



Accountability, Research & Evaluation

APEX program evaluation study

Are online courses less rigorous than in the regular classroom?

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Executive summary

In response to concerns about APEX courses rigor, researchers from the Accountability Research and Evaluation Department have investigated measures of course rigor in two high school core courses: Algebra 1 and Introduction to Literature and Composition Semester 1 using DPS transcript data and APEX records.

Given the comparisons of pass rates and performance on subsequent courses and standardized tests, the study found no evidence indicating that (the above mentioned) APEX classes are less rigorous than regular classes.

- It is NOT true that almost everyone registered for an APEX class would get an easy credit. In fact, a large percentage of them will not complete the class.
- APEX classes have significantly lower pass rates than regular classes
- Students who earned APEX credits perform at the same level on standardized tests (TCAP and ACT) as students who earned regular classroom credits.
- Students who earned APEX credits are somewhat *more likely* to earn a credit in the subsequent course than students who earned credits through regular settings.

Interviews with school staff involved in APEX courses confirm our findings about APEX course rigor. Most teachers think that it is as hard to earn credits with APEX as in regular classes. Some teachers believe that APEX credits are actually harder to earn.

Some teachers expressed minor concerns that students who pass APEX with shortened time might not have had a chance to benefit from teacher's contextual explanations as in a regular classroom, which is important to effectively understand the contents.

Introduction

APEX, a virtual learning environment, has been used extensively throughout Denver Public Schools (DPS) in the last few years as an alternative method that allows students to earn credits. According to the Seattle-based company, their online courses tailor learning to individual students, by using flexible pacing, extra practice, frequent assessment, and robust monitoring and reporting on participation and progress, while open for personal interaction with teachers (Trotter, 2008). In DPS, due to the limited number of seats available, some schools specifically prioritized students who have previously failed a course to “recover” that course credit. Others also let students, who have not failed the course, take it with APEX (e.g., students entering the school in the middle of the year after the courses had been scheduled or students are in shape to graduate, but are running out of time to get the credits they missed). In some schools, teachers identify and recommend students for APEX courses. In others, the task is done by both teachers and counselors and the APEX coordinator would receive a recommended list from them.

In DPS, most APEX students work independently in the lab, but they are also encouraged to take their study guides with them and work at home (however, they can only take tests in the lab). In the lab, students raise their hands if they have a question and the teachers in the lab work with them to answer their questions. A question could be referred to other teachers, if the nature of the question is not in the lab teachers’ background.

According to the 2012-13 High School Procedure Guide, students are required to pass all quizzes, unit’s computer-scored test, teacher-scored test and the final with mastery of 80 percent or better in order to earn credits in an APEX course. When applied at school level, we observed some level of flexibility but overall, the Guide is followed. For instance, quizzes could be required in some schools, but not others. In schools where quizzes are required, sometimes, at teacher discretion, a student can skip to taking the unit tests without completing the quizzes in that unit, but a student must pass both teacher scored and computer scored tests (at 80 percent or better) in one unit in order to move on to the next unit.

Also according to the 2012-13 High School Procedure Guide, the default setting for quizzes is set for three attempts. At school level, the Guide is generally followed with some level of flexibility. In some schools, students have three chances to pass each of the unit and final tests. In others, there is no official limit on the number of times a student can retake the tests. According to teachers interviewed, most students passed a test within two trials. For students who need additional attempts, teachers will work with them to go over the materials again, or require them to provide evidence indicating that they did go back and put in additional effort to study the materials before allowing them to retake the test.

Our records show that APEX popularity among DPS schools has been growing in the past few years. During the 2009-2010 school year, 5,003 students registered for at least one courses with APEX and this number quickly climbed to 6,088 during the 2010-2011 school year. The number of courses registered also jumped during this time period, from 12,131 to 22,572 according to APEX records. Most of registered courses were in English and Math (Table 1).

Table 1: Number of APEX courses registered in the past two years

Subject	2009-2010	2010-2011
Electives	280	965
English	3,275	5,288
Math	4,269	8,237
Science	2,062	3,511
Social Studies	1,973	3,395
World Language	272	1,176
Total	12,131	22,572

Along with APEX’s growing popularity, there have been concerns about how school districts are using it, as well as the rigor of the courses. At the administrative level, under pressure of raising graduation rates, school districts may view the online credit-recovery options as a way of shuffling students out the door without their having received the full value of a high school education (Trotter, 2008). At the classroom level, some students could just pass the tests and earn an easy credit without having to sit through the lessons. The possibility also exists whereby students may look up answers in websites online during the test, and/or pass the answers around to their friends (Asmar, 2011).

Fortunately, it is not easy for APEX registered students to just search the web for answers or share them with other students given tight supervision that takes place in the labs. Having teachers in the labs is not just to ensure that students comply strictly with the testing procedure; rather, it also facilitates their learning. It is also recommended by the district that quizzes be set for closed book, which prohibits students from viewing Apex curriculum during the test. Copying, taking screen shots, and printing quizzes are prohibited through programming. Also, many schools are using software to limit student access to online content/materials. In addition, the 80 percent cut point in each unit’s computer scored test and teacher scored test, and the final to earn a credit with APEX is significantly higher than the 60 percent cut point in many regular classes.

Regarding the possibility that a student can just take the final exam without completing the course activities, DPS Assistant Superintendant, Antwan Wilson said: "The purpose of a final is to measure a student's mastery, [and] if we have students who have the ability to master the final, but who don't have the ability to earn credit for that, I'd question the logic of that". Moreover, according to DPS teachers who are directly involved in APEX classes, a student must really work hard on quizzes and pass all computer scored, teacher scored tests, and then pass the final in order to earn a credit. Therefore, the possibility that a student who registers could proceed immediately to the final is highly unlikely.

To address the public's concerns, the focus of this study is to determine whether online APEX courses are less rigorous than the same courses taught in the regular classroom setting. This question is broken down into two specific research questions:

- What are the pass rates of APEX classes compared to regular classes?
- Do students who passed APEX classes perform lower in subsequent courses and standardized tests than their peers who passed classes conducted in a regular classroom setting?

In addition, we will investigate

- If results hold universally or do they vary by school, and
- What teachers think about APEX course rigor

In the next parts, we will elaborate on the research design, descriptive analyses, results of quantitative analyses, and summary of interviewed school staff on their opinion regarding APEX. Based on the combined evidence, the report will draw a conclusion/inference about the rigor of APEX courses and policy implication for the DPS leadership team.

Data, research design and method

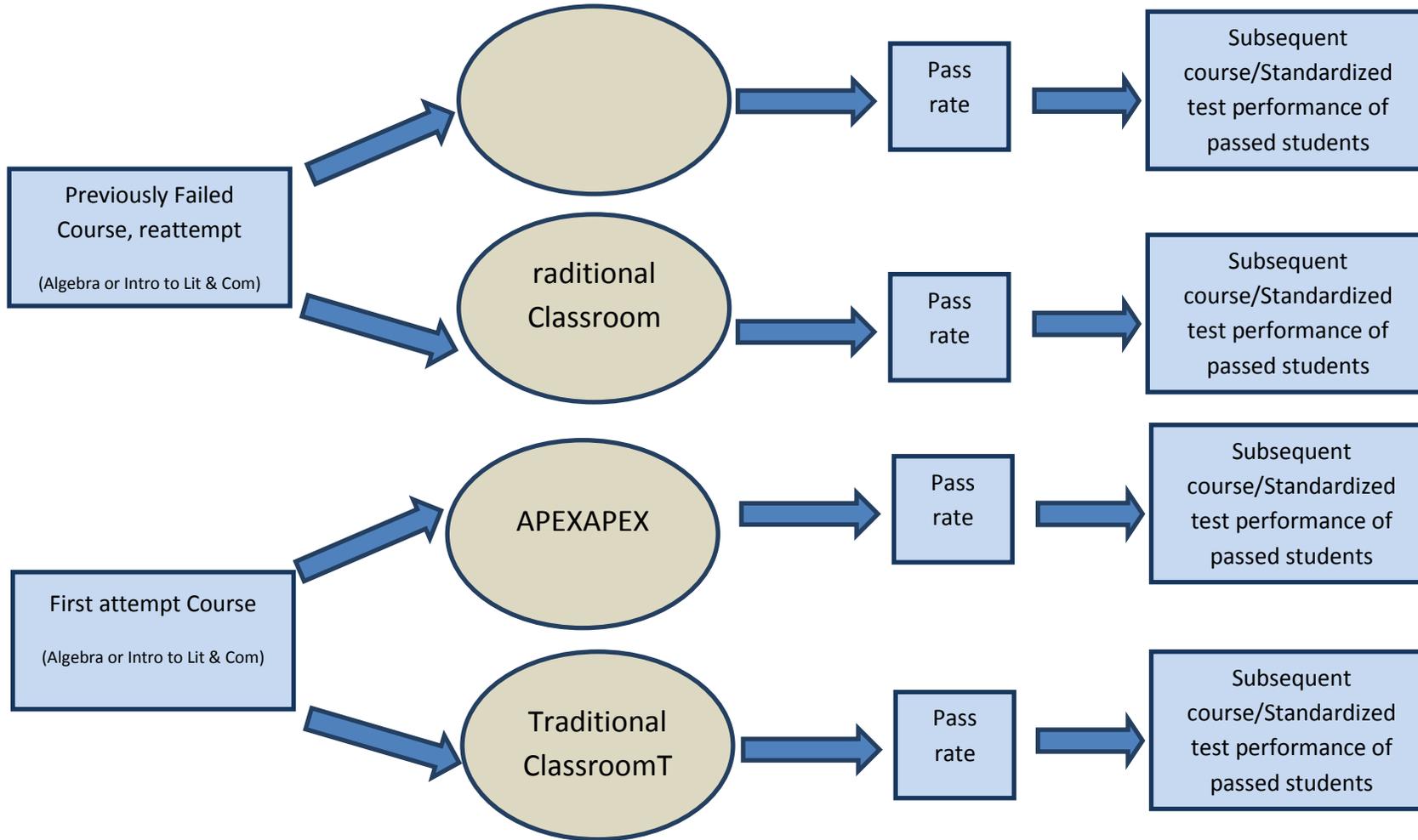
In this study, we focused on APEX records for school years 2009-2010 and 2010-2011, specifically, the 9th grade cohort of 2009-2010. We also looked at all the 9th graders transcript data in the last 5 years to have a comparison to regular classrooms. The results of two core courses: Algebra 1 Semester 1 and Introduction to Literature and Composition Semester 1 are of primary interest, because these courses are among the first courses students have in high school. They are considered the “gate keepers” to earn credits in higher Math and English classes and they are the most popular classes students registered for through APEX.

The quantitative component of our research design is illustrated in Figure 1. Students are divided into two populations: ones who have previously failed a core course taught in a classroom setting and are now retaking it, and ones who have not failed the core course. Students could earn credits either through APEX courses or regular classroom courses. By comparing the ratios at which students earn credit, we have a general idea of whether students pass APEX classes more easily. For instance, a higher pass rate in APEX classes compared to regular classes might support the argument that APEX classes are not as rigorous. In the following step, we compared the performance of students who have earned the credit on the subsequent regular-setting course (for Algebra 1, the subsequent course is Geometry 1; and for Intro to Lit & Comp the subsequent course is American Literature, both in regular settings for apple-to-apple comparisons) and standardized tests (TCAP Math and Reading in 9th grade and 10th grade, and ACT Reading and Math scores in 11th grade). After adjusting for observable selection biases (prior test score, gender, ethnicity, FRL status, and ELL status), any differences in performance on these tests may indicate differences in course rigor.

In our analyses, comparing performance in subsequent courses and standardized tests, we employ random effect Hierarchical Linear Models (HLM), with School ID being the level II variable. In education research, HLM are usually the preferred method because of the nature of school data where students are generally nested within schools. For example, students in the same school share unobservable characteristics (unobserved teacher quality, school policies, school culture, etc.) that may influence outcomes in other channels than through the treatment (here being whether a student is in an APEX course or not). Estimates of student level coefficients are more reliable once variation at the school level is accounted for.

The qualitative component of this study includes interviews with school staff in 3 DPS high schools that have the largest number of students registered for courses through APEX. They were asked to describe their school's procedure to select students for APEX courses and how students earn a credit through APEX in their school. We also asked them to rate the level of difficulty for a student to earn credit through APEX, in comparison with that of a regular classroom. This is to describe what the general practice in DPS is regarding APEX courses and show teachers' opinion of the course rigor. Due to the small sample size of school staff interviewed, we make no claim that their opinions are representative of all teachers in DPS.

Figure 1: Quantitative component of the research design



Results

Unlike the claim made in Asmar (2011), based on author’s interviews with some former DPS school staff, that almost everyone registered in an APEX class will earn an easy credit, Table 2 shows strikingly low percentages of students in APEX courses that actually have completed the courses they registered for compared to regular classes. While in regular classes, almost no one dropped out/withdrew before the end of the course; such is not the case for APEX classes. The percentage of students withdrawing after attempting¹ credit through APEX is as high as 61 percent in Algebra 1 and as low as 44 percent in Intro to Lit & Comp. Furthermore, among those who stayed at the end of the course, the percentages at which students are given credits are actually *lower* in APEX courses than in the regular setting. For example, 86 percent of students who first attempted and stayed until the end of a regular setting Algebra 1 class earn the credit, but this rate for APEX Algebra 1 is only 72 percent.

Table 2: Descriptive analysis

		Algebra 1		Intro to Lit & Comp	
		Non APEX	APEX	Non APEX	APEX
Students first attempt at course	Number of students attempted	1,762	728	1,654	741
	Number of students remained at the end of the course	1730	282	1633	413
	Percent of students remained at the end of the course	98%	39%	99%	56%
	Number of students completed course with credit	1487	204	1414	268
	Completed course with credit/remained at end of course	86%	72%	87%	65%
	Completed course with credit/attempted	84%	28%	85%	36%
Students previously failed course	Number of students reattempted	58	60	57	59
	Number of students remained at the end of the course	58	29	57	29
	Percent of students remained at the end of the course	100%	48%	100%	49%
	Number of students completed course with credit	42	15	31	14
	Completed course with credit/remained at end of course	72%	52%	54%	48%
	Completed course with credit/attempted	72%	25%	54%	24%

Interviews with teachers involved in APEX corroborate this finding. A teacher at one of the schools with the highest number of APEX enrolled students said “at first, many students enrolled in APEX thinking that these courses are easy. But, soon, they realized that it’s actually much harder than they thought and that they will have to work hard in order to pass each unit’s computerized test, which is not at all easy”. While most teachers think that the rigor of the courses is about the same, either in APEX or the regular classroom, some teachers believe it’s actually harder to earn credit with APEX.

¹ An attempt is defined as having registered for the course and spent time logging in and doing course activities.

One might argue that students selecting into APEX classes are low performing students, which might be true, but we would argue that most of the selection effect would be evened out after a large number of students dropped out of APEX courses. Next steps, in our HLM models we will control for differences in student characteristics between the two populations.

We first took a look at 9th grade Math. Table 3 shows the quantitative analysis results for students who previously failed Algebra 1, reattempted and earned Algebra 1 credit (either through APEX or through a regular class).

We looked at four different outcomes in four models. Model 1 compared student performance in TCAP Math 9th grade, model 2 compared performance on TCAP Math 10th grade, model 3 compared performance on ACT, and model 4 compared odds of earning a Geometry credit. Due to a limited sample size, the only variable controlled for in the models was previous test score (here TCAP Math in 8th grade). The variable “APEX credit” is a binary variable, indicating whether a student has received Algebra 1 credit through APEX or not. TCAP Math 9th grade and TCAP Math 10th grade are continuous scale scores in the two tests. ACT Math is the outcome captured in 11th grade. Because just a few students had ACT scores in our records, we are unable to run this model for this subset of student population. Geometry Credit is a binary variable, indicating whether the student earned Geometry credit in a regular classroom (note that students who attempted Geometry through APEX are excluded in this model). Also because of the sample size, we could not apply HLM models to take into account variations explained at the school level.

Looking at the second row in table 3, among students who have previously failed Algebra 1 and have reattempted, compared to students who earned Algebra1 credits in regular classrooms, those who earned APEX Algebra 1 credit scored about 4 points lower on TCAP Math 9th grade, 2 points lower on TCAP Math 10th grade, but the differences are too small to be statistically significant. Interestingly, they were about four times as likely to earn Geometry credit as those who earned Algebra 1 credit through a regular class, but again this difference is not statistically significant at 0.05 level.

Table 3: Quantitative Analysis results of students who previously failed Algebra 1

	TCAP Math 9th grade	TCAP Math 10th grade	ACT Math	Geometry Credit (OR)
TCAP Math 8th grade	0.77*	1.00*	N/A	1.00
APEX credit	-4.38	-2.09	N/A	4.58

Note: * indicates statistical significance at 0.05 level
 TCAP Math 9th grade range: 340-920
 TCAP Math 10th grade range: 370-886
 ACT Math range: 3-36

Similarly, table 4 shows results for students who attempted Algebra 1 the first time, either through APEX or through a regular class. This time, we have enough sample size to implement HLM models to take into account variations at school level and also control for demographic differences. FRL status, ELL status, Gender, African American, Hispanic, Other races are binary variables indicating if a student qualifies for free or reduced price lunch, is an English language learner, male, African American, Hispanic, Asian or Native American (white students are the reference group). For students who attempted Algebra 1 for the first time, the second row of table 4 indicates that those who earned APEX Algebra 1 credits scored about 2 points lower in TCAP Math 9th grade, 10 points lower in TCAP Math 10th grade, and 0.12 points lower in ACT Math, but the differences are too small to be statistically significant. However, they are about four times as likely to earn a Geometry credit as students earning Algebra credit in regular settings, and the difference is statistically significant at 0.05 level. The last row of the table indicates that some variations of the data are explained at the school level and HLM is the right specification. This means results vary significantly across schools.

Table 4: Quantitative Analysis results of students who first attempted Algebra 1

	TCAP Math 9th grade	TCAP Math 10th grade	ACT Math	Geometry Credit (OR)
TCAP Math 8th grade	0.76*	0.74*	0.03*	1.00*
APEX credit	-2.31	-9.72	-0.12	4.54*
FRL status	-2.62*	0.43	-0.01	0.98
ELL status	0.73	0.78	-0.02	1.05
Gender	2.06*	3.80*	0.33*	0.85*
African American	-8.22*	-6.55*	-1.03*	1.14
Hispanic	-5.36*	-4.72*	-1.03*	0.98
Other minorities	-4.36	-1.96	-0.26	1.10
School level Random effect Chi2	86	109	6	531

Note: * indicates statistical significance at 0.05 level

TCAP Math 9th grade range: 340-920

TCAP Math 10th grade range: 370-886

ACT Math range: 3-36

Moving on to 9th grade Literacy, table 5 shows results for students who previously failed Introduction to Literature and Composition. The outcomes now are TCAP Reading, ACT Reading, and odds of earning credit in American Literature. Again, compared to students who earned Intro to Lit & Comp credits in regular classrooms, students who earned APEX Intro to Lit & Com credits scored lower in TCAP Reading, but the differences are not statistically significant. APEX credited students are twice as likely to earn credit in American Literature as students earning Intro to Lit & Com credits in regular settings, but the difference is not statistically significant.

Table 5: Quantitative Analysis results of students who previously failed Introduction to Literature and Composition

	TCAP Reading 9th grade	TCAP Reading 10th grade	ACT Reading	American Lit Credit (OR)
TCAP Reading 8th grade	0.66*	0.60*	N/A	1.02
APEX credit	-11.96	-7.76	N/A	2.00

Note: * indicates statistical significance at 0.05 level

TCAP Reading 9th grade range: 350-995

TCAP Reading 10th grade range: 370-888

ACT Reading range: 1-36

Results in table 6 tell a similar story, students who attempted Introduction to Literature and Composition the first time and earned credit through APEX score about 4 points lower on TCAP Reading 9th grade and 10th grade, about 0.2 points lower on ACT, but all these differences are not statistically significant. No differences in odds of earning a credit in American Literature were detected. Again, school level statistics indicate that a HLM specification is necessary, and that results vary significantly across schools.

Table 6: Quantitative Analysis results of students who first attempted Introduction to Literature and Composition

	TCAP Reading 9th grade	TCAP Reading 10th grade	ACT Reading	American Lit Credit (OR)
TCAP Reading 8th grade	0.60*	0.60*	0.04*	1.00
APEX credit	-4.40	-4.48	-0.24	0.99
FRL status	-0.78	-0.87	-0.44*	0.98
ELL status	-2.14*	1.81	0.09	1.00
Gender	-1.85*	-6.72*	0.17	0.97
African American	-5.71*	-5.43*	-2.02*	1.31
Hispanic	-3.73*	-2.63	-1.60*	1.06*
Other races	-1.48	1.15	-1.28*	1.18
School level Random effect Chi2	112	86	26	293

Note: * indicates statistical significance at 0.05 level

TCAP Reading 9th grade range: 350-995

TCAP Reading 10th grade range: 370-888

ACT Reading range: 1-36

Conclusions

Given the comparisons of pass rates and performance on subsequent courses and standardized tests, the study found no evidence indicating that APEX classes are less rigorous than regular classes.

Specifically:

- It is NOT true that almost everyone registered for an APEX class would get an easy credit. In fact, a large percentage of students will not complete the class.
- Among those who remained at the end of the classes, APEX classes have significantly lower pass rate (earning credit) than regular classes.
- Students who earned APEX credits perform at about the same level on standardized tests (TCAP and ACT), compared to students who earned regular classroom credits.
- Students who earned APEX credits were generally *more likely* to earn credit in subsequent courses than students who earned credits through regular settings. This has great implications on graduation rates, because accumulating credits is the key to graduation in DPS.

While this study is unable to link APEX credits directly with college enrollment/remediation or graduation (due to the truncated nature of the data), analyses done by DPS's Department of Accountability Research and Evaluation show that TCAP scores are highly predictive of college remediation, ACT is highly predictive of college enrollment, and earning credits in core courses is key to graduation. In all these intermediate outcomes, students who earned APEX credits performed at about the same level as students earning credits in regular classrooms. They even tend to perform better in Geometry and American Literature classes.

Interviews with a subset of teachers involved in APEX courses corroborate the argument that APEX is not handing out free credits. Students actually have to work hard to earn them. Most teachers think that it is about as hard to earn credits with APEX as in regular classes. Some teachers believe that APEX credits are actually harder to earn.

Even though no concerns about the course rigor was raised in our interviews, some teachers expressed minor concerns that students who pass APEX with shortened time might not have had a chance to benefit from teacher's contextual explanations as in a regular classroom, which is important to effectively understand the contents.

Limitations

It is important to note that due to limited resources available, this study only covers analyses using data on two courses: Algebra 1 and Introduction to Literature and Composition semester 1. Although they are both important core courses, we make no claim that they are representative of what happens in other courses. Therefore, inference of the study should be limited to these two core courses only.

Another important factor that might affect the research is the transcript data quality in DPS. Currently, there is no clear link between courses and course codes. For one course, such as Algebra 1, there are as many as 30 different corresponding course codes. We had to make decisions to pick the link that makes the most sense.

School level curriculum flexibility may also affect the study. For instance, there were 303 students failing Algebra 1 Semester 1 in 2009-2010, of which only 60 reattempted with APEX, and 58 reattempted in regular settings. The remaining 185 students had not reattempted Algebra 1 Semester 1. The fact that we observe so many students who had not tried to reattempt Algebra 1 Semester 1 might indicate that some of them might have gone through an “alternative route” to earn an “equivalent” credit. But because the “equivalent” credit, if this is true, was not coded as Algebra 1 Semester 1 credit, we could not determine if this is the case. In this study, we treated this possible “alternative route” as random, meaning that it does not systematically affect the sample of students choosing APEX or regular settings in anyway. It is also possible that credits would be recovered in a later year than 2010-2011.

Using standardized test performance as one of the outcomes could be an issue because the correlation between standardized test score and subject content is quite questionable. For instance, it would be ideal if we could measure the gain in Algebraic thinking skills after taking Algebra 1 class reflected in TCAP math, but the data did not allow for separating Algebraic score from TCAP. Moreover, gain in TCAP could have also reflected the influence of other courses students might have taken during the year before they take the TCAP.

To determine whether APEX helps increase number of credits (of the same quality) that students would not have earned otherwise requires a complicated design that is beyond the scope of this study. In our interview with teachers, we were unable to be conclusive about their belief that APEX helps students earn credits that they would not have earned otherwise. However, some teachers believe that more options are better. “Imagine a student failing Algebra 1, it wouldn’t be much fun to go back to the same classroom with the same teacher who the student probably hates” (teacher interview). Dessoiff (2009) also pointed out that online courses are suited for a substantial number of students who have problems with following the pace in regular classrooms (either they think are too fast or too slow for them). In an online environment students can decide when to work and how fast or slow they want to go, as long as they get the job done within the allowed timeframe, they will get the credit. In DPS, because online credit is granted largely on mastery basis and not on seat time, students could make up for their mistakes faster if they choose to work hard. This would be especially meaningful for juniors and seniors. When they have to take ACT, advanced placement classes, and work on college application, they cannot

afford to sit through a 120-hour class when they've already known 60 hours worth of it. In addition, many students can recover their credits using online options during summer or when regular classes are not offered (Zehr, 2010). In one DPS school that is phasing out (scheduled to be closed down in a few years), APEX is the only option for their current juniors and seniors to make up for the credits they missed.

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