

No Pain, No Gain: Lessons from a Test Prep Experiment

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ACT[®]



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SUMMARY

Scores from standardized tests are common criteria for admission to a four-year college or university, and most require, recommend, or consider test scores as part of the admissions process. To help improve their chances of college admission, many high school students turn to test-preparation programs. We used an experimental design to evaluate the effectiveness of an online test-prep course to improve test scores. Specifically, given the current climate around test preparation and the call for more and better research evidence documenting the impact of test preparation, this research study sought to provide representative, relevant, and rigorous research on the use of ACT® Online Prep (AOP).

SO WHAT?

Overall, most students did not use the course as intended. Despite all the students in our sample expressing interest in using the product for free prior to their test date, many of the students who were assigned to the treatment group did not actually use the product during the month prior to their test date. These results indicate that simply granting a population of students access to a self-directed test preparation product such as AOP would not be sufficient for improving the college readiness of this population, as many of these students would not make adequate use of the product. Students' may not be self-directed enough to engage with an unstructured test preparation program despite motivation to perform well on a standardized test.

NOW WHAT?

More work needs to be done within and external to the program to both encourage and create the necessary structure for students to become more consistently engaged with the program over a prolonged period in order to study its impact under these conditions. This study highlights some key avenues for future research on the ACT Online Prep product. We recommend qualitative research be conducted to better understand student motivational issues. Another issue surrounding usage of AOP is the lack of guidance on how to effectively utilize the program. To this end, we are currently working with schools that use AOP to learn about the dissemination and use strategies they are employing. Both of these types of studies, motivational and utilization strategies, will lay a solid foundation for understanding for whom, and under what conditions, AOP is most effective.



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Introduction

Scores from standardized tests such as the ACT® or SAT® are common criteria for admission to a four-year college or university. According to recent data from the Integrated Postsecondary Education Data System (IPEDS), 88% of the nation's four-year selective-admission institutions report that they require, recommend, or consider test scores as part of their admissions process (U.S. Department of Education, National Center for Education Statistics, Integrated Postsecondary Education Data System, 2016). These 1,555 colleges and universities that use test scores during the admission process enroll 95% of all first-time students at four-year selective-admission institutions.

There is a generally held belief that test-preparation programs can result in significant score gains and a postsecondary competitive edge (MacGowen, 1999; McDonough, 1997; Cole, 1987), and this belief drives many college-bound students to participate in these programs to improve their scores and thus their chances for college admission and scholarship opportunities. Since 1938 when Stanley H. Kaplan began tutoring students to prepare for the SAT, the phenomenon of test preparation has had a firm presence in American education. By 1981, when Adam Robinson and John Katzman founded The Princeton Review there was an appetite for these types of services. Fast-forwarding to the 2016-2017 academic year, 24% (903,038) of students who took an ACT test reported using some form of test preparation, and over 60,000 places of business in 2018 were estimated to offer exam preparation and tutoring (Barnes Reports, 2017). Although the test preparation industry in the US—currently worth an estimated \$10 billion—is thriving as a result of this assumption, rigorous, research-based evidence in evaluation of this

assumption has been challenging for researchers, and the test preparation efficacy claims based on this research have received increased scrutiny by the school counseling community.

There are many studies that suggest that test preparation activities, including practice tests and retesting, have a small but notable association with score gains on standardized tests such as the ACT or SAT (e.g. Andrews & Ziomek, 1998; Cole, 1987; Powers & Rock, 1998; Moss, 1995; Becker, 1990; Kulik, Bangert-Drowns, & Kulik, 1984; DerSimonian & Laird, 1983; Scholes & Lain, 1997; Scholes & McCoy, 1998). For example, a review of test preparation research by the National Association for College Admissions Counseling (Briggs, 2009) found test preparation solutions have minimal effects on test scores—an average gain of only around 30 points on the SAT and less than one point on the English, reading, and math sections of the ACT, both of which are within the standard error of measurement for their tests. A potential key to understanding these effect sizes may be in understanding what is called “test preparation.” Broadly speaking, test preparation can encompass activities that mirror classroom instruction and focus on content skill development, or it can encompass test-taking skills (i.e., tips and tricks). In the former case, the test preparation is addressing core content knowledge, while in the latter case, test preparation utilizes strategies that are unrelated to content knowledge to improve test scores. Research has found that longer-term preparatory activities such as taking rigorous coursework have a greater association with score gains than shorter-term activities such as using workbooks, workshops, or learning test-

taking skills (ACT, 2005; Allensworth, Correa, & Ponisciak, 2008).

According to a 2009 NACAC discussion paper addressing prior research in this area, most of the existing studies of the effects of test preparation rely on small, non-representative samples and suffer from methodological limitations that narrow their findings (Briggs, 2009). The discussion paper also notes that “the optimal design for an evaluation of the effect of test preparation would involve the random assignment of students into different preparatory conditions. To date no such study has been successfully conducted on a large scale” (p. 16). Finally, the discussion paper calls upon the research community to specifically document the magnitude of test preparation effects for the ACT, which the author felt was lacking in the literature.

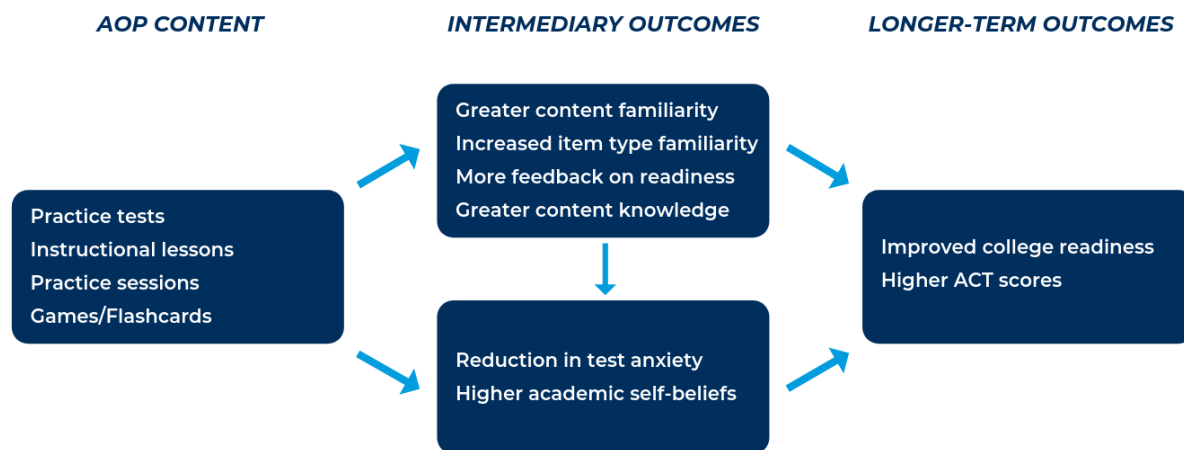
More recent studies confirm previous research findings of an association of modest score gains with test preparation for the ACT or SAT (i.e., typically within or near the standard error of measurement; Schiel & Valiga, 2014a; Schiel & Valiga, 2014b; Schiel & Valiga, 2014c; Appelrouth, Zabucky, & Moore, 2015; Buchmann, Condrón, & Roscigno, 2010; Moss, Chippendale, Merston, & Carney, 2012; Lane et. al 2009).¹ As has been noted, though, the benefits of test preparation, particularly very expensive test preparation, remains unclear (Adams, 2011). Despite the call by NACAC for the use of more rigorous research designs, most studies continue to struggle with relatively small samples and do not use more rigorous methods such as experimental or quasi-experimental designs.

Given the current climate around test preparation and the call for more and better research evidence documenting the impact of test preparation, this research study sought to provide representative, relevant, and rigorous

research on the use of ACT Online Prep (AOP), a self-directed online test preparation program currently with over 350,000 active accounts. To overcome the limitations of prior research in this area, we used randomized controlled trials to evaluate the short-term effectiveness of AOP in improving the ACT scores of students who had registered to take the test for a second time. This approach gives us a pre-test/post-test design with random assignment to treatment and control groups.

Conceptual Framework

AOP was developed for the purpose of improving students' academic readiness for college-level coursework as measured by higher test scores on the ACT. To meet this purpose, AOP is hypothesized to improve several intermediary outcomes that have been empirically associated with improved test scores (see Figure 1). AOP familiarizes students with the content areas measured by (and the item types appearing on) the ACT and identifies those content areas where the student needs improvement. It then assists the student in skilling up in those identified areas through a personalized learning plan comprising instructional lessons and practice sessions along with tools to track progress and daily goals to help students stay on target. Prior research on the effects of test preparation and test familiarity have shown small positive gains in test scores. Several meta-analyses of studies of the effect of test preparation on test scores (Bangert-Drowns, Kulik, & Kulik, 1983; Powers, 1993; Montgomery & Lily, 2012) have consistently found average test score gains of approximately one-quarter standard deviation. Similarly, a meta-analysis of practice effects (i.e., test content and item familiarity) by Hausknecht, Halpert, Di Paolo, and Gerrard (2007) found an average test score gain of about one-quarter standard deviation.

Figure 1. ACT Online Prep Conceptual Framework

In addition to raising students' levels of test familiarity and content mastery, AOP is hypothesized to increase academic self-beliefs and lower test anxiety, factors that have also been empirically linked to higher test scores. In a meta-analysis of 55 studies, Valentine, DuBois, and Cooper (2010) found that students' academic self-beliefs (i.e., self-concept, self-esteem, and self-efficacy) had a small positive incremental effect on academic achievement (i.e., grades or standardized test scores) after statistically controlling for a comparable prior measure of academic achievement. Hembree's (1988) meta-analysis of 73 studies of the relationship between test anxiety and test performance found that students with low levels of test anxiety scored on average about one-half standard deviation higher on a standardized test than students with high levels of test anxiety (i.e., a stronger effect than that found for test preparation).

To influence these intermediary outcomes, AOP was designed with different components such as practice tests and instructional lessons that contain an estimated 200 hours of content and activities that are aligned with the blueprints for the ACT subject tests. Specifically, AOP offers multiple short and long forms of ACT-produced practice tests in English, mathematics, reading, and science, and it offers predicted subject test scores and a predicted Composite score based on practice test results. Instructional lessons

within AOP provide an in-depth review of the content covered by each section of the ACT test and are an opportunity for students to review domain content and improve content mastery. Finally, practice sessions provide students with an opportunity to take over 2,400 practice items covering all sections of the ACT. The games and flashcards provide students with an opportunity to test their knowledge of specific concepts covered by the ACT. Student's experience with the different components within the program is largely self-directed.

Study Design

Minimizing Selection Effects

In practice, selection into a paid test preparation program like AOP is not random, but rather is based on the students' willingness to *pay* for the program and their willingness to *use* the program. As a result, observed differences in average test scores between those students who do and do not use AOP can be biased by self-selection. To address potential selection bias, we incorporated the following elements into our design. First, to minimize any potential selection bias that could be attributed to differences in the students' willingness to pay for AOP, we received permission to award roughly 2,500 AOP subscriptions for free to our study participants. Second, to minimize any potential

selection bias that could be attributed to differences in the students' willingness to use the product, we emailed prospective study participants to gauge their interest in participating in a study in which they would be given AOP at no cost to prepare for their upcoming ACT test. Among those students who expressed an interest in using the product, we randomly assigned students to our treatment group (i.e., received free AOP) or a control group (i.e., did not receive free AOP).

Treatment

The treatment for this study was a free subscription to AOP during the five to six weeks between the registration deadline for an ACT national test date and the national test date itself. Although students can sign up for AOP at other times, the vast majority of students register for AOP at the same time that they register for an ACT test date, so the time frame in which AOP is used in our study is consistent with the time frame in which the program is often used in practice. Our goal in this research was to gauge the effectiveness of AOP not as it is intended to be used, but rather as it is *actually used* by students. As such, our treatment did not include any attempt by us to encourage more usage of the product or different usage patterns within the product.

Sample and Study Protocol

For this study, we conducted randomized controlled trials leading up to two different ACT national test dates: October 2016 and April 2017. We chose two different test dates because we wanted a representative sample of both 11th graders and 12th graders in our study. Historically, registrations for fall test dates are predominantly 12th graders, whereas registrations for spring test dates are predominantly 11th graders. We pooled the samples together across the two trials for a single analysis of the effectiveness of AOP.

For both trials, our target population comprised students who met the following criteria: (a) registered for the selected upcoming ACT

national test date, (b) tested on a prior ACT national test date, (c) indicated on the test-day survey for the prior test date that they had not participated in any test preparation leading up to that prior test date, and (d) did not have a current or prior AOP subscription. Using these criteria, we pulled our target population from the ACT registration records that were available to us as of the registration deadline for the upcoming ACT test date.

From this target population, we emailed a random sample of 87,718 students across the two test dates asking about their interest in participating in a study in which they would be given AOP at no cost to prepare for their upcoming ACT test (see Appendix A). As per the email instructions, those recipients who were interested in receiving AOP for free were required to express their interest by completing a short online survey (see Appendix B) that was accessible through a hyperlink embedded in the email. Of the 7,085 students who responded to the survey indicating that they were interested in participating in our study, we selected 5,106 for our study, randomly assigning 2,553 to the treatment group and 2,553 to the control group.² Members of the treatment group were notified by email that they were selected for the study and were provided with next steps for setting up their AOP account (see Appendix C). Members of the control group (and those not selected for our study) were notified by email that they were not selected for the study and were thanked for expressing their interest (see Appendix D). To ensure that treated students were given the most time possible with AOP, the identification of our target population and the recruitment and selection process were completed within one week of the registration deadline for the upcoming test.

Analysis

We utilized an intention-to-treat (ITT) approach to our analysis, which requires that we include all students in the analysis based upon their initial assignment to either the treatment or control group. This approach is different than a per-protocol approach, whereby only those students who fully comply with the treatment are included in the analysis. We use the ITT approach because any decisions that students make after their random assignment (e.g., non-compliance with treatment, dropout, contamination, etc.) are not assumed to be at random and thus may bias the study results. Although ITT helps to guard against potential threats to internal validity, this approach changes the nature of our research question from the effectiveness of AOP as received to the effectiveness of AOP as assigned. Given this, an ITT approach will result in a more conservative estimate of the effectiveness of AOP. The trade-off for this more conservative estimate is that the finding will be unbiased and generalize back to the target population. Compared to a per-protocol analysis, ITT analysis is expected to provide a more realistic estimate of the effect of introducing AOP to a population of students because, in practice, not all members of that population would accept, comply with, or complete AOP.

Using an ITT approach, we estimated five models regressing the post-test score in each ACT subject area (i.e., English, mathematics, reading, and science) and the post-test Composite score on the respective pre-test score, the students' treatment status, and a set of covariates. Although random assignment created well-balanced groups (see Table 1), we elected to statistically control for additional covariates that we felt were important predictors of students' post-test scores. Specifically, we included in our models the amount of time that had elapsed in months between the students' pre- and post-test dates, as we felt that this was a necessary control given that not all students had taken the pre-test on the same test date and that academic growth that occurs during high school would differ by the amount of time that had elapsed between test dates. We also added an additional set of covariates for the students' high school grade level, race/ethnicity, gender, and parents' education level, as prior ACT research (Sanchez, 2013; Bassiri, 2016; McNeish, Radunzel, & Sanchez, 2016) has found variation in ACT test scores by these covariates in both cross-sectional and longitudinal models. Finally, we also included the trial (i.e., Fall and Spring) in which the students' participated as a way to capture any unobserved differences in the students across the two trial dates. Descriptive statistics for the treatment and control group variables in our models are provided in Table 1.

Table 1. Descriptive Statistics for Treatment Group vs. Control Group, Full Sample vs. Post-test Sample

Variable	Full Sample				Sample with Post-test			
	Treatment		Control		Treatment		Control	
	Percent/ Mean	SD	Percent/ Mean	SD	Percent/ Mean	SD	Percent/ Mean	SD
African American	13.0		14.3		12.8		14.5	
Asian American	10.6		8.7		10.6		8.8	
Hispanic	9.8		10.4		9.9		10.0	
Other Race	6.1		5.5		5.8		5.5	
Unknown Race	8.4		9.2		8.4		9.3	
White	52.1		51.9		52.5		51.9	
Parent Ed: Unknown	12.6		13.4		12.4		13.0	
Parent Ed: No College	7.0		6.9		6.9		6.9	
Parent Ed: Some College	18.2		19.3		18.2		19.0	
Parent Ed: Bachelor's Degree	29.9		29.8		30.4		30.1	
Parent Ed: Graduate Degree	32.4		30.6		32.2		31.0	
Female	62.4		61.2		62.6		61.9	
Male	37.6		38.8		37.4		38.1	
10th Grade	10.3		9.6		10.6		9.9	
11th Grade	39.6		39.1		39.8		39.3	
12th Grade	47.0		47.2		46.9		47.4	
Other Grade	3.1		4.2		2.7		3.5	
Trial 1	65.1		65.1		64.7		64.7	
Trial 2	34.9		34.9		35.3		35.3	
Time Between Tests					7.7	6.3	7.6	5.9
Pre-test: English	22.9	6.1	22.7	6.1	23.0	6.1	22.8	6.0
Pre-test: Mathematics	22.2	5.1	22.1	5.0	22.2	5.1	22.2	5.0
Pre-test: Reading	23.5	6.0	23.3	5.9	23.6	5.9	23.4	5.9
Pre-test: Science	22.5	4.7	22.4	4.7	22.6	4.6	22.5	4.7
Pre-test: Composite	22.9	4.9	22.7	4.8	23.0	4.8	22.8	4.8
Post-test: English					24.8	6.2	24.6	6.2
Post-test: Mathematics					23.3	5.2	23.2	5.1
Post-test: Reading					24.9	6.1	24.7	6.1
Post-test: Science					23.7	5.1	23.4	5.1
Post-test: Composite					24.3	5.1	24.1	5.1
N	2,553		2,553		2,345		2,359	

Limitations

Although all participants in our study were registered for their respective national test dates, we discovered that not all students were in attendance on their test day. In particular, 402 students in total were absent on their test day, 208 from the treatment group and 194 from the control group. Table 1 also provides descriptive statistics for the reduced sample that sat for the post-test. As the information in the table illustrates, the relative balance between the treatment and control groups that was created by random assignment for the full sample still holds for these observable characteristics after removing those participants that did not sit for their post-test. These descriptive statistics suggest that the missing post-test data should not introduce bias in our results. Our models were therefore estimated only for those students who had post-test scores.

Additionally, although all study participants indicated their interest in using AOP to prepare for their test, we discovered that a number of students who were randomly assigned to the treatment group did not follow through on their expressed interest and activate the AOP account that was provided to them. Specifically, 718 students across the two trials (28% of the treatment group) who were given complimentary access to AOP never activated their accounts.³ Following our ITT analytic plan, these students were still included in the analysis.

Results

The parameter estimates and standard errors for the five models predicting post-test scores for the four subject tests and the Composite are presented in Table 2. As seen in the table, the coefficient for treatment group status was not statistically significant for any of the five models, meaning that the students who had short-term access to AOP at no cost did not perform differently than the control group on any of the subject tests or the Composite score. We believe the most likely reason why we did not find a meaningful group-mean difference associated with the treatment is that the usage rates within the

AOP program were extremely low. Upon additional investigation, we found not only that 28% of the students who were randomly assigned to the treatment did not activate their AOP accounts, but also that an additional 27% activated their accounts but had zero active days within the program. This means that only 45% of the students who were randomly assigned to AOP were active within the program. Among the treated students who actually used the program, the average amount of time taking practice tests or practice sessions in the program was only 2.1 hours. When we looked at student activity within AOP over time, we found that the cumulative time spent in the program increased exponentially over the days prior to the test date, suggesting that students were using AOP as a last-minute effort to improve their test scores.

We were concerned that this low usage rate among students randomly assigned to the treatment was a function of some limitation in our study design; however, we discovered that this level of inactivity among our sample is actually consistent with the level of inactivity within the general population of students who purchase AOP. Of the almost 475,000 students who had purchased AOP as of the time of this writing, 51% had zero active days on the platform. Among those that had taken practice tests or practice sessions, the average amount of time engaged in the program was 8.3 hours. In this regard, while the percentage of students who had at least one active day in the system was consistent with the general AOP population, our experimental treatment group spent less time using the practice test and session sections than the general population of AOP users. We should note, however, that students in our study were granted access to the program for only one month, whereas the population of students who purchase AOP had access for up to 12 months depending on their particular subscription; this difference in access between our sample and the population of users may explain the difference in the time spent in the program. We also found a similar pattern of increased activity leading up to national test dates for this population of students as compared to our sample.

Table 2. Regression Results for ACT Post-test Score

Predictor	English			Mathematics			Reading			Science			Composite		
	B	SE	P> t	B	SE	P> t	B	SE	P> t	B	SE	P> t	B	SE	P> t
Intercept	2.31	0.38	0.00	2.39	0.33	0.00	4.44	0.46	0.00	4.20	0.43	0.00	0.59	0.26	0.03
Treatment Group	0.05	0.09	0.55	0.03	0.07	0.71	-0.06	0.10	0.59	0.10	0.09	0.27	0.04	0.06	0.47
African American	-0.83	0.14	0.00	-0.76	0.12	0.00	-1.27	0.17	0.00	-1.29	0.15	0.00	-0.61	0.09	0.00
Asian American	0.21	0.16	0.19	0.13	0.13	0.32	0.20	0.19	0.29	0.52	0.16	0.00	0.11	0.10	0.26
Hispanic	-0.09	0.16	0.59	-0.16	0.13	0.21	0.00	0.19	0.98	-0.26	0.16	0.11	-0.08	0.10	0.42
Other Race	-0.19	0.20	0.34	-0.04	0.16	0.78	-0.29	0.23	0.21	-0.29	0.20	0.15	-0.17	0.12	0.18
Unknown Race	0.52	0.17	0.00	0.14	0.13	0.30	0.16	0.20	0.43	0.11	0.17	0.51	0.17	0.11	0.10
Parent Ed:															
Unknown	-0.10	0.15	0.52	0.26	0.12	0.04	-0.01	0.18	0.97	0.13	0.16	0.42	0.11	0.10	0.25
Parent Ed: No															
College	-0.62	0.19	0.00	-0.45	0.15	0.00	-1.31	0.23	0.00	-0.84	0.20	0.00	-0.50	0.12	0.00
Parent Ed: Some															
College	-0.31	0.13	0.02	-0.36	0.11	0.00	-0.75	0.16	0.00	-0.51	0.13	0.00	-0.26	0.08	0.00
Parent Ed:															
Bachelor's Degree	-0.10	0.11	0.37	-0.10	0.09	0.27	-0.30	0.13	0.03	-0.24	0.12	0.04	-0.06	0.07	0.41
Female	-0.12	0.09	0.18	-0.40	0.07	0.00	-0.10	0.11	0.35	-0.38	0.09	0.00	-0.29	0.06	0.00
10th Grade	2.34	0.29	0.00	2.38	0.24	0.00	2.52	0.35	0.00	2.31	0.30	0.00	2.16	0.19	0.00
11th Grade	2.55	0.28	0.00	1.96	0.22	0.00	2.56	0.33	0.00	2.42	0.29	0.00	2.00	0.18	0.00
12th Grade	1.42	0.28	0.00	1.18	0.23	0.00	1.71	0.34	0.00	1.38	0.29	0.00	1.28	0.18	0.00
Time Between															
Tests	0.12	0.01	0.00	0.11	0.01	0.00	0.10	0.01	0.00	0.11	0.01	0.00	0.12	0.01	0.00
Trial 2	-0.09	0.12	0.44	-0.18	0.10	0.06	-0.62	0.15	0.00	-0.39	0.13	0.00	-0.13	0.08	0.09
Pre-test Score	0.87	0.01	0.00	0.86	0.01	0.00	0.79	0.01	0.00	0.78	0.01	0.00	0.94	0.01	0.00
N	4,684			4,685			4,682			4,678			4,678		

Discussion

The purpose of this study was to examine the effect of a particular test prep program—ACT Online Prep—on the test scores of students. An experimental research design was used to help overcome a number of the limitations of prior research in this area. In order to minimize any potential bias that would come from differences in students' willingness to pay for and use AOP, we drew our study sample from a population of students who had expressed an interest in using the product for free over the month prior to their ACT test. We used a pre-test/post-test design with random assignment to the treatment and control groups to create balanced groups for comparison and used an ITT analytic approach to minimize any bias due to differences between groups that can occur after assignment (e.g., non-compliance, dropout, and contamination).

Despite all the students in our sample expressing interest in using the product for free prior to their test date, many of the students who were assigned to the treatment group did not actually use the product during the month prior to their test date. Because of our use of ITT, these students remained in our treatment sample despite their non-compliance, and we found that none of the estimated differences in post-test scores between our treatment and control groups were statistically significant. The proper interpretation of these null findings is that simply granting a population of students access to a self-directed test preparation product such as AOP is not sufficient for improving the college readiness of the population, as many of the students would not make adequate use of the product.

While the present study did not find an effect for assignment to the AOP program, a finding that runs counter to much of the test preparation research, there are important differences to consider between our study and prior research. The most important issue is the manifest lack of participation of students in our treatment group. In our study, we utilized random assignment to treatment with an ITT methodology, which meant that students were retained in our

treatment group regardless of their participation level. This methodology provides an unbiased estimate of the treatment effect but changes the study question from the impact of program use to the impact of program assignment. Prior studies that have focused only on active users of test preparation products may be addressing the question of program use, but their reliance on per-protocol analysis without random assignment suggests that estimates of the effect of test preparation on standardized test scores may be biased.

There are also important methodological differences between our study and prior studies. As Briggs (2009) noted, relatively few studies have made use of random assignment or quasi-experimental designs. Notable exceptions include Domingue and Briggs (2009), Holmes and Keffer (1995), McMann (1994), and Scholes and Lain (1997). These studies found mixed results for the preparation programs examined. Of these studies which employed more rigorous research designs, Domingue and Briggs (2009) and Scholes and Lane (1997) found no statistically significant differences between those who used test preparation and those who did not. Interestingly, both of these studies relied on global indicators of test preparation use but did not follow up with more detailed information on student participation within the prep programs.

The test preparation programs in these studies differ in, among other things, their samples, program examined, content covered, mode of delivery, and intensity of interaction with the programs. This makes comparisons across studies challenging.

Like our study, these studies could benefit from an examination of the heterogeneity of program utilization. Furthermore, the studies that found an effect for test preparation examined single programs that were offered through their school as opposed to other studies that examined test preparation across environments including self-directed test preparation.

This study, while highlighting the more obvious “non-effect” associated with not utilizing the program as it is intended, has important implications for future practice. First, the results of this study not only shed light on the low usage rates of students, but they provide evidence that minimal use of AOP just before a test is not an effective approach to improving test scores. Decades of research into student learning finds that distributing practice over time is more beneficial for long-term retention than massing practice (Bjork & Bjork, 2014). Second, the results of this study suggest that students’ may not be self-directed enough to engage with an unstructured test preparation program despite expressing an interest in using the product to improve their performance on a standardized test. This reminds us of the work of Allensworth et al. (2008), who found that despite students expressing high motivation to do well on the ACT, 45% of them reported studying for the ACT on their own only “once in a while” or “never.” More work needs to be done within and external to the program to both encourage and create the necessary structure for students to become more consistently engaged with the program over a prolonged period in order to study its impact under these conditions.

This study also highlights some key avenues for future research on the ACT Online Prep product. One of the key issues that impacted our study was that of motivation and utilization of the product. As almost 50% of our treatment group did not utilize the product, it is important to examine the motivational barriers to using test preparation. If we can understand when students elect to actively participate in test preparation, we can begin to get a better understanding of the efficacy of the program for students who use the program. We recommend qualitative research be conducted to better understand student motivational issues. Another issue surrounding usage of AOP is the lack of guidance on how to effectively utilize the program. To this end, we are currently working with schools that use AOP to learn about the dissemination and use strategies they are employing. Both of these types of studies, motivational and utilization strategies, will lay a solid foundation for understanding for whom, and under what conditions, AOP is most effective.

Notes

1. The standard error of measurement estimates how repeated assessments by the same person on the same test would be distributed around a person's "true" score. For example, the median SEM for ACT Composite score is 0.93. Therefore, we would expect a student to score within approximately one point if they were to take the ACT again without additional learning having taken place. The ACT SEM values are available at http://www.act.org/content/dam/act/unsecured/documents/ACT_Technical_Manual.pdf.
2. Given this sample size, we had 87% power to detect an effect size of about one-half point on the ACT score scale.
3. Less than 0.5% of our control group went on to purchase AOP during the study period.

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Appendix A

Example Invitation Letter

Hello <First_Name>,

Congratulations! You've taken a big step toward your future by registering to take the April 2017 ACT Test®. We know how important the ACT test is to you, and we want you to be successful!

We are looking for high school students interested in participating in a test prep study this spring before taking the ACT in April. In this study we will give you **free** access to ACT Online Prep™, a \$39.95 value, to use to prepare for your April ACT test.

This study is the first of its kind from ACT, as we look for new ways to assist students in strengthening academic skills and preparing for the ACT. We look forward to learning how access to new test preparation materials can positively impact your preparation and performance on the ACT.

By participating in this study we ask that you:

- Activate your account on ACT Online Prep **within 48 hours** of being notified of selection
- Make use of the resources that ACT Online Prep has to offer to help you prepare for your April ACT exam
- Take the ACT test on April 8th
- Complete a brief survey after you take the ACT sharing your experience using ACT Online Prep

We look forward to the chance to help you prepare for your spring ACT test date!

Are you interested in participating? Please follow the link below and complete the included two question survey to be considered for participation: <Survey_Link>

Appendix B

Example Sign-up Survey

Thank you for your interest in participating in our test prep study. This offer is exclusively for you. Please do not forward this offer to anyone else. To be considered for inclusion in the research study and be eligible to receive free access to ACT Online Prep you must complete this two question survey.

- I have read the terms and conditions.

Which of the following test preparation activities, if any, are you planning to use to prepare for the April 8th ACT test? (Choose all that apply.)

- I will prepare for the ACT by myself
- I will prepare for the ACT with other people in a group setting
- I will prepare for the ACT with other people **online** in a group setting
- I will use 1-on-1 tutoring to prepare for the ACT test
- Other (please explain) _____
- I do not plan to do any other test preparation activities

The following is a list of goals you may want to meet to prepare for the ACT test. Please rank the following goals from the most important to least important. Click and drag to rank items, where 1 is the most important, 6 the least.

- _____ Reviewing what will be on the test
- _____ Learning what to expect on the test day
- _____ Learning about study habits and skills
- _____ Learning about time management
- _____ Learning test taking strategies
- _____ Other (please explain)

Congratulations Page Content <Final Page of the survey>:

Thank you! You have registered your interest to participate in ACT's test prep study.

Be sure to check your inbox as we will be notifying those selected to participate in the next few days. That email will include log-in information and next steps.

Slots for the study are limited so you need to confirm your account within 48 hours of receiving the selection email. If you do not, we will need to offer your slot to another student.

Thanks for your interest!

Appendix C

Example Acceptance Letter

Hello <First_Name>,

Congratulations! We are pleased to inform you that you have been selected to participate in the test preparation research study. As part of this study you will have free access to ACT Online Prep™, a \$39.95 value, to use to prepare for your April ACT test. You will have access to the ACT Online Prep system through April 8th.

For this study we ask that you make use of ACT Online Prep to help you prepare for your April test date and answer a short survey after your ACT test date. We encourage you to make frequent use of the resources that are available to you through this program. Each will help you take additional steps toward your goal of performing well on your April ACT test date.

ACT Online Prep includes:

- Mobile App – you will gain access to the free mobile app so you can prepare anytime, anywhere!
- Quality learning content – Our library of lessons helps with reviewing content assessed on the ACT in all four subject tests.
- Personalized learning path – You can get started with ACT Online Prep by taking a short-form ACT test to get a predicted score range. The system will create a learning path specific to your needs.
- Guided plan – You can stay on track by entering your ACT test date; the learning path will adjust based on that timeframe.
- Game center – You can choose from several different games and compete with other students to test your knowledge.
- Tests – Our full-length practice test (which will give you a predicted ACT score) and practice questions are designed to simulate the actual exam, helping you get used to the content and format of the ACT so there will be no surprises on test day.

You will be receiving a separate email with information about how to access the ACT Online Prep system very soon.

Again, congratulations and best of luck on your April test date!

Appendix D

Example Rejection Letter

Hello <First_Name>,

We thank you for your interest in participating in this research study on test preparation. Unfortunately you were not selected to participate in the study. We wish you good luck on your April ACT test.

Thank you and good luck!

About ACT

ACT is an independent, nonprofit organization that provides assessment, research, information, and program management services in the broad areas of education and workforce development. Each year, we serve millions of people in high schools, colleges, professional associations, businesses, and government agencies, nationally and internationally. Though designed to meet a wide array of needs, all ACT programs and services have one guiding purpose—helping people achieve education and workplace success.

About ACT Research

ACT Research leads the field with authority and high-quality scientific evidence in support of education and workforce practices, solutions, and services. Our mission-driven team comprises a variety of backgrounds and disciplines, and offers a wide spectrum of knowledge and skills, enabling us to deliver quality, high-impact products and services aligned to ACT's strategy and mission. Together, our research teams provide policymakers, educators, parents, and learners with research-based insights to inform their decision-making, and deliver educators and workforce development professionals with tools and services needed for education and career navigation.



[ACT.org/research](https://act.org/research)

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