Alternative Pass Measures on the Professional Readiness Exam

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MICHIGAN Department of Education

Introduction

In 2011, the Michigan Department of Education (MDE) established policy goals to improve the quality of teachers entering the workforce. These goals addressed changes to educator preparation, certification, and continuing education. These policy changes may impact the pool of teacher candidates in Michigan—both directly (if teacher candidates do not meet new requirements) and indirectly (if students opt not to become teacher candidates). For this reason, it is necessary for State leadership to balance quality measures with maintaining a sufficient pool of teacher candidates by both geographic and content area. In October, 2013, MDE established a new Professional Readiness Exam (PRE), which teacher candidates must pass before student teaching. The standard-setting panel, comprised of K-12 educators and college and university faculty, used a new paradigm to recommend cut scores for the PRE.

The PRE consists of three sections, each devoted to a single subject. The first section covers reading, the second math, and the third writing. The reading section contains six approximately equally weighted sections covering word meaning, main idea and detail, writer's purpose, idea relationships, critical reasoning, and study skills. The math section contains four sections; quantitative literacy and logic, and statistics and probability each receive a 20% weight, while algebra and functions, and geometry and trigonometry each receive a 30% weight. Writing consists of a multiple-choice section on the principles of effective writing and a free-response composition section, both of which are equally weighted.

Students must pass all three subjects to pass the PRE. Each section receives a scaled score between 100 and 300, with the threshold for passing at 220. Students do not have to pass all three sections at the same sitting—students may retake sections that they have failed without retaking those that they have passed. Students may retake the PRE as often as they wish. Educator Preparation Institutions (EPIs) in Michigan often use a passing score on the PRE as a requirement for admittance into a teacher preparation program. The requirement that students pass all three sections, while necessary to ensure that prospective teacher candidates have the requisite K-12 knowledge to perform well in a teacher preparation program, may make it challenging for some qualified candidates to pass the PRE examination as a whole.[1] MDE therefore explored alternative ways in which students may demonstrate proficiency in these subjects, while maintaining the rigorous expectations recommended by the standard setting panel.

Methodology

MDE examined several alternate ways a student could pass the PRE as a whole to account for the impacts of a conjunctive passing rule (i.e., candidates' needing to pass all three sections).

One method for addressing potentially high false negative rates involves looking at the standard error of measurement on each subject area test (or section of the PRE). The standard error of measurement is different from the standard deviation of scores. The standard deviation of scores looks at scores produced by students of varying ability and preparation levels. While useful in many ways, it reflects the type of students taking an exam at least as much as it reflects the exam itself. The standard error of measurement (SEM) measures something different—it asks the hypothetical questions of what the distribution of scores would look like if a large number of students *identical* in their subject area knowledge took the same exam, or if the same candidate took the same test a large number of times without changing in subject matter knowledge from administration to administration.

Accounting, in a thoughtful manner, for measurement error on the PRE allows us to reduce

[1] Consider a candidate whose content knowledge is exactly consistent with the passing score in each section. Due to exam-day circumstances and other factors, s/he may randomly score higher or lower than is representative of his/her true achievement. Such a candidate can be considered equally likely to score above or below the passing score in each content area. Thus, this student has a 50% chance of passing each subject. Assuming that measurement error (scoring above or below one's true achievement level) is uncorrelated from test to test, this means that s/he has a 1/8 probability of passing the PRE overall on his or her first attempt, for a first-attempt "false negative" rate of 7/8. Of course, this student could retake any sections failed initially, and students with higher predicted scores would have lower false negative rates. While this hypothetical example is the most extreme possible case, and is not representative of the vast majority (if any) students, it demonstrates why MDE has chosen to focus on this exam.

the potentially high "first-time test taker" false negative rate without significantly reducing the rigorous level of basic content knowledge expected of candidates on all three PRE sections for students near the passing threshold on all three PRE sections. In order to maintain an appropriate level of rigor, the method considered here is to allow for incorporating measurement error for a third subject area test only if the candidate has passed in the other two. If the SEM adjustment is limited to one SEM below the PRE passing threshold, assuming normally distributed measurement error, fully two-thirds of the students of concern would be considered to have passed the third PRE sub-test, and the remaining third would be exceedingly likely to do so upon retesting. If the SEM adjustment is at two SEM below the PRE passing threshold, assuming normally distributed measurement error, fully 98% of the students of concern would be considered to have passed the third PRE sub-test without retesting. The concern with a larger SEM adjustment is that rigor would be lowered unreasonably in the one subject area in which the student had performed poorly and that unqualified candidates would therefore be allowed to more forward at an unacceptable rate.

Another method of addressing false negatives is to allow for alternate measures to be considered, so long as those alternate measures can be shown to be reasonably valid. Therefore, MDE also considered candidates' performance on the Michigan Merit Exam (MME) and the ACT (administered as part of the MME). Each exam has scaled scores in the three subjects covered by the PRE. Within each subject are, MDE performed several analyses. The first was to regress PRE scores on either MME scores or ACT scores to establish the basic relationship between scores on each exam. While some difference is to be expected between scores on different assessments, additional analyses would not make any sense if the relationships between PRE scores and scores from the potential alternate measures (MME and ACT) are weak or non-significant.

Assuming reasonably strong relationships between the PRE and the potential alternate measures, the second step is to identify thresholds on the alternate measures that are essentially equivalent to the thresholds for passing on the PRE. As discussed above, the threshold for passing on the PRE is the score at which a student has a 50% chance of passing if his or her true level of achievement is exactly consistent with the threshold. To identify thresholds on the potential alternate measures that can be interpreted in the same way, another set of regressions analyses was performed. These procedures identify the scores on the alternate measures that result in a 50% *predicted* probability of passing a given section of the PRE based on either MME or ACT scores. These "cut scores" can be interpreted in the same way, as the ACT or MME score at which a student is expected to pass the corresponding PRE subject with 50% probability (essentially the same as a student whose true achievement level is exactly the same as the PRE threshold). To assure that the PRE-equivalency passing scores on the MME and ACT are at least as rigorous as the achievement expected of Michigan public high school students, an additional check was put in place. PRE equivalency scores were set at the higher of the scores identified through this analysis or (for the MME) the thresholds for "proficiency" or (for the ACT) the "college readiness benchmarks" identified by ACT.

Using this second approach, candidates would be considered to have passed the corresponding section of the PRE (in lieu of taking that section of the PRE) if their ACT or MME scores meet the threshold identified for an alternate measure. Thus, some candidates would not need to take the PRE at all, some would need to take only one section, some would need to take only two, and some would need to take all three.

Michigan college and university representatives also requested that MDE establish equivalent passing scores using PRAXIS or similar tests administered by other states. MDE determined that there were insufficient data at this time to begin the process of reviewing correlational relationships. MDE will consider these options in the future if data can be obtained and a similar study conducted.

After determining which students would have passed under each possible alternate arrangement, MDE examined the net effect of combining the SEM

exceptions with the MME and ACT exceptions. These were used to make a recommendation regarding the appropriate usage of the various exceptions based on the new hypothetical pass rates.

Data Manipulation

The primary challenge in matching scores on the MME and the ACT to performance on the PRE is that the information used to identify students on the PRE differs from that used to identify students on the MME and the ACT. On the PRE, students are identified by their name, their date of birth, and the last four digits of their social security number. Because of privacy concerns regarding minors, the State of Michigan does not collect high school students' social security information, removing one potential high-quality link between these two data sets. Fortunately, in the data set used for these analyses, no unique combination of names and dates of birth on the PRE had multiple social security numbers associated with it.

PRE data consist of the student identifiers listed above, the test date, institutions receiving scores, state of residence, and score information. The PRE has been administered on four occasions since its inception—in October, November, and December 2013, and in January 2014—and students have information listed for every occasion on which they sat for the exam. At some sittings, students sent scores to multiple institutions. As these scores represented only a single exam performance, only one score per student per sitting was used. Each sitting has students' scaled scores in reading, writing, and math, whether they passed each of the three subjects at that sitting, and the subjects they had passed up to that point.

All analyses used the scaled scores for each exam. Both the MME and ACT contain scaled scores in math, reading, and writing. MME scores may range from a low of 950 to a high of 1250 in each subject, though proficiency cutoffs vary by subject.[2] ACT scores may range from 1 to 36 in each subject, with differing college readiness benchmarks by subject.[3]

While MME and ACT data exist from 2007 onward, data were available in an immediately usable format only from 2008 onward for the MME and 2009 onward for the ACT. MME and ACT data required some additional formatting to be matched to PRE records because students were identified by a Unique Identification Code (UIC) but could appear multiple times under each UIC value. Students who appeared in the data multiple times under the same UIC but had different information listed in each case were first assigned the modal value of each variable—for instance, if a student was listed twice as female and once as male, the two female records outweighed the one male record. Students were dropped from the data if they did not have a modal gender value, which guaranteed in practice that all of their other data was missing. Students were also dropped from the data if they did not have a valid score on any subsection of the MME. This accounted for the vast majority of duplicate UIC values. Some students had multiple MME scores on file. In these cases, they were assigned their highest score in each subject. In the vast majority of cases, removing duplicate UIC values allowed identification of student records by name and date of birth. Analogous processes were used to uniquely identify students in each year of ACT data.

In every year of data, in less than 0.1% of the records remaining after the procedures listed above, some student records had identical names and dates of birth but different UIC values. It was uncertain whether these records reflected multiple students or one student with multiple UIC values. If these records represented multiple students, it would be impossible to tell which one took the PRE. As these cases represented a very small number of students, these students were dropped from the data.

After completing this data cleaning, MME and ACT data were merged with PRE data. In some cases, data discrepancies prevented the successful merging of score data. This may reflect keystroke

[2] Among the sample used in analysis, math scores on the MME range from a low of 950 to a high of 1179, reading scores range from 986 to 1250, and writing scores range from 978 to 1223. Proficiency begins at a score of 1116 in math, 1108 in reading, and 1100 in writing.

[3] Among the sample used in analysis, math scores on the ACT range from a low of 13 to a high of 36, reading scores range from 8 to 36, and writing scores range from 9 to 35. College-ready benchmarks are at scores of 22 in math and reading and 18 in writing.

error—someone may have mistakenly written a "1" where they meant to write a "2" in a test-taker's date of birth, for instance. In other cases, students may have included their middle name or a suffix (such as Jr. or III) on one exam but not on the other. In a few cases, students' names contained punctuation, such as hyphenation or apostrophes, in one exam but not in the other. Finally, some students' names were simply spelled differently on one exam than on the other.[4] As a computer would not recognize these individuals as identical, their performance data was merged by hand.

In total, there were 2,534 PRE sittings, but not all are applicable. Of these sittings, 201 were by students from out of state, who do not exist in MDE's records. Another 702 sittings were by students with birthdays before 1990 (who are too old to appear in MME or ACT data) or after 1994 (who might still be high school students). Of the remaining 1,631 sittings, MME data were successfully matched to 1,251 (76.6%) and ACT data were successfully matched to 1,208 (74.1%). In all, 1,344 PRE sittings (82.4%) could be matched to at least one other data set.[5]

Baseline analysis was further restricted to students' initial PRE sittings to look at students taking all three PRE exams simultaneously. While students may rationally choose to distribute their study time unevenly across subjects, their goal will still be to pass all three.[6] This also prevents results from reflecting students' reactions to not passing any of the three subjects on their initial sitting. These results are then applied to scores on all exams taken, regardless of whether it is a student's first time taking the PRE or his fourth.

Analysis

The first set of analyses regressed PRE scores on ACT scores and on MME scores. Linear regression finds the average relationship between two variables (in this case, PRE and ACT or MME scores). This analysis was done to establish that the ACT and the MME are valid predictors of PRE performance and can therefore be reasonably used as alternative methods of demonstrating achievement on the three PRE subtests. Both exams do a very good job of predicting students' scores on the PRE. Students' scores on the ACT and MME explain about half of the variation in PRE scores. This amount is slightly higher in math, where ACT and MME scores explain nearly 60% of the variation in PRE scores, and slightly lower in reading, where they explain about a third. This means that correlations between the PRE and the alternate measures range from approximately 0.57 to 0.76. Further detail may be found in Appendix A.

These results make it clear that performance on the MME and on the ACT is fairly consistent with performance on the PRE, though there is still a decent amount of variation in PRE scores that these exams do not explain. This is an ideal scenario. If scores on the exams were not closely related, it would be difficult to justify using MME or ACT scores as alternate methods of passing the PRE, as the exams would be measuring very different things. However, if the scores were too closely linked, MME and ACT scores would do too good a job predicting pass rates on the PRE to be much use—if they perfectly predicted which students would pass the PRE (generally at least four years before taking the PRE), little additional information would be gained by using them.

The next set of analyses consists of logistic regressions of whether students passed a particular PRE section on their MME or ACT score from that section. This provides estimates of the probability that a student will pass that section of the PRE based

[4] Probably due to character constraints, several students named "Christopher" had their first name listed instead as "Christophe" on the PRE, for instance.

[5] As our ACT data begin a year later than our MME data, 109 additional PRE sittings predate our ACT data. Subtracting these cases, the ACT match rate rises to 79.4%

[6] To illustrate why these analyses do not consider later sittings, consider a student who is very good at reading and writing but does poorly at math, and whose MME and ACT scores reflect this. If this student fails the math section of the PRE, he or she may devote a large amount of time to studying math. His or her second test would therefore reflect this additional study time (and the fact that he or she does not have to take reading and writing), rather than a more "natural" division of effort. This would attenuate any links between MME or ACT scores and PRE scores.

on his MME or ACT score.[7] Table 1 shows the cut scores generated by these regressions as well as versions that take into account MME proficiency standards and ACT college readiness benchmarks. Figures 1-6 contain predicted probability graphs for each exam and each subject. Figures 1-3 reflect predicted and actual pass rates on the PRE based on MME performance in math, reading, and writing respectively, while Figures 4-6 do so for the ACT.

In Figures 1-3, the dashed line represents the MME score at which a student has an estimated 50 percent chance of passing the relevant PRE section. The three solid lines represent the three state proficiency cutoffs. These divide the graph from left to right into sections representing "not proficient," "partially proficient," "proficient," and "advanced" MME scores. The bold line represents the border between partial proficiency and full proficiency—as teachers are expected to be at least proficient in the subjects that they teach, PRE test-takers must be above both the dashed line and the bold line to qualify for an alternative pass. To avoid overcrowding the graphs or showing information that does not substantially affect predicted pass rates, data points are shown only at MME scores achieved by at least three students.

Figures 4-6 are set up similarly, using ACT scores instead of MME scores. Here, the dashed line represents the ACT score at which a student has an estimated 50 percent chance of passing the relevant PRE section. The bold line in these graphs represents the ACT college readiness benchmark. Once again, students must be above both the cut score and the college readiness benchmark to qualify for an alternative pass.

Table 2 contains passing scores based on standard errors of measurement. For instance, using scores within one standard error of measurement would affect math scores of at least 198, reading scores of at least 200, and writing scores of at least 202.[8] Again, in order to avoid reducing rigor, these passing scores would apply only to students who have already passed two out of the three subjects.

Table 3 shows how these different passing provisions can be anticipated to translate into new pass rates. The first column describes the various scenarios discussed above. The second column gives the overall PRE pass rate if alternative pass measures were applied to all exams taken. This is then broken down into the impact of these measures on the math, writing, and reading sections and their overall impact on pass rates. Since these measures apply only to students already passing two out of three PRE subjects, the math, reading, and writing columns do not overlap at all, and the overall impact is the sum of the impacts on each of the three subjects.[9] The new pass rate is simply the original pass rate of 21.0% plus the overall impact of the alternative pass measure in question.[10]

Row A in Table 3 provides the baseline pass rate on the PRE. As this is the starting point from which hypothetical policies would be applied, the remaining columns are left blank. Rows B through E show the impact of the hypothetical alternative pass methods, taken individually. Row B shows the impact of considering candidates to have passed the PRE in a subject area if they score at most one SEM below

[7] Logistic regressions predict the likelihood of appearing in a particular category, and are primarily used for binary outcomes—in this case, "Pass" versus "Fail." The main advantage of using logistic regressions is that they do not assume that fixed improvements in MME or ACT scores will always have the same impact on one's probability of passing the PRE. For instance, students with ACT math scores of 18 and 21 may have very different probabilities of passing the math section of the PRE, while students with scores of 33 and 36 will have virtually identical probabilities (of nearly 100%) of passing the PRE despite having the same three-point difference in their scores.

[8] Readers may notice that scores two SEMs from the original passing score may not be exactly twice as far as scores one SEM away. While seemingly inconsistent, this is due to rounding procedures in computing raw scores and scaled scores. SEMs were applied to raw PRE scores; these were then rounded to the nearest whole number (as raw scores are in whole-number increments) and converted to scale scores. This rounding therefore produces what appear to be differently sized SEMs.

[9] This table applies MME and ACT alternative pass measures only for students who have passed two out of three exams. The recommended policy would apply to all students prior to their taking the PRE. As a result, rows referencing MME and ACT pass measures may underestimate the impact of the policy to some degree.

[10] These pass rates apply to tests already taken. As one of MDE's goals is to encourage more students to take the PRE, is it possible that pass rates going forward would be slightly different than those presented here. The nature of any changes depends on who these additional students are, and is beyond the scope of this brief to predict. However, it is likely that pass rates would closely reflect those in Table 3.

the passing threshold and have already passed the other two subjects without the SEM adjustment. Row C does the same, using two SEMs rather than one. Row D allows students to pass if they meet MME score requirements, while row E does the same for ACT scores.[11] Row F shows the net impact of the policies in rows B, D, and E, while row G shows the net impact of the policies in rows C, D, and E. Some students may pass the PRE under several of these measures simultaneously; for instance, a student who scores highly on the MME may score highly on the ACT as well. As passing under multiple measures simultaneously still results in passing a single exam, the net impact of these measures is lower than the sum of the three measures taken individually.

The impact of using SEMs as alternative pass measures is far greater than that of using MME or ACT scores, likely because MME and ACT scores are already highly correlated with PRE scores. Furthermore, adding MME and ACT pass provisions to SEM pass provisions has a larger effect when using one SEM than when using two, since using two SEMs already catches the vast majority of students already passing two exams. Each measure has the greatest impact on the pass rate in writing and the smallest impact on the pass rate in reading. This is because very few students fail only reading, a larger number fail only math, and a still larger number fail only writing. As a result, any policy will have a larger impact in writing than in math and a larger impact in math than in reading.

Policy Recommendation

Based on the results in Table 3, MDE made the following recommendations to the State Superintendent:

1. If a candidate scores at or above the threshold identified for the MME or for the ACT on any sub-test corresponding to a PRE subtest, that candidate shall be considered to have passed the corresponding PRE subtest. The thresholds are as follows: Mathematics (1116 on the MME, 22 on the ACT), Reading (1108 on the MME, 22 on the ACT), and Writing (1129 on the MME and 24 on the ACT English+Writing subtest)
2. If a candidate is considered to have passed two of the three PRE subtests, and he or she scores within one SEM of the passing score on the third PRE subtest, that candidate shall be considered to have passed the PRE as a whole. One SEM was chosen because of needing to maintain the balance between a low false negative rate and maintaining adequate rigor, and because with the combination of the one SEM adjustment and unlimited retesting, all "false negative" candidates are highly unlikely to remain as such.

The State Superintendent approved the application of these alternate methods of passing the PRE, with rollout based on dates of feasibility. The rollout of the first option is not immediately feasible. Systems must first be built to allow for two types of transactions:

- MTTC vendor systems will need to "talk" to MDE K-12 student assessment systems for feasible identification of those who have already taken the ACT or MME (even upon completing system development, some handwork will still be required because of different identifying elements used by the two systems). This is a completely new build and will require significant work on both sides.
- MTTC and/or MDE vendor systems will need to be updated to allow for submission of ACT scores from tests taken outside the purview of the MME. This is also a significant build on the part of one or both parties.

EPIs will be notified as soon as these systems are in place. Availability of funding and staff to build these systems may mean that this option will not be available for some time.

The rollout of the second option can happen nearly immediately, as it is simply applying a different threshold on one of out three MTTC scores already existing in MTTC vendor systems.

[11] These calculations use the ACT score generated as part of the MME testing process. Many students will retake the ACT on their own. As MDE does not have access to these scores, and as students will use their highest ACT scores to qualify, row E provides the lower bound of this measure's impact. MDE is studying how to allow students to provide scores from other ACT administrations while protecting the confidentiality of these scores.

TABLE 1:

Cut Scores by Exam and Subject

Alternate Measure	Subject Area	Thresholds from…		Final Threshold
		Logistic Regression	Proficiency/College Ready Check	
MME	Reading	1090	1108	1108
	Mathematics	1112	1116	1116
	Writing	1129	1100	1129
ACT	Reading	15	22	22
	Mathematics	21	22	22
	Writing	24	18	24

TABLE 2:

Passing Scores Based on Standard Errors of Measurement

Subject Area	Passing Score	-1 SEM	-2 SEM
Reading	220	200	170
Mathematics	220	198	176
Writing	220	202	180

TABLE 3:

Passing Rates Under Various Hypothetical Scenarios

Scenario		PRE Pass Rate	Impact of Adjustment			
			Writing	Math	Reading	Overall
A	No Adjustment	0.21	—	—	—	—
B	One subtest at -1 SEM	0.35	0.10	0.03	0.01	0.14
C	One subtest at -2 SEM	0.44	0.17	0.05	0.01	0.23
D	MME cut scores	0.25	0.02	0.01	0.00	0.04
E	ACT cut scores	0.24	0.02	0.01	0.00	0.03
F	B, D, and E	0.35	0.10	0.03	0.01	0.14
G	C, D, and E	0.44	0.17	0.05	0.01	0.23

FIGURE 1:

Predicted PRE Pass Rates versus MME Math Scores

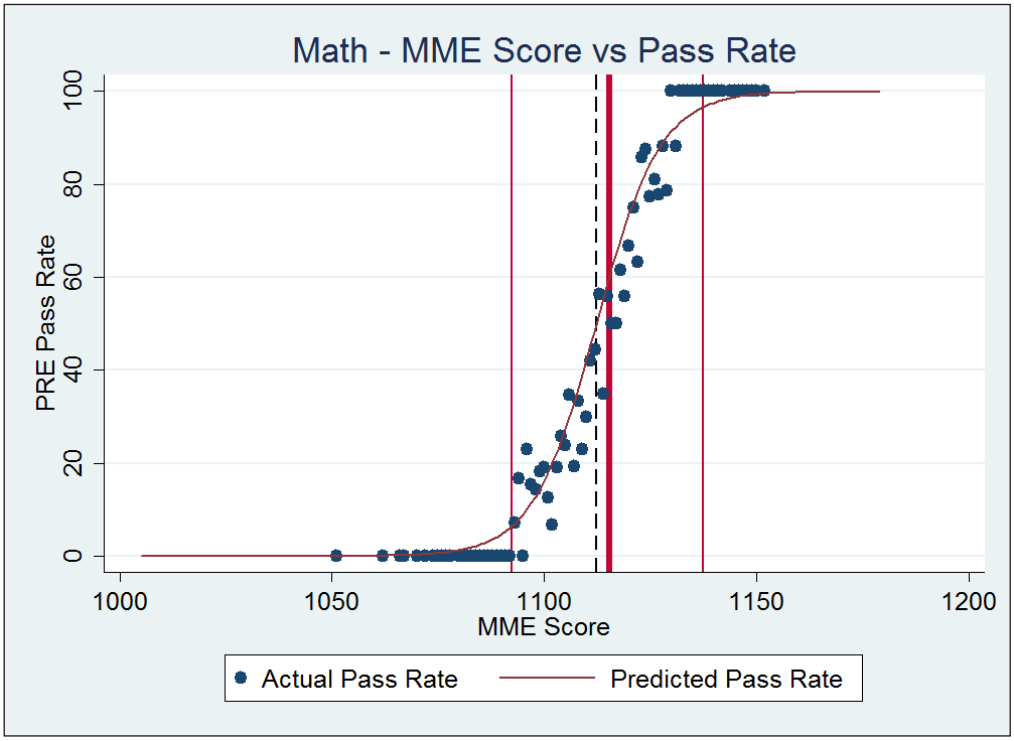


FIGURE 2:

Predicted PRE Pass Rates versus MME Reading Scores

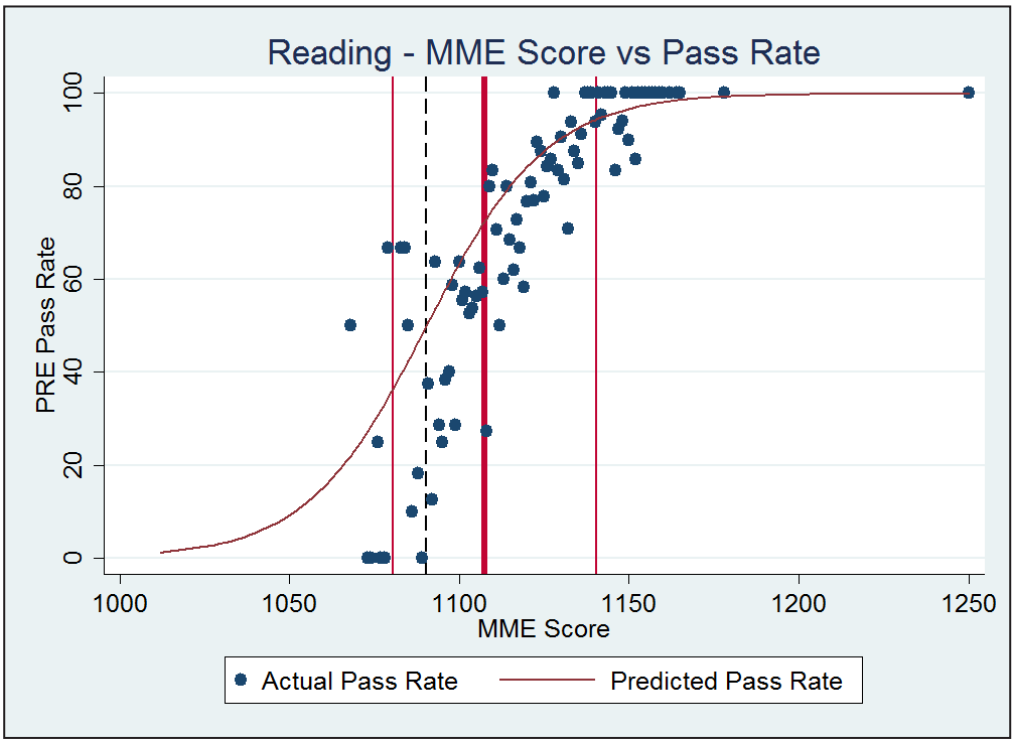


FIGURE 3:

Predicted PRE Pass Rates versus MME Writing Scores

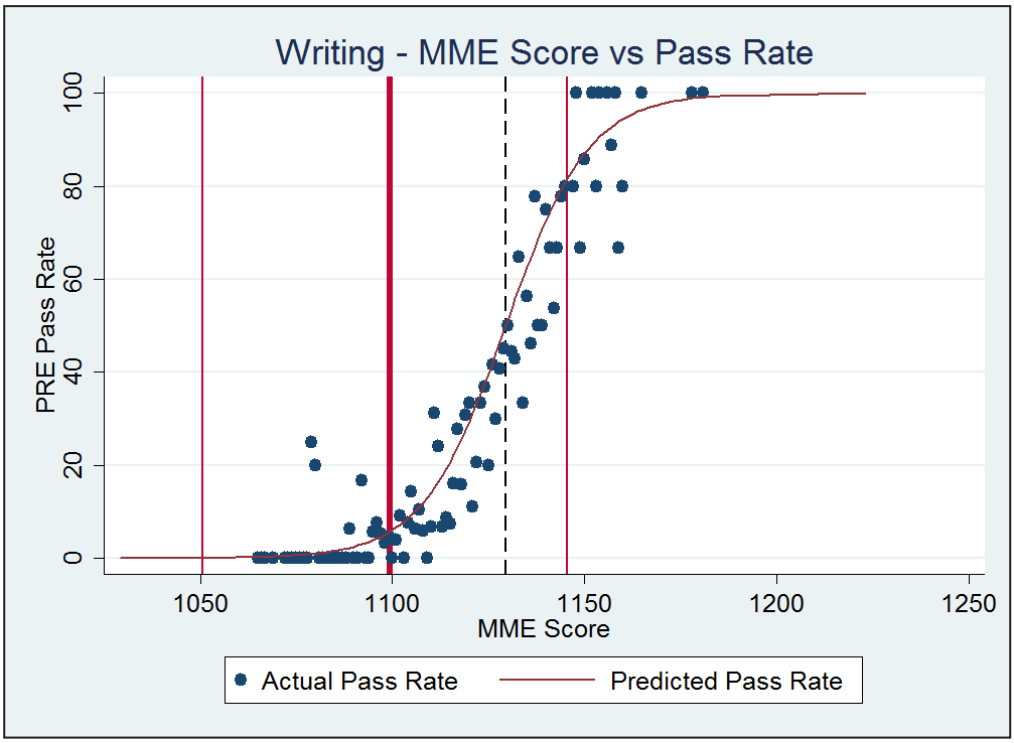


FIGURE 4:

Predicted PRE Pass Rates versus ACT Math Scores

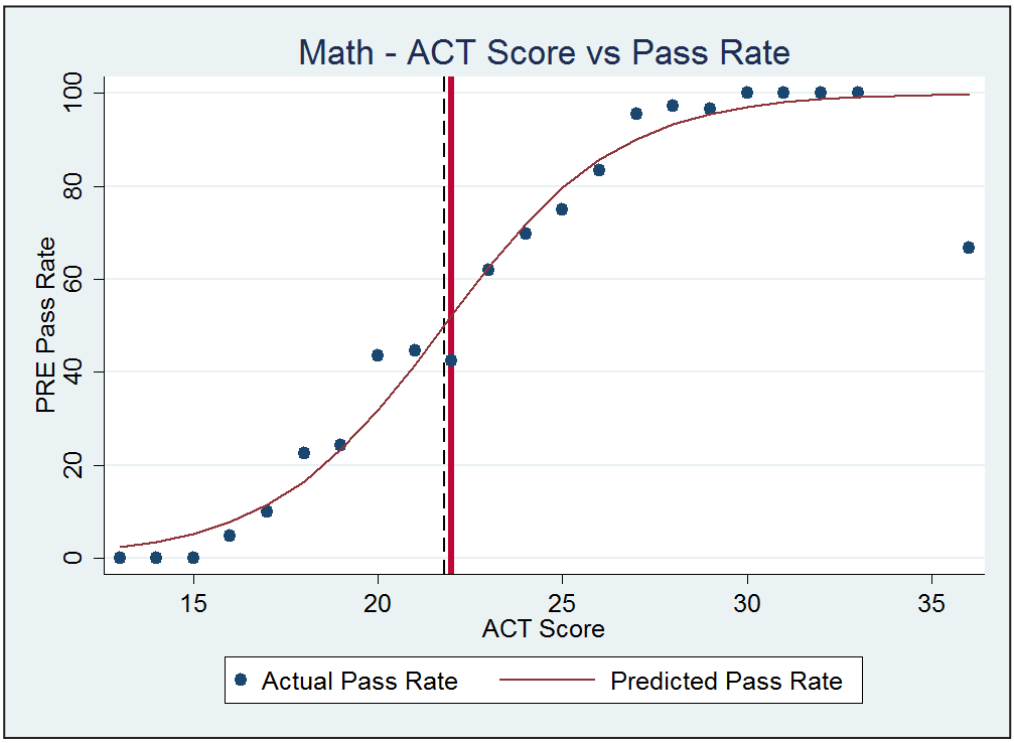


FIGURE 5:

Predicted PRE Pass Rates versus ACT Reading Scores

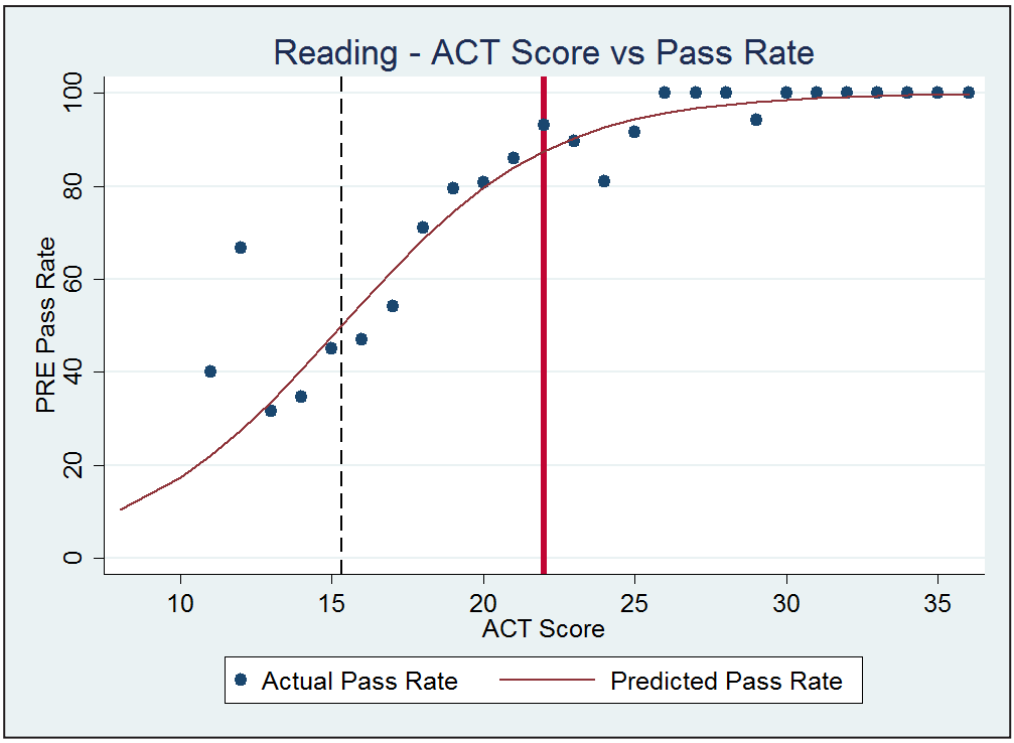
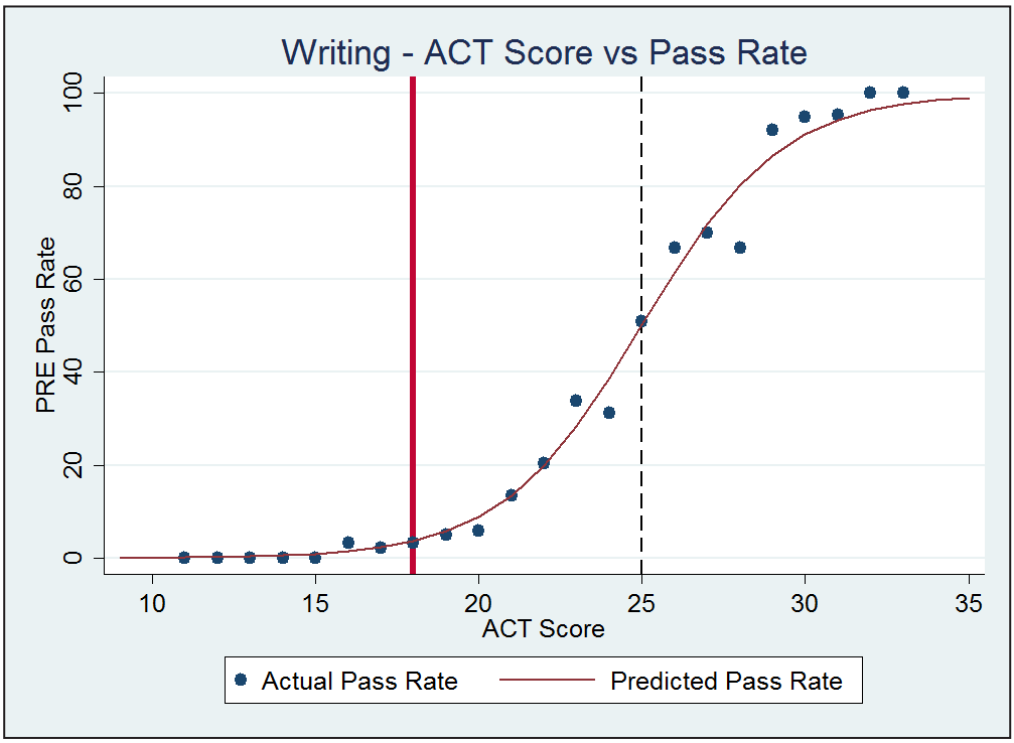


FIGURE 6:

Predicted PRE Pass Rates versus ACT Writing Scores



Appendix A: The Relationship Between PRE scores and those on the MME and ACT

Appendix Table A contains the results of regressions of PRE scores on MME and ACT scores. The relationship between scaled scores on the MME and ACT and those on the PRE is not one-to-one, due to the different scales used on each exam, but scaled scores on both exams are statistically significantly related to scores on the PRE. The relationship between the two variables is statistically significant at the 0.1% level—in other words, it is a virtual certainty that the relationship between these two variables is due to an underlying correlation rather than to statistical chance. Interestingly, controlling for when students took the PRE (in case some sittings were particularly challenging) or when they took the MME or ACT (in case their skills grew or faded with time), did not greatly affect the results.[12]

Appendix Table B shows the R-squared values associated with each of the regressions in Appendix Table A. R-squared values show how much of the variation in the dependent variable (PRE scores) is accounted for by the independent variables in each regression. MME scores account for between a third (in reading) and 60 percent (in math) of the variation in PRE scores. This result is virtually identical when using ACT scores rather than MME scores as the explanatory variable. Appendix Table C contains correlations between scaled scores on the PRE and those on the MME and ACT respectively. The lowest correlation in this table—that between the reading section of the PRE and the reading section of the ACT—still has a correlation of nearly 0.57. Correlations in writing are over 0.7 between the PRE and the MME and nearly 0.73 between the PRE and the ACT. Correlations in math are highest—approximately 0.75 on each set of exams.

Several factors may explain why MME and ACT reading scores do not predict performance on the PRE as well as math or writing scores do. The first is that scores on the reading section of the PRE are awarded in increments of 10, while scores in the other two sections are awarded in finer increments. Another is that the distribution of reading scores is more densely clustered than the distribution of math or writing scores—a wide range of MME reading scores therefore has to translate to a fairly small distribution of PRE scores. Finally, the distribution of reading scores on the PRE is fairly high—students pass this section at a higher rate than the other two sections.

[12] These analyses also included regressions with a quadratic term to account for the possibility that the relationship between the two sets of scores is something other than a straight line. These results did not produce substantial additional insight and are not shown here but are available upon request.

APPENDIX TABLE A:

Regression of PRE scores on MME and ACT scores

	MME			ACT		
	Math	**Reading**	**Writing**	**Math**	**Reading**	**Writing**
Test Scores Only	1.6143 (0.0438) N = 1023	0.9461 (0.0426) N = 1013	1.1652 (0.0368) N = 1002	7.1877 (0.2038) N = 1008	4.0407 (0.1837) N = 1009	6.2986 (0.1881) N = 996
Cohort and sitting effects	1.6251 (0.0448) N = 1022	0.9525 (0.0431) N = 1012	1.2169 (0.0372) N = 1001	7.4135 (0.2136) N = 925	4.1414 (0.1979) N = 925	6.6305 (0.2007) N = 912

APPENDIX TABLE B:

R-squared values from regression of PRE scores on MME and ACT scores

	MME			ACT		
	Math	**Reading**	**Writing**	**Math**	**Reading**	**Writing**
Test Scores Only	Adj. R^2 = 0.5703	Adj. R^2 = 0.3274	Adj. R^2 = 0.5006	Adj. R^2 = 0.5524	Adj. R^2 = 0.3238	Adj. R^2 = 0.5296
Cohort and sitting effects	Adj. R^2 = 0.5712	Adj. R^2 = 0.3321	Adj. R^2 = 0.5218	Adj. R^2 = 0.5675	Adj. R^2 = 0.3292	Adj. R^2 = 0.5486

APPENDIX TABLE C:

Correlations between PRE scaled score and MME and ACT scaled scores

	MME and PRE	**ACT and PRE**
Math	0.7554 N = 1023	0.7435 N = 1008
Reading	0.5728 N = 1013	0.5696 N = 1009
Writing	0.7079 N = 1002	0.7280 N = 996