Examining Effects of PreACT Adoption on College Readiness Outcomes

Jeff Allen, PhD

Based on the first cohort of students who took the PreACT® in 10th grade and the ACT® test in 11th grade, this study examines the effects of PreACT adoption on ACT test scores, participation in challenging high school courses, interest-major fit, and college score sending behavior. Adoption of the PreACT led to an increase in ACT Composite score of 0.23 score points, which is comparable to one month of instruction. Adoption of the PreACT also led to small increases in interest-major fit and out-of-state score sending.

Introduction

The PreACT test is a multiple choice test that provides students with practice for the ACT test and measures of progress towards college readiness. The PreACT can be administered to students in any grade but is most commonly administered to 10th graders. This paper documents a study that examined the effects of schoolwide PreACT adoption on college readiness outcomes for the first cohort of students to have taken the PreACT and ACT tests. The outcomes include ACT test scores, participation in challenging high school courses, interest-major fit, and college score sending behavior. Table 1 provides rationale for why administration of the PreACT could affect these outcomes.

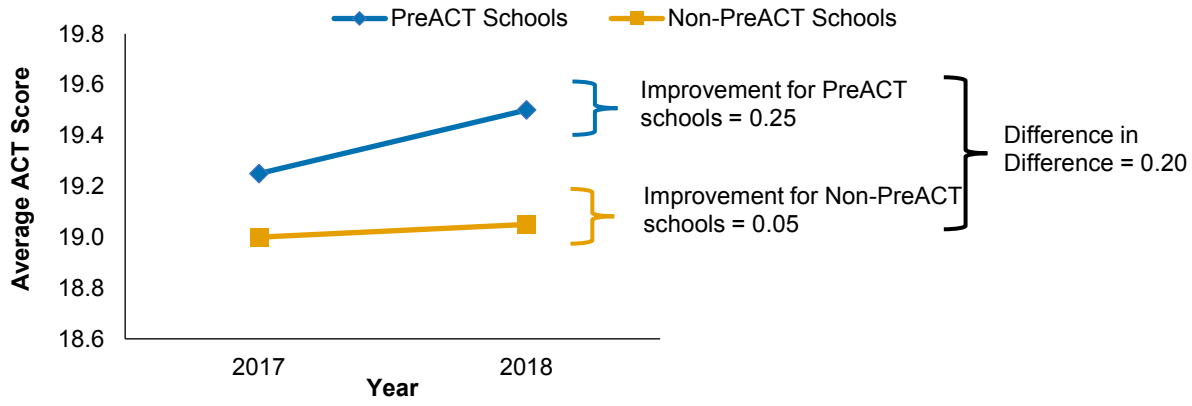
College Readiness Outcome	Rationale for PreACT Effect
ACT test scores	By taking the PreACT, students are exposed to content and test items that simulate the ACT testing experience, leading to greater familiarity of the knowledge and skills tested by the ACT. Further, by receiving feedback on their PreACT performance, students may focus on areas that need more work and may be more likely to engage in other preparation and learning activities.
Participation in advanced high school coursework and upper-level math and science courses	Through the feedback they receive from the PreACT test, students learn that they are ready for advanced high school coursework. Further, if PreACT feedback stimulates college planning, students may be more likely to take challenging high school courses to improve their readiness for college.
Interest-major fit	Students who take the PreACT test may take the Interest Inventory and engage in college major exploration. Increased exploration may lead to greater fit between their personal interests and the major they plan on entering when they take the ACT test in 11th grade.
College score sending behavior	Students who take the PreACT test may engage in more college exploration and planning, which could result in them sending ACT test scores to more colleges and to more out-of-state colleges. Moreover, they may participate in the PreACT Educational Opportunity Service (EOS), which could increase their exposure to, and knowledge of, more colleges.

Study Design: The Difference-in-Difference Approach

The effects of PreACT adoption are examined using a *difference-in-difference* (DiD) approach (Figure 1). PreACT schools administered the ACT test to all 11th graders in spring 2017 and spring 2018 and the PreACT test to 10th grade students in 2016-2017. Therefore, most students who were in the spring 2018 11th-grade cohort took the PreACT test, while none of the students who were in the spring 2017 11th-grade cohort took the PreACT test. Figure 1 shows a hypothetical scenario where the mean ACT Composite score increased from 19.25 in 2017 to 19.50 in 2018 for PreACT schools.

Non-PreACT schools also administered the ACT test to all 11th graders in spring 2017 and spring 2018 but did not administer the PreACT test for either cohort. Figure 1 shows a hypothetical scenario where the mean ACT Composite score increased from 19.0 in 2017 to 19.05 in 2018 for non-PreACT schools. The first difference measures improvement in college readiness outcomes from the first cohort (2017) to the second cohort (2018) and is calculated for both PreACT and non-PreACT schools. In Figure 1, PreACT schools improved by 0.25 score points and non-PreACT schools improved by 0.05 score points. The DiD is calculated as the difference in improvement for PreACT schools versus non-PreACT schools (e.g., 0.25-0.05=0.20) and estimates the effect of PreACT adoption.

Figure 1. Hypothetical Difference-in-Difference for Measuring Effects of PreACT Adoption



Sample and Data

To be included in the analysis, schools must have administered the ACT test to 11th graders through a state or district program in spring 2017 and spring 2018 and the number of students tested in the two years must have been relatively stable.[1] ACT test records from spring 2018 were matched to PreACT test records from 2016-2017. Schools that had at least 75% of student records matching to a PreACT test record were considered PreACT schools.[2] Schools that had less than 2% of student records matching to a PreACT test record were considered non-PreACT schools. Schools from states that had some PreACT schools and some non-PreACT schools were included so that effects of PreACT adoption can be distinguished from other changes in the states. Schools from North Carolina and Oklahoma were not included in the analysis because virtually all schools were PreACT schools and so effects of PreACT adoption cannot be distinguished from other changes in those states. Table 2 summarizes the number of schools and students included in the analysis, as well as their background variables.

There were 400 PreACT schools and 3,972 non-PreACT schools from 31 states. The number of students who took the ACT test was very similar across the two cohorts. For both PreACT schools and non-PreACT schools, the demographic breakdowns were very similar across the two cohorts. Relative to PreACT schools, non-PreACT schools had larger concentrations of African American (13% vs. 8%), Hispanic (12% or 13% vs. 9%), missing race/ethnicity (14% vs. 9% or 10%), and missing parent education level (40% and 35% vs. 32% and 24%) (Table 2).

Table 2. Schools and Students Included in Analysis of Effects of PreACT Adoption

Variable	PreACT schools 2017	PreACT schools 2018	Non-PreACT schools 2017	Non-PreACT schools 2018
Number of students	55,536	54,833	606,917	600,508
% who took PreACT	0%	83%	0%	<1%
Gender				
Female	49%	49%	48%	48%
Male	49%	49%	48%	48%
Missing	2%	2%	4%	4%
Race/ethnicity				
African American	8%	8%	13%	13%
Asian	3%	3%	3%	3%
Hispanic	9%	9%	12%	13%
Other	4%	5%	5%	5%
White	66%	66%	52%	52%
Missing	10%	9%	14%	14%
Parent education level				
High school or less	16%	15%	18%	17%
Some college, < bachelor's	21%	18%	19%	17%
Bachelor's degree	25%	22%	18%	16%
Graduate study or more	14%	12%	10%	9%
Missing	24%	32%	35%	40%

Statistical Analysis

College readiness outcomes were compared using the DiD approach. The outcomes included:

- ACT test scores (English, mathematics, reading, science, and Composite)
- Number of subjects (out of five) for which a student took advanced placement, accelerated, or honors courses
- Taken (or plan to take) calculus, other advanced math courses, and physics
- Interest-major correlation (the correlation of vocational interests with the environment of student's planned college major)
- Sending ACT scores to at least four colleges[3]
- Sending ACT scores to at least one out-of-state college[4]

For each school and each cohort, the mean outcome was calculated. The cohort difference (mean for 2018 – mean for 2017) was then calculated for each school. Next, the mean cohort difference was calculated for PreACT schools as the mean of the school mean differences. Similarly, the mean cohort difference was calculated for non-PreACT schools as the mean of the school mean differences. The DiD was calculated as the difference between the mean cohort difference for PreACT and non-PreACT schools.

PreACT and non-PreACT schools could have underlying differences that impact the DiD. A propensity score weighting approach (Austin, 2011) was used to ensure that the PreACT and non-PreACT schools were similar on several covariates, including the ratio of students tested in 2017 and 2018 (N_{2018}/N_{2017}), mean outcome at baseline (e.g., for the 2017 cohort), changes in demographics from 2017 to 2018 (proportion male, African American, Hispanic, parents with no college degree), and changes in ACT month tested. A logistic regression model was used to predict group membership (PreACT or non-PreACT) using the covariates. The logistic regression model produces

a predicted probability of being a PreACT school, and this predicted probability is known as the propensity score (*ps*). After assigning inverse probability of treatment weights to PreACT schools (weight = 1/*ps*) and non-PreACT schools (weight = 1/(1-*ps*)), the two groups are balanced on the covariates. A weighted regression model was used to estimate the adjusted DiD and determine if it was significantly different than zero (e.g., if the mean cohort difference for PreACT schools was different than the mean cohort difference for non-PreACT schools).

Some effects of PreACT adoption are contingent on student participation in certain components of the PreACT. For example, through the Educational Opportunity Service (EOS), students may be provided information about prospective colleges that they may not have received otherwise. To realize the benefits of EOS through the PreACT, students must opt-in when they take the PreACT test so that their name and other information is provided to colleges. Similarly, to realize the full benefit of PreACT's college major and career exploration tools, students must take the PreACT Interest Inventory. In this study, among students in the PreACT schools who took the PreACT, 68% opted in to the EOS and 90% took the Interest Inventory. In addition to the DiD analyses, we examined outcomes within PreACT schools, comparing students who did and did not participate in the Interest Inventory and EOS. The propensity score weighting approach (Austin, 2011) was used to ensure that the participants and nonparticipants are similar on PreACT Composite score, gender, race/ethnicity, and parent education level.

Comparison of College Readiness Outcomes

Table 3 summarizes the results of the DiD analyses. The results suggest a small positive effect of PreACT adoption on ACT test scores. PreACT schools improved 0.378 English score points more than their non-PreACT counterparts. The effects for mathematics (0.168), reading (0.199), science (0.258), and Composite (0.231) were smaller. A previous ACT study estimated the average gain in ACT scores per month of instruction (Camara & Allen, 2017). Using those results, the estimates of the PreACT effects from the DiD model can be compared to the months of instruction typically needed to obtain the same gain (Table 4). For example, mean ACT Composite score typically increases by 0.227 points per month of instruction. The PreACT effect on Composite score (0.231) is therefore comparable to 1.02 (0.231/0.227) months of instruction.

Table 3. Comparison of College Readiness Outcomes

Outcome	PreACT schools 2017	PreACT schools 2018	PreACT schools Diff.	Non-PreACT schools 2017	Non-PreACT schools 2018	Non-PreACT schools Diff.	DiD	Adjusted DiD
ACT English	19.589	19.574	-0.015	18.032	17.785	-0.247	0.232	**0.378
ACT Mathematics	19.961	19.842	-0.119	18.845	18.623	-0.222	0.104	**0.168
ACT Reading	20.521	20.359	-0.163	19.204	18.961	-0.243	0.080	**0.199
ACT Science	20.314	20.223	-0.091	19.091	18.848	-0.242	0.151	**0.258
ACT Composite	20.220	20.125	-0.094	18.917	18.679	-0.238	0.144	**0.231
Advanced coursework	1.505	1.535	0.030	1.635	1.660	0.026	0.004	-0.013
Calculus	0.338	0.340	0.002	0.370	0.375	0.005	-0.003	-0.008
Other advanced math	0.674	0.683	0.009	0.661	0.659	-0.002	0.011	*0.012
Physics	0.503	0.495	-0.008	0.529	0.524	-0.005	-0.003	-0.009
Interest-major correlation	0.379	0.372	-0.007	0.334	0.328	-0.006	-0.001	**0.026
Four scores sent	0.541	0.535	-0.006	0.480	0.491	0.011	-0.018	0.008
Out-of-state scores sent	0.445	0.451	0.007	0.423	0.420	-0.003	0.010	**0.018

DiD = difference in difference, ** p-value < 0.01, * p-value < 0.05

The DiD estimates for the other outcomes were generally small. For example, the percentage of students sending at least one score to an out-of-state college increased slightly for PreACT schools from 44.5% to 45.1% and decreased slightly for non-PreACT schools from 42.3% to 42.0%. The DiD was 0.01 (1.0%), and the adjusted DiD was 0.018 (1.8%) and statistically significant. The adjusted DiD was also positive and significant for interest-major correlation, suggesting a small effect of PreACT adoption on interest-major fit.

Table 4. Estimated Effects of PreACT Adoption on ACT Scores

Subject area	ACT gain per month of instruction	PreACT effect adjusted DiD estimate	PreACT effect months of instruction
English	0.277	0.378	1.36
Mathematics	0.199	0.168	0.84
Reading	0.228	0.199	0.87
Science	0.200	0.258	1.29
Composite	0.227	0.231	1.02

DiD = difference in difference

Additional analyses were conducted to examine differences in outcomes for students who did and did not participate in the EOS and the Interest Inventory components of the PreACT. This analysis was confined to students in PreACT schools who took the PreACT. ACT score sending behavior was compared for EOS participants and nonparticipants. Interest-major correlation was compared for Interest Inventory participants and nonparticipants. Because the participants and nonparticipants could have underlying differences related to the outcome, a propensity score weighting (PSW) approach was used to balance the two groups.[5] By weighting the sample, an adjusted difference between participants and nonparticipants can be calculated.

Students who completed the PreACT Interest Inventory had higher correlation between their ACT planned major and their vocational interests (0.381 for participants versus 0.359 for nonparticipants, difference=0.022). After applying the PSW and linear regression, the adjusted difference (0.035) was larger than the unadjusted difference and was statistically significant (Table 5). Students who opted into EOS for the PreACT were more likely to send their ACT scores to at least four colleges (0.567 for participants versus 0.447 for nonparticipants, difference=0.120). After applying the PSW and logistic regression, the adjusted difference was 0.029 and was statistically significant. Students who opted into EOS for the PreACT were also more likely to send their ACT scores to at least one out-of-state college (adjusted difference=0.019).

Table 5. Comparing Outcomes Among PreACT Component Participants and Nonparticipants

Outcome	Participation variable	Mean Outcome Participants	Mean Outcome Nonparticipants	Difference	Adjusted difference
Interest-major correlation	Interest Inv. completion	0.381	0.359	0.022	**0.035
Four scores sent	EOS opt-in	0.567	0.447	0.120	**0.029
Out-of-state scores sent	EOS opt-in	0.469	0.436	0.033	**0.019

****p-value<0.01**

Conclusion

This study provides evidence that schoolwide adoption of the PreACT leads to small improvements in ACT test scores. This effect could be due to exposure to test content and items that mimic the ACT test, or by the feedback students receive from taking the PreACT. The study also provides evidence of small effects of PreACT adoption on interest-major correlation and out-of-state college score sending. Further, within PreACT schools, students who participated in the PreACT EOS were more likely to send their ACT scores to at least four colleges and at least one out-of-state college. And, students who completed the PreACT Interest Inventory had slightly higher fit between their interests and planned major when they took the ACT. The study does not provide evidence of PreACT effects on outcomes related to taking challenging high school courses.

There are several limitations of the study that should be understood. First, it's possible that the PreACT test was not the only new intervention introduced between the two study cohorts. It's possible that both PreACT and non-PreACT schools introduced other interventions that could affect the study outcomes or confound the relationship of PreACT

adoption and study outcomes. Second, there are no data available on how PreACT results were used within schools. If the PreACT test was taken but no action was taken to use the results, we would not necessarily expect PreACT adoption to lead to improved outcomes. There is likely significant variation across schools in how PreACT results are used, and this study does not provide insight into best practices for using PreACT results. Third, the study only measured the impact of PreACT adoption for the first cohort of students tested (e.g., 11th graders of spring 2018). It's possible that PreACT will have a larger impact as educators have more time to learn to use the results and integrate the assessment with other programs designed to improve college readiness outcomes.

References

Austin, P. C. (2011). An introduction to propensity score methods for reducing the effects of confounding in observational studies. *Multivariate Behavioral Research, 46*(3), 399-424.

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Notes

1. N_{2017} and N_{2018} must have been within 50% of one another.
2. Some schools had a very small percentage of students with a PreACT test record, likely due to student migration from a PreACT school.
3. Students may send ACT scores to four colleges at no additional charge.
4. Among four scores sent at no additional charge.
5. Inverse probability of treatment weights were assigned (Austin, 2011) based on propensity scores for participation in the PreACT component. The propensity score models estimated the probability of participation, based on PreACT Composite score, student gender, race/ethnicity, and parent education level.

Jeff Allen, PhD
Jeff is a statistician in the Research division at ACT. He specializes in longitudinal research linking test scores to educational outcomes and student growth models.

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