models have evolved to include more recent student performance data available: end-of-year grades from the previous school year in 2016, to end-of-semester grades from the current school year in 2017, to mid-semester grades from the current school year in 2018. By incorporating more recent student data, the prediction models became simpler and excluded fewer students due to missing data. Additionally, the models were expanded to include predictions for 9th graders and 10th graders.

Despite using simpler models and including more students, the predictions have become more accurate

The more parsimonious prediction models, which used recent student data and included more students in 2017, were more accurate than the complex models that relied on older student data and included fewer students in 2016. The accuracy of the predictions for 9th graders were reasonably close to the accuracy of the predictions for 10th graders.

The models and process evolved to get the data to schools earlier

School staff requested the predictions earlier in the school year to assist them in identifying and recruiting students for AP courses. Therefore, the models were built on data that was available earlier in the school year to provide the predictions in January. It is yet to be determined if this change has adversely affected the accuracy and will be examined as data become available.

School staff regard the AP predictions data as helpful, but dissemination of the data, along with findings about the predictions' accuracy, could be improved

To understand the usefulness of the data we provided, we surveyed AP coordinators and teachers in 2018. Although less than half of the respondents received the predictions data, many who did receive it were using the predictions in conjunction with teacher recommendations and student interest to identify students for AP courses. Those who reported using the AP predictions data did so in conversations with students and with other staff. Folks who used the data found it to be helpful for its primary purpose of identifying and recruiting students, but the survey revealed some uncertainty about the accuracy of the predictions. Therefore, future efforts to make the data more useful will need to concentrate on ensuring AP coordinators and teachers receive the predictions data and understand our findings about the accuracy of the predictions so far.

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