2014

# ONLINE EDUCATION IN SOUTH CAROLINA

SC EDUCATION
OVERSIGHT COMMITTEE

PO Box 11867 | 227 Blatt Building | Columbia SC 29211 | WWW.SCEOC.ORG

## Executive Summary

This study examines the relative effectiveness of instruction provided exclusively in an online setting, where teacher/student interaction is conducted via computer to instruction provided exclusively in a traditional face-to-face setting. Online instruction is available to all students in South Carolina primarily through two avenues. First is the South Carolina Virtual Schools Program (SCVSP), which enables students in any school district in South Carolina to take courses offered for high school credit. Students are able to take courses that may not be offered in their home district, or to take courses that may conflict with a student's current schedule. The SCVSP also serves students by providing the opportunity to recover credits for course that they did not successfully complete initially, and by providing assistance to students who are identified as not likely to receive credit for a course they are currently enrolled in by allowing them to focus on specific areas of academic weakness with a course (content recovery). Second is through a school affiliated with the South Carolina Public Charter School District (SCPCSD) that provides instruction in an online setting. For the 2012-2013 academic year seven SCPCSD schools provided instruction exclusively in an online setting. Some school districts offer online instruction for specific classes, however, these course offerings are only available to students in those school districts. Students enrolled in these classes are not currently identifiable through the student information system.

Very little research has been conducted that directly compares the academic outcomes of students in an online instructional setting to the academic outcomes of students in a traditional instructional setting. One study conducted by the U.S. Department of Education (2010), reported on research conducted between 1996 and 2008. Only five studies were found that compared online instruction to traditional instruction in the K-12 setting that used rigorous statistical designs. Included in a Rand Corporation study by Zimmer, Gill, Booker, Lavertu, & Witte (2009) is a detailed analysis comparing the gains made by middle school students in an online learning setting in Ohio to students in a traditional educational setting. Although the results of this research are mixed, the best summary of research performed to date is that there is no difference between the progress made by students in the online learning setting compared to students in a traditional learning setting.

This study compared the progress made by students in an online learning setting in the Public Charter School District to the gains made by students in a traditional learning setting. Two different statistical methodologies were utilized to examine student progress from 2012 to 2013. The first is Analysis of Covariance, and the second is Propensity Score Analysis. Analyses were performed for elementary and middle school students who took the Palmetto Assessment of State Standards (PASS) Reading and Research and Mathematics tests in 2012 and 2013, and for high school students who tested in 2013 using the Algebra I and English I End of Course tests, and at some previous time with the PASS Mathematics and Reading tests

An analysis of the student, teacher, and parent surveys from the Spring of 2013 was also performed. Questions are asked to determine the level of satisfaction of respondents in three major areas, (1) the learning environment of the school, (2) the social and physical environment of the school, and (3) home/school relations. Responses from individuals involved in an online instructional setting were compared to the responses in traditional instructional settings within the SCPCSD, and to responses in traditional instructional settings in public schools not associated with the SCPSCD.

Based on the analyses conducted here, the following conclusions can be stated:

- In the elementary and middle grades, students who move from an online to a traditional learning setting make more progress than all other students by learning setting, for both Reading & Research or Mathematics.
- In the elementary and middle grades, there are no differences in student progress for students who were in a traditional learning setting compared to students who were in an online learning setting, for both Reading & Research and Mathematics.
- In the elementary and middle grades, students who move from a traditional to an online learning setting make less progress than all other student group by learning setting, for both Reading & Research and Mathematics.
- In high school, there are no differences in student progress for students who were in a traditional learning setting compared to students who were in an online learning setting, for both English I and Algebra I.
- In high school, students who change their learning setting, either from online to traditional or from traditional to online, make less progress than do students who remain in the same learning setting, for both English I and Algebra I.
- Students, teachers, and parents who are associated with an online learning environment view their learning setting more favorably than do students, teachers, and parents in a traditional learning setting.

## Introduction

The delivery of academic instruction to students in South Carolina in an online instructional setting can be traced back to May 2006, when the South Carolina Department of Education launched the South Carolina Virtual Schools Program (SCVSP) pilot. The pilot was designed to obtain information regarding the demand for such a program, which was created within the framework of providing all students in South Carolina access to high-quality instruction.

Subsequently, the SCVSP was created in May of 2007. Students in any school district in South Carolina can take courses offered for a unit of high school credit through the SCVSP, enabling students to take courses that may not be offered in their home district, or to take courses that may conflict with a student's current schedule. The SCVSP also serves students by providing the opportunity to recover credits for course that they did not successfully completed initially, and by providing assistance to students who are identified as not likely to receive credit of a course they are currently enrolled in by allowing them to focus on specific areas of academic weakness with a course (content recovery).As of 2013, there is no limit to the number of classes a student can obtain credits for through the SCVSP. To demonstrate the breadth of SCVSP course offerings, a complete list of tentative course offerings (as of March 24, 2014) for the 2014-15 academic year can be accessed at https://scvspconnect.ed.sc.gov/index.php?q=current-course-offerings.

Online education is also offered through schools associated with the South Carolina Public Charter School District (SCPCSD), which was created in 1996. Most schools that are members of the SCPCSD are traditional "brick and mortar" schools; however, for the 2013-14 academic year 7 SCPCSD schools provide instruction exclusively in an online setting (Table 1). Four of these schools provide instruction at the elementary and middle school level (grades K-8), and five of these schools provide instruction at the high school level (grades 9-12). Students at these schools attend classes via computer; however, online schools may not provide no more than 75% of a student's core academic instruction using online instruction. The remaining 25% must be provided using "regular instructional opportunities", which is interpreted as activities that require resources that are not online or accessed via computer, such as reading hard copy resources, using library resources that are not online, and field trips (S.C. Code Ann.§59-40-65(C)).

Table 1. Exclusively online schools active in the Public Charter School District during the 2012-13 academic year.

| School | Opening Year | Grades Served |
|---|---|---|
| Palmetto State E-cademy | 2008 | 9-12 |
| Provost Academy South Carolina | 2009 | 9-12 |
| South Carolina Virtual Charter School | 2008 | K-12 |
| South Carolina Calvert Academy | 2009 | K-8 |
| South Carolina Connections Academy | 2008 | K-12 |
| South Carolina Whitmore School | 2011 | 9-12 |
| Cyber Academy of South Carolina | 2012 | K-9 |

The online instructional setting has a number of purported advantages and disadvantages compared to traditional "brick and mortar" schooling. Students have greater flexibility as to when they perform the work associated with online courses, although online interactions with teachers are at fixed times, just as in a traditional school setting. Because students choose the courses they pursue, it is proposed that student involvement in greater in the online setting.

Although teachers make presentations to classes of students, teachers are better able to individualize and differentiate instruction for students. Behavioral distractions are eliminated, which allows greater focus on classroom content. Teacher time is better used because many administrative responsibilities are automated.

One potential disadvantage is that students have greater responsibility for keeping on-track in the online setting, although effective online instruction should be designed to keep students and parents award of student progress. Another limitation may be that opportunities for in-person interaction among students may be limited.

## Purpose of the Study

This study will document two aspects of online learning:

1) How do the academic outcomes of students enrolled in an online instructional setting compare to the academic outcomes of students in traditional educational settings?

2) How do the perceptions of the educational environment differ for students, parents, and teachers in an online instructional setting differ from those of individuals in a traditional instructional setting?

## Review of the Literature

Within the literature, instruction in an online setting has been referred to as online or virtual learning, instruction in an online or virtual school, or similar verbiage. A similar instructional setting is blended learning, where the primary instruction may be provided online; however face-to-face interaction with the instructor is available on a frequent basis. The analyses performed in is study will focus exclusively on the merits of instruction provided in an online instructional setting compared to instruction provided in a traditional instructional setting.

A review of the literature to identify those studies that make the most substantively meaningful comparisons between instruction in an online setting and instruction in a traditional setting reveals a startling result: a paucity of research has been conducted in the K-12 educational setting to determine the relative merits of instruction in an online setting. The best designed studies examine the achievement gains of students in an online instructional setting to those of students in a traditional educational setting, where appropriate statistical methods are used to ensure comparisons made consider the cultural context and previous academic achievement of students in each setting. Because these studies have similar rigorous research designs, their results can be combined using meta-analysis. Many studies compare the academic achievement of students at the end of an online learning experience to the academic achievement of students at the end of traditional learning experience, with no attempt to ensure that students in the two instructional settings are comparable. The results of these studies cannot be attributed solely to the difference in learning experience, and therefore, are not as informative.

Meta-analysis is a technique which combines the numeric measures of the relative effectiveness of online learning obtained from multiple studies into a single number that characterizes the effectiveness of online leaning compared to traditional instruction. In order to be included in a meta-analysis, each study must have included in its results an effect size, or the information necessary to create an effect size. An effect size is computed by dividing the difference between a “treatment” and a “control” by the standard deviation of the scores of the individuals in both groups computed around the mean for each group (a pooled standard deviation). Within the educational setting an effect sizes with magnitude (positive or negative) near 0.20 are regarded as small, effect sizes with magnitude near .5 are regarded as medium, and effect sizes with magnitude near .8 may be considered as large (Cohen, 1988).

The two kinds of studies that are included in the meta-analyses discussed here are experimental studies, where students are randomly assigned to the treatment condition (online learning), and quasi-experimental studies, where students are not assigned at random to the treatment condition. In a quasi-experimental study, information is obtained from each student in both the treatment (online learning) and control (traditional learning) group, and appropriate statistical methodologies are used to make comparisons between students who are similar in their cultural background and in their previous academic achievement.

A meta-analysis of the evidence for the effectiveness of online learning was performed by the U.S. Department of Education (2010), which reported on research conducted between 1996 and 2008. For this study, two types of online learning were considered. First were studies for which learning was conducted exclusively in an online setting, with all communication between the teacher and students using electronic means. Second were studies of blended or hybrid learning, where the primary mode of instruction was online; however face-to-face interactions between teachers and students were also a part of the instructional setting.

The authors found 176 studies of online learning between 1996 and 2008 that utilized either an experimental or quasi-experimental design that traditional learning to completely online or blended learning. Only 99 of these studies compared traditional learning to completely online learning. Most notably, only 9 of these 99 studies were of students in the K-12 educational setting. Of these 99 studies, only 45 contained sufficient information to compute effect sizes that could be used for a meta-analysis. Only 5 of these studies were of students in the K-12 setting. Fifty effect sizes were computed from these 45 studies (some studies included results for more than one subject area).

Of these 50 effect sizes, 11 were statistically significant favoring online or blended learning, three were statistically significant favoring traditional instruction. The authors' conclusions are:

- Students in online learning or blended learning performed modestly better than those in traditional instruction. The mean effect size was 0.20 in favor of online learning.

- Instruction using blended learning had a larger effect than did purely online learning. The mean effect size for blended learning compared to traditional learning was 0.35, and the effect size for purely online learning compared to traditional learning was 0.05.

- The authors concluded that purely online instruction was no more effective than traditional instruction.

- Effect sizes were larger and statistically significant for studies where instruction was collaborative (effect size 0.25) or instructor-directed (effect size 0.39), rather than where online learners worked independently (effect size 0.05).

- The effectiveness of online learning was demonstrated for undergraduates (effect size 0.30), and for graduate students and professionals (0.10).

- The effect size for K-12 students was positive, but not statistically significant. There were, however, only 7 effect sizes to be considered.

The authors caution that many factors change when online instruction is utilized (e.g., students are engaged in learning for longer periods of time, access a greater variety of materials, and

increase collaboration), and should these changes occur in the traditional learning setting, similar gains may be obtained. In other words, although students participating in blended learning demonstrated greater learning outcomes, it is not clear that these greater outcomes can be attributed to the change in learning medium from traditional to online or to the changes in student habits that occurred in conjunction with the change to the blended learning setting.

The National Education Policy Center (2014) produced a document that summarized the policy issues associated with virtual schools, the research to date regarding the effectiveness of virtual schools, and a summary of the effectiveness of virtual schools as represented by school report card ratings. The author's note, consistent with the U.S. Department of Education (2010) study, that there is little peer-reviewed research into the effectiveness of online learning in the K-12 setting.

The authors cited several analyses that compare student achievement outcomes in online learning settings to those in traditional learning settings. Online learning students in Colorado scored lower than did students in traditional learning settings. In Wisconsin, online charter school students had higher median scores in reading, but lower median scores in mathematics. In Minnesota, online charter school students were found to have comparable levels of reading achievement, but lower levels of achievement in mathematics. Similar results were also found in Arizona, where full-time line students had lower levels of performance in mathematics and comparable levels of performance in reading. In Minnesota and Arizona the graduation rates of full-time online student s were found to be lower than state averages. A major limitation of these studies, however, is that they examine student scores on state exams, but do not make comparisons between students who initially had the same levels of achievement. The results of these studies can best be characterized as describing the differences between students who choose to pursue their education in the online environment and those who choose a traditional education setting rather than assessing and comparing the learning of students in these contexts.

A Rand Corporation study by Zimmer, Gill, Booker, Lavertu, & Witte (2009) examined the relative achievement gains made by charter school students in eight states. Although much of this study addresses the achievement gains made by students in charter schools that are not in an online setting, it does contain a detailed analysis comparing the gains made by students who are in a middle school online learning setting in Ohio to students in traditional learning settings. They found that students attending middle school virtual charter schools gained substantially less (effect size -0.44 for Mathematics and -0.25 for Reading) than did students in traditional learning settings.

The achievement of students enrolled in schools managed completely by K12, Inc., a for-profit company Educational Management Organization (EMO) that provides online schooling was investigated by Miron and Urschel (2012) for the National Education Policy Center, which found "…a consistent pattern of weak performance". Schools managed by K12, Inc. in Pennsylvania were studied by the Center for Research on Education Outcomes (2011), which found that students in the online schools performed significantly worse in both Reading and Mathematics than students in public schools that students left to attend the Pennsylvania K12, Inc. online schools. Officials of K12, Inc. (Saul, 2011) responded that the student bodies served by K12, Inc. were scored lower initially and were more economically disadvantaged than students in the public schools. Data analyzed by Miron and Urschel (2012), however, found that students served by K12, Inc. were more often white and less often qualified for subsidized meals.

In summary, only a small database of research compares students in online schools to students in traditional K-12 school settings with sufficiently rigorous statistical methodologies to justify making claims regarding the relative effectiveness of these two instructional platforms. Considering these studies, it appears that students in online schools make gains that are no different from students in traditional school settings. Research that is based on summaries of student achievement and does not compare the gains of students with similar cultural characteristics and educational achievement histories generally reach the same conclusion, but should be viewed more skeptically. Research by advocacy groups for online learning tend to find positive results for online learning, but should be interpreted with caution.

## Data

Data utilized in this study are from the Palmetto Assessment of State Standards (PASS), the End-of-Course Evaluation Program (EOCEP), and the annual surveys of students, parents administered by the South Carolina Department of Education. Access to this data is obtained through an annual data request made to the Department by the EOC.

To examine student growth from 2012 to 2013 on PASS, PASS data from the Spring of 2012 were matched to PASS data from the Spring of 2013. Matching was done for only those students with a valid state identification number in the testing record, using a character string that included the state identification number, the first two letters of the last name, and the first letter of the first name. Four student groups were identified for further analyses based on their location of testing in each year:

1) Students who tested in a traditional learning setting in both 2012 and 2013,
2) students who tested in a traditional learning setting in 2012 and in an online learning setting within the Public Charter School District in 2013,
3) students who tested in an online learning setting within the Public Charter School District in 2012, and in a traditional learning setting in 2013, and
4) students who tested in an online learning setting within the Public Charter School District in both 2012 and 2013.

Students who were enrolled in a brick and mortar school within the Public Charter School District in either 2012 or 2013 were eliminated from all analyses in order that comparisons be made only between students enrolled in traditional learning settings in the public schools and students enrolled in an online learning setting associated with the Public Charter School District.

Similarly, to examine student growth from PASS to the EOCEP English 1 or Algebra 1, PASS data from the Spring of 2011, 2012, and 2013 were matched to EOCEP data from the 2012-2013 academic year. Only the most recent PASS record was utilized for prediction purpose. Matching was done for only those students with a valid state identification number in the testing record, using a character string that included the state identification number, the first two letters of the last name, and the first letter of the first name. The same four student groups based on the pattern of learning setting were created for analysis. It should be noted that the current analyses did not include students who were enrolled in the South Carolina Virtual Schools program because staff were not able to obtain information from the Department to identify the students who were enrolled in courses through the SCVSP.

Included in the student, parent, and teacher survey data was the school identification code each student, parent, or teacher was affiliated with. For each survey three groups of respondents were created, based on the type of school the student is enrolled in:

1) schools not associated with the Public Charter School District,
2) traditional schools of the Public Charter School District, and
3) virtual schools of the Public Charter School District.

By creating these three groups, distinctions could be made between the perceptions of students, parents, and teachers in schools that are not associated with the Public Charter School District and virtual schools that are associated with the Public Charter School District. It was not assumed that respondents associated with traditional schools of the Public Charter School District were similar to respondents associated with non-Public Charter School District

schools because they attend a brick and mortar school, or to respondents of online schools because they are a part of the Public Charter School District.

## Methods

The first question addressed is whether the academic outcomes of students in online learning settings obtain educational outcomes that differ from the educational outcomes of students in traditional learning settings. This question was addressed in two ways at the elementary and middle school levels, and in two ways at the high school level. Separate analyses were performed by school level because different information is available by school level.

At the elementary and middle school levels, the analyses examined the gains made by students from PASS 2012 to PASS 2013. Two kinds of analyses were performed. In the first analysis, analyses of covariance were performed to compare the relative achievement gains of four groups of students:

1) Students who tested in a traditional learning setting in both 2012 and 2013,
2) students who tested in a traditional learning setting in 2012 and in an online learning setting within the Public Charter School District in 2013,
3) students who tested in an online learning setting within the Public Charter School District in 2012, and in a traditional learning setting in 2013, and
4) students who tested in an online learning setting within the Public Charter School District in both 2012 and 2013.

For both Mathematics and Reading and Research, Analyses of Covariance were performed where the PASS 2013 scale score was predicted from the PASS 2012 scale score and the student grade level in 2013. Analysis of Covariance allows comparisons to be made between two or more groups that differ on variables (the covariates) that are related to the outcome of interest as if the groups were similar on the covariates. Student grade level in 2013 was used as a covariate because, although PASS score scales for all grades are on a scale from 200 to 800 with a mean near 600, the between PASS 2012 and PASS 2013 may differ by grade level. By including the 2012 PASS score as a covariate, comparisons were made among students in each of the four groups noted above, where the comparisons can be regarded as between students with the same initial levels of academic achievement.

The second analysis performed also examined PASS 2013 scores predicted from PASS 2012 scores; the method used for this second analysis was propensity score matching (d'Agostina, 1998). When students are not randomly assigned to the treatment and control groups, as we have for our study, propensity score matching identifies a student in the control group that can be regarded as a "match" to a student in the treatment group for comparison purposes. In this study, students in the online learning setting are regarded as being in the treatment group, and students in the traditional learning setting are regarded as being in the control group. Using logistic regression, predictions were made for all students (in both the online and traditional learning settings) regarding how likely they were to be in the online learning setting using previous assessment scores, gender, ethnicity, and subsidized meal status as predictors. The result of the logistic regression is a probability that each student would be in the online learning setting. For each student in the online learning setting the student in the traditional learning setting with the closest probability of being in the treatment group is selected as a "match". Note that for the propensity score analysis only two groups of students were compared; students who were in an online learning setting for both assessments were compared to propensity score matched students who were in a traditional learning setting for both assessments.

The End-of-Course (EOCEP) scores obtained by students in the online instructional setting were then compared to the EOCEP scores obtained by students in the traditional learning setting, again using Analysis of Covariance, but this time using the propensity score as covariate. Using the propensity score as a covariate is another way to compare the gains made by similar students with the same initial characteristics. For the same reason, PASS scores were also again used as a covariate.

At the high school level similar analyses were performed, where PASS scores obtained by students in 2011, or 2012, or 2013 were used as predictors of scores from End-of-Course exams administered in the 2012-13 academic year. PASS Reading and Research scores were used to predict English I EOCEP scores, and PASS Mathematics scores were used to predict Algebra I EOCEP scores. The most recent PASS score for each student was utilized as a predictor. Using the most recent PASS score, the same four groups of students were identified. PASS scores and student grade level of the PASS score were used as covariates, and differences in the each EOCEP score were obtained by the pattern of student attendance.

Propensity score analysis was also used to assess EOCEP scores predicted from PASS scores. Students again were identified for their probability of being in an online educational setting. Students who were assessed on both occasions in an online school were compared to students who were assessed on both occasions in a traditional learning setting, again using the propensity score, PASS score, and student grade level as a covariate.

## Results

The first analysis performed examined the relationships between 2012 PASS and 2013 PASS by student learning setting. Analyses were performed for both PASS Reading and PASS Mathematics. Analyses of Covariance (ANCOVA) were performed predicting PASS 2013 from student learning setting with PASS 2012 and student grade level as covariates. The demographics of students and number of students in each learning setting for 2012 and 2013 are presented in Table 2. Among the four student groups by learning setting, there are minimal differences by gender, and a slightly larger percentage of students who were in the traditional learning setting for both assessments were African-American and received subsidized meals. For all other learning settings, the percentages by race/ethnicity and meals status nearly the same. The distributions for PASS Reading are similar across groups; however, for PASS Mathematics a larger percentage of students in the traditional learning setting for first testing score at the exemplary level, and a smaller percentage score at the Not Met level.

Table 2. Demographics of elementary and middle school students in each learning setting.

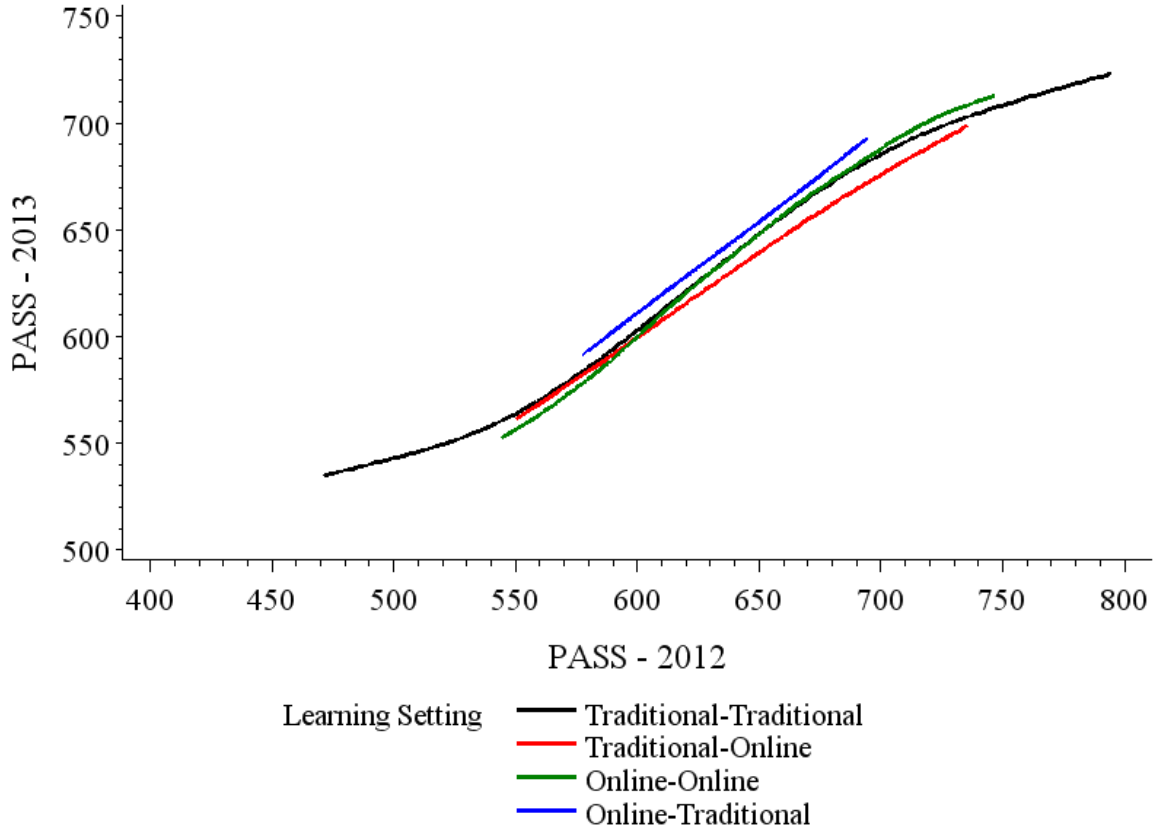
| Demographic | Learning Setting (2012 – 2013) | | | |
|---|---|---|---|---|
| | Traditional – Traditional | Traditional – Online | Online – Online | Online - Traditional |
| Gender | | | | |
| Female | 123,125 (49) | 486 (51) | 619 (48) | 232 (46) |
| Male | 128,375 (51) | 470 (49) | 660 (52) | 277 (54) |
| Race/Ethnicity | | | | |
| African-American | 88,148 (37) | 154 (17) | 201 (16) | 88 (19) |
| Hispanic | 16,402 (7) | 36 (4) | 48 (4) | 13 (3) |
| White | 133,220 (56) | 736 (79) | 982 (80) | 368 (78) |
| Meal Status | | | | |
| Full-Pay | 102,862 (41) | 448 (47) | 610 (48) | 235 (46) |
| Subsidized | 148,402 (59) | 507 (53) | 669 (52) | 274 (54) |
| 2012 PASS Reading | | | | |
| Exemplary | 133,493 (42) | 421 (44) | 544 (43) | 639 (38) |
| Met | 103,616 (32) | 320 (34) | 407 (32) | 526 (32) |
| Not Met | 82,037 (26) | 209 (22) | 324 (25) | 500 (30) |
| 2012 PASS Math | | | | |
| Exemplary | 113,152 (35) | 345 (36) | 264 (21) | 242 (15) |
| Met | 122,205 (38) | 347 (36) | 506 (40) | 662 (40) |
| Not Met | 84,047 (26) | 257 (27) | 507 (40) | 762 (46) |
| Total* | 321,025 | 956 | 1,279 | 1,713 |

* Totals may exceed sums within each column because of missing values.

PASS 2012 Reading to PASS 2013 Reading

A visual representation of the mean 2013 PASS scores by 2012 PASS score is presented in Figure 1. Data points included in Figure 1 are only those points that were based on 10 or more observations. Visually, it appears that students who were in an online setting in 2012 and transitioned to a traditional setting in 2013 gained more than students with any other learning setting pattern. It also appears that students who were in a traditional learning setting in 2012 and transitioned to an online learning setting in 2013 made smaller gains than any other group. Students who were in the same learning setting for 2012 and 2013, whether that setting be traditional or online, made similar gains. Analysis of Covariance (ANCOVA) predicting 2013 PASS Reading from 2012 PASS Reading, student grade level, and learning setting for 2012 and 2013 are presented in Table 3. This analysis will determine if the differences observed in Figure 1 are large enough to claim real differences by learning setting are present.

Figure 1. Mean 2013 PASS Reading by 2012 PASS Reading for each 2012-2013 learning setting.




Because a slight curvilinearity is present in the pattern of mean scores, the ANCOVA that was performed to determine whether the visually observed differences among learning settings in

Figure 1 are statistically significant was conducted treating the 2012 PASS score as a discrete rather than a continuous variable; in other words each 2012 PASS value was treated as a separate variable in the analysis. This eliminated any possibility that lack of linearity may adversely affect the interpretability of the ANCOVA results. This approach does, however, decreases the power of the statistical test.

The main effect of learning setting is the factor that is of greatest interest in this study. To ensure that the effect of learning setting is not confounded with other factors, all potential interaction effects among PASS Reading & Research, grade level, and learning setting were included in this analysis.

Table 3. ANCOVA predicting 2013 PASS Reading from 2012 PASS Reading, student grade level, and learning setting.

| Factor | df | Sum of Squares | Mean Square | F | p-value |
|---|---|---|---|---|---|
| PASS Reading | 172 | 2024661.62 | 11771 | 11.36 | <.0001* |
| Grade Level | 5 | 29483.00 | 5897 | 5.69 | <.0001* |
| Grade Level * PASS Reading | 257 | 472891.46 | 1840 | 1.78 | <.0001* |
| Learning Setting | 3 | 32512.08 | 10837 | 10.45 | <.0001* |
| Learning Setting * PASS Reading | 375 | 482318.98 | 1286 | 1.24 | 0.0010* |
| Learning Setting * Grade Level | 15 | 9657.87 | 644 | 0.62 | 0.8604 |
| Learning Setting * Grade Level * PASS Reading | 156 | 161749.58 | 1037 | 1.00 | 0.4841 |

* Statistically significant at the .05 level.

Consider the results presented in Table 3; each Factor that has a p-value less than .05 is judged to be statistically significant at the .05 level. Only one interaction effect was found to be statistically significant, the interaction of grade level and PASS Reading. There is no interaction of PASS Reading and learning setting, which suggests that the slopes of the line predicting 2013 PASS scores from 2012 PASS scores do not differ by learning setting, which is consistent with the visual presentation of Figure 2. The main effect of PASS Reading is statistically significant, which was to be expected; this main effect indicates that the 2013 PASS scores depend upon the 2012 PASS scores, which is clear from Figure 1. The main effect of grade level is also statistically significant, which suggests that for different grade levels, the 2013 PASS scores obtained by students with the same 2012 PASS scores differ. For a graph such as Figure 1, parallel lines of prediction could be plotted by grade level.

The effect of interest for this study Is learning setting, which was statistically significant, which means that the 2013 PASS scores of at least one of the four learning setting groups differ from the other learning setting groups, for each 2012 PASS score. Post-hoc analyses were performed to determine which student groups were different from one another, which confirmed the results visually presented in Figure 1. Students who initially were in an online learning setting and transitioned to a traditional setting made the largest gains, and these gains were significantly larger than the gains made by either students who were in the online learning setting for both years or students who were in the traditional learning setting for both years. These two groups of students were not distinguishable by their gains. Students who initially were in a traditional learning setting and transitioned to an online learning setting made gains that were lower than students in all other learning setting pattern.

In the propensity score analysis students who were in the online learning setting for both years were compared to students who were in the traditional learning setting for both years. To reiterate, for each student in the online learning setting in both years, a student in the traditional learning setting for both years with the nearest probability of being in the online learning setting for both years was found, and this student became the "control" student for the student in the online learning setting. The goal of propensity score matching is to compare groups that are more similar to one another. The demographics of propensity score matched students are presented in Table 4. Notice that for each variable, nearly identical percentages of students are in the traditional and online groups, which is evidence of the effectiveness of the matching.

Table 4. Demographics of elementary and middle school students after propensity score matching.

| | Learning Setting (2012 – 2013) | |
|---|---|---|
| Demographic | Traditional – Traditional | Online – Online |
| Gender | | |
| Female | 606 (48) | 613 (49) |
| Male | 653 (52) | 645 (51) |
| Race/Ethnicity | | |
| African-American | 187 (15) | 196 (16) |
| Hispanic | 38 (3) | 45 (4) |
| White | 993 (79) | 971 (77) |
| Meal Status | | |
| Full-Pay | 584 (46) | 614 (49) |
| Subsidized | 675 (54) | 643 (51) |
| PASS Reading Level | | |
| Exemplary | 485 (39) | 538 (43) |
| Met | 437 (35) | 399 (32) |
| Not Met | 336 (27) | 318 (25) |
| PASS Mathematics Level | | |
| Exemplary | 364 (29) | 261 (21) |
| Met | 501 (40) | 499 (40) |
| Not Met | 393 (31) | 497 (40) |
| Total* | 1,259 | 1,258 |

* Totals may exceed sums within each column because of missing values.

To guard against the possibility that predictions of 2013 PASS scores may differ by propensity score, it was included as a covariate in the analysis. Results of the propensity score ANCOVA are presented in Table 5.

Table 5. Propensity Score ANCOVA Predicting PASS 2013 Reading from PASS 2012 Reading, Virtual School Attendance, and Propensity Score.

| Factor | df | Sum of Squares | Mean Square | F | p-value |
|---|---|---|---|---|---|
| Learning Setting | 1 | 1717.93 | 1717.93 | 1.44 | 0.2295 |
| Propensity Score | 1 | 17000.28 | 17000.28 | 14.29 | 0.0002* |
| Learning Setting * Propensity Score | 1 | 1411.20 | 1411.20 | 1.19 | 0.2761 |
| PASS Reading | 1 | 277155.16 | 277155.16 | 233.05 | <.0001* |
| Learning Setting * PASS Reading | 1 | 1901.45 | 1901.45 | 1.60 | 0.2062 |
| PASS Reading * Propensity Score | 1 | 17953.81 | 17953.81 | 15.10 | 0.0001* |
| Learning Setting * Propensity Score * PASS Reading | 1 | 1680.51 | 1680.51 | 1.41 | 0.2347 |

* Statistically Significant at the .05 level.

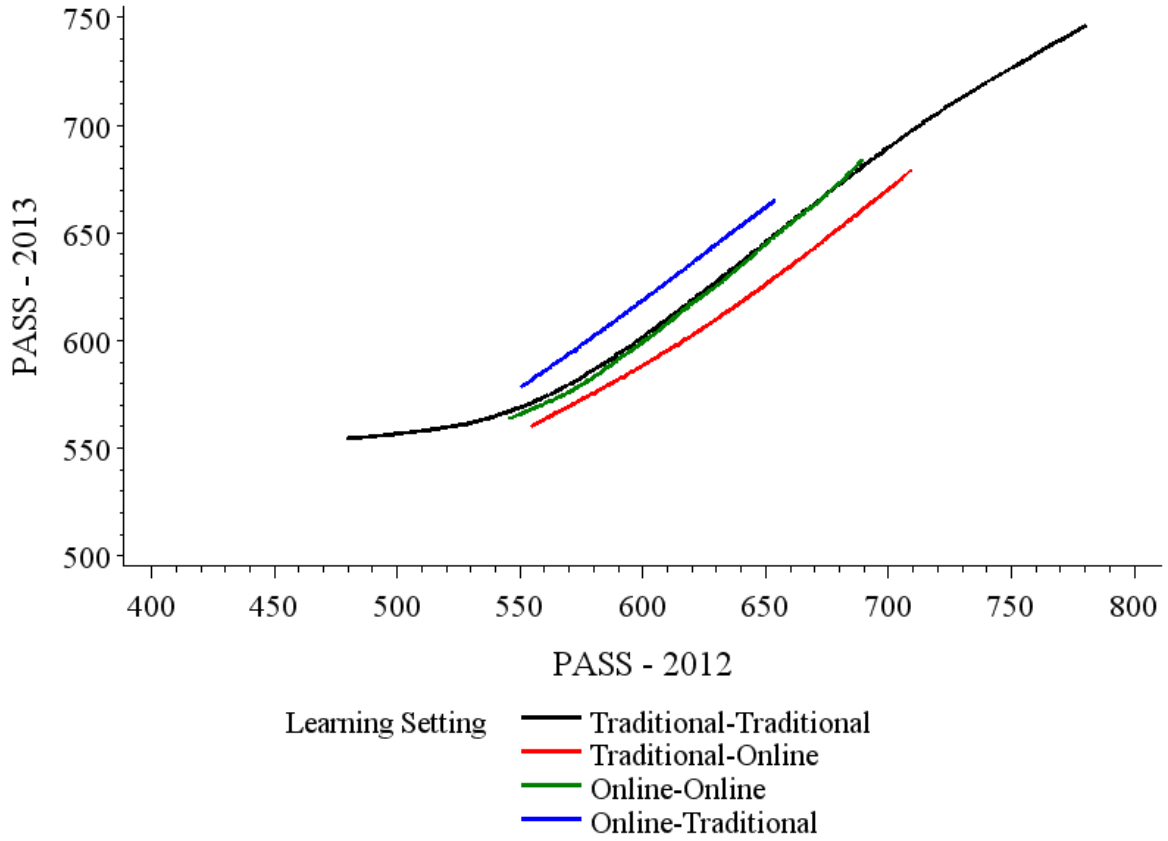
As with the previous analysis, the inclusion of all covariates and interactions in the model were to ensure that should differences be observed by learning setting, that these differences could be attributed uniquely to learning setting. The interaction of PASS Reading and propensity score is statistically significant, which means that the relationship between 2012 PASS Reading and 2013 PASS Reading depends upon the propensity score. The main effect of PASS Reading was expected to be statistically significant, yet the main effect of propensity score was not anticipated to be significant. Regardless of the statistical significance of the other covariates, their inclusion in the ANCOVA was to isolate the effect of learning setting for analysis.

Results of this analysis indicate that there is not a statistically significant difference by learning setting, which means that 2013 PASS scores do not differ by learning setting groups, for each 2012 PASS score. This lack of statistical significance is consistent with the ANCOVA results presented in the previous analyses where, although a statistically significant result was found for the main effect of learning setting, post-hoc analyses indicated that was no difference between the gains made by students who were in the online setting for both years and students who were in the traditional setting for both years.

PASS 2012 Mathematics to PASS 2013 Mathematics

A visual representation of the mean 2013 PASS scores by 2012 PASS score is presented in Figure 1, and results of the ANCOVA predicting 2013 PASS Reading from 2012 PASS Reading, student grade level, and learning setting for 2012 and 2013 are presented in Table 5. Data points included in Figure 2 are only those points that were based on 10 or more observations. Results for Mathematics appear to be similar to those for Reading. It appears that students who were in an online setting in 2012 and transitioned to a traditional setting in 2013 gained more than students with any other learning setting pattern. It also appears that students who were in a traditional learning setting in 2012 and transitioned to an online learning setting in 2013 made smaller gains than any other group. Students who in the same learning setting for 2012 and 2013, whether that setting be traditional or online, made similar gains.

Figure 2. Mean 2013 PASS Mathematics by 2012 PASS Mathematics for each 2012-2013 learning setting.




Curvilinearity was not judged to a significant factor in the relationship between 2012 and 2013 PASS scores, therefore 2012 PASS scores were considered as a continuous variable in the prediction of 2013 PASS scores. Again, the main effect of learning setting is the factor that is of greatest interest in this study. To ensure that the effect of learning setting is not confounded with other factors, all potential interaction effects were included in this analysis.

Table 6. ANCOVA predicting 2013 PASS Mathematics from 2012 PASS Mathematics, student grade level, and learning setting.

| Factor | df | Sum of Squares | Mean Square | F | p-value |
|---|---|---|---|---|---|
| PASS Mathematics | 203 | 510468119.8 | 2514621.3 | 3012.84 | <.0001* |
| Grade Level | 5 | 4282954.4 | 856590.9 | 1026.31 | <.0001* |
| Grade Level * PASS Mathematics | 306 | 996128.0 | 3255.3 | 3.90 | <.0001* |
| Learning Setting | 3 | 419223.2 | 139741.1 | 167.43 | <.0001* |
| Learning Setting * PASS Mathematics | 424 | 428241.2 | 1010.0 | 1.21 | 0.0019* |
| Learning Setting * Grade Level | 14 | 62993.7 | 4499.5 | 5.39 | <.0001* |
| Learning Setting * Grade Level * PASS Mathematics | 250 | 215642.3 | 862.6 | 1.03 | 0.3447 |

* Statistically significant at the .05 level.

Considering the results presented in Table 6, two interaction effects were found to be statistically significant, the interaction of learning setting and PASS Mathematics and the interaction of learning setting with grade level. The interaction of learning setting with PASS Reading and Research implies that the slopes of the lines in Figure 1 are different by learning setting. Although this is true, it does not appear to be so dramatic that the test of the main effect of learning setting should not be considered. The main effect of PASS Mathematics is statistically significant, which was to be expected; this main effect indicates that the 2013 PASS scores depend upon the 2012 PASS scores, which is clear from Figure 1. The main effect of grade level is also statistically significant, which suggests that for different grade levels, the 2013 PASS scores obtained by students with the same 2012 PASS scores differ. For a graph such as Figure 1, parallel lines of prediction could be plotted by grade level.

Again, the effect of interest for this study Is learning setting, which was statistically significant, which means that the 2013 PASS scores of at least one of the four learning setting groups differ from the other learning setting groups, for each 2012 PASS score. Post-hoc analyses were performed which confirmed the results visually presented in Figure 2; students who initially were in an online learning setting and transitioned to a traditional setting made the largest gains, and these gains were significantly larger than the gains made by either students who were in the online learning setting for both years or students who were in the traditional learning setting for both years. These two groups of students were not distinguishable by their gains. Students who initially were in a traditional learning setting and transitioned to an online learning setting made gains that were lower than students in all other learning setting pattern.

In the propensity score analysis (Table 7), students who were in the online learning setting for both years were compared to students who were in the traditional learning setting for both years. To reiterate, for each student in the online learning setting in both years, a student in the traditional learning setting for both years with the nearest probability of being in the online learning setting for both years was found, and this student became the “control” student for the student in the online learning setting. To guard against the possibility that predictions of 2013 PASS scores may differ by propensity score, it was included as a covariate in the analysis.

Table 7. Propensity Score ANCOVA Predicting PASS 2013 Mathematics from PASS 2012 Mathematics, learning setting, and propensity score.

| Factor | df | Sum of Squares | Mean Square | F | p-value |
|---|---|---|---|---|---|
| Learning Setting | 1 | 998.96 | 998.96 | 1.75 | 0.1857 |
| Propensity Score | 1 | 12162.95 | 12162.95 | 21.34 | <.0001* |
| Learning Setting * Propensity Score | 1 | 279.02 | 279.02 | 0.49 | 0.4842 |
| PASS Mathematics | 1 | 24813.00 | 24813.00 | 43.53 | <.0001* |
| Learning Setting * PASS Mathematics | 1 | 1131.153 | 1131.153 | 1.98 | 0.1591 |
| PASS Mathematics * Propensity Score | 1 | 29225.92 | 29225.92 | 51.27 | <.0001* |
| Learning Setting * Propensity Score * PASS Mathematics | 1 | 260.51 | 260.51 | 0.46 | 0.4991 |

* Statistically significant at the .05 level.

As with the previous analysis, the inclusion of all covariates and interactions in the model were to ensure that should differences be observed by learning setting, that these differences could be attributed uniquely to learning setting. There is an interaction between PASS Mathematics and propensity score, which suggests that the relationship between 2012 PASS and 2013 PASS differs by propensity score. There is a statistically significant relationship for PASS Mathematics which was expected, and for propensity score. Most importantly, there does not appear to be a statistically significant relationship for learning setting, which indicates that there is no difference between the gains made by students in an online learning setting compared to students in a traditional learning setting. This result is consistent with the previous analysis, which that there is no difference between the gains made by students who were in the online setting for both years and students who were in the traditional setting for both years.

Predicting EOCEP from PASS.

Analyses were conducted predicting scores on the English I and Algebra I EOCEP tests from the most recent scores on the most recent PASS Reading & Research and Mathematics tests a student received. The most recent PASS score used for prediction could be obtained from several grade levels, which may result in different relationships between PASS and EOCEP scores; therefore, PASS grade level was included as a covariate for these analyses. The focus of this investigation was on the four student groups were compared based on their pattern of learning setting, which were identified in the same manner as for the PASS to PASS analysis.

English I EOCEP from PASS Reading.

Results presented in Table 8 are for analyses predicting English I EOCEP scores from the most recent PASS Reading scores. No interaction effects were statistically significant. Only one main effect, the effect of PASS Reading & Research was statistically significant, which was

expected because higher levels of PASS Reading in 2012 are associated with higher levels of PASS Reading in 2013. The focus of this investigation is on the main effect of learning setting, which was not statistically significant, which means that for these data there are no differences in student learning from 2012 PASS to 2013 PASS by learning setting.

Table 8. Predicting EOCEP English I from PASS Reading, learning setting, and PASS grade level.

| Factor | df | Sum of Squares | Mean Square | F | p-value |
|---|---|---|---|---|---|
| PASS Reading & Research | 1 | 3132.98 | 3132.98 | 61.62 | <.0001* |
| Grade Level | 2 | 44.39 | 22.20 | 0.44 | 0.6463 |
| PASS Reading & Research * Grade Level | 2 | 95.81 | 47.91 | 0.94 | 0.3897 |
| Learning Setting | 3 | 287.00 | 95.67 | 1.88 | 0.1302 |
| PASS Reading & Research * Learning Setting | 3 | 273.64 | 91.21 | 1.79 | 0.1459 |
| Grade Level * Learning Setting | 3 | 167.61 | 55.87 | 1.10 | 0.3481 |
| PASS Reading & Research Learning Setting Grade Level | 3 | 173.44 | 57.81 | 1.14 | 0.3325 |

* Statistically significant at the .05 level

Algebra I EOCEP from PASS Mathematics.

Results presented in Table 9 are for analyses predicting Algebra I EOCEP scores from the most recent PASS Mathematics scores. Only one interaction was statistically significant, the interaction between grade level and PASS Mathematics scores. Most importantly, there was a statistically significant result for learning setting. Post-hoc analyses indicate that each of the four learning setting groups could be distinguished from one another. The group with the largest gains was students in the traditional learning setting on both testing occasions, followed by students in the online learning setting on both occasions, followed by students whose first testing was in an online setting and second testing was in a traditional setting, and students whose first testing was in a traditional setting and second testing was in an online setting.

Table 9. ANOVA predicting EOCEP Algebra I from PASS Reading, virtual school attendance, and student grade level.

| Factor | df | Sum of Squares | Mean Square | F | p-value |
|---|---|---|---|---|---|
| PASS Mathematics | 227 | 444073.97 | 1956.27 | 36.86 | <.0001* |
| Grade Level | 5 | 513.03 | 102.61 | 1.93 | 0.0853 |
| Grade Level * PASS Mathematics | 128 | 11461.33 | 89.54 | 1.69 | <.0001* |
| Learning Setting | 2 | 2351.54 | 1175.77 | 22.15 | <.0001* |
| Learning Setting * PASS Mathematics | 289 | 16850.11 | 58.30 | 1.10 | 0.1204 |
| Learning Setting * Grade Level | 6 | 326.71 | 54.45 | 1.03 | 0.4060 |
| Learning Setting * Grade Level * PASS Mathematics | 95 | 6174.57 | 65.00 | 1.22 | 0.0679 |

* Statistically significant at the .05 level

Surveys of Students, Teachers, and Parents

All schools in South Carolina are administered student, teacher, and parent surveys annually, the results of which are reported on the state report card. Questions are asked to determine the level of satisfaction of respondents in three major areas, (1) the learning environment of the school, (2) the social and physical environment of the school, and (3) home/school relations. For schools in an online setting, questions regarding the physical environment of the school are not pertinent; however, questions regarding the social environment are pertinent. A summary is provided here of the overall question for each of these areas that is asked of all three groups (students, teachers, and parents).

Examining the results presented in Table 10 it is clear that among students, teachers, and parents the group that views the learning environment of their school most favorably are those respondents associated with the online learning setting. Respondents in the online setting have the largest percentage of all three groups who responded that they strongly agree that they are satisfied with the learning environment of their school.

Table 10. Percentage of respondents in each group indicating they are satisfied with the overall learning environment of their school.

| Repondents | No Response | Strongly Disagree | Disagree | Agree | Strongly Agree | Number of Responses |
|---|---|---|---|---|---|---|
| Students | | | | | | |
| PCSD | 0 | 7 | 9 | 45 | 38 | 543 |
| Online | 4 | 3 | 5 | 29 | 60 | 441 |
| Non-PCSD | 1 | 8 | 11 | 40 | 40 | 139.069 |
| Teachers | | | | | | |
| PCSD | 0 | 1 | 4 | 31 | 64 | 166 |
| Online | 0 | 1 | 0 | 20 | 79 | 158 |
| Non-PCSD | 0 | 4 | 6 | 29 | 61 | 40,133 |

| Repondents | No Response | Strongly Disagree | Disagree | Agree | Strongly Agree | Number of Responses |
|---|---|---|---|---|---|---|
| Parents | | | | | | |
| PCSD | 1 | 2 | 4 | 51 | 42 | 212 |
| Online | 1 | 3 | 3 | 38 | 56 | 298 |
| Non-PCSD | 2 | 3 | 8 | 49 | 38 | 64,671 |

Table 11 presents results for how satisfied respondents are with the social and physical environment of their school. Notice that among teachers in the online setting, 17 percent chose not to respond to the question. This lack of response may be explained by the fact that an online setting does not have physical environment. As was the case for the evaluation of the learning environment, a larger percentage of students, teachers, and parents in the online setting expressed greater satisfaction with the social and physical environment of their school.

Table 11. Percentage of respondents in each group indicating they are satisfied with the social and physical environment of their school.

| Repondents | No Response | Strongly Disagree | Disagree | Agree | Strongly Agree | Number of Responses |
|---|---|---|---|---|---|---|
| Students | | | | | | |
| PCSD | 0 | 7 | 9 | 45 | 38 | 543 |
| Online | 4 | 3 | 5 | 29 | 60 | 441 |
| Non-PCSD | 1 | 8 | 11 | 40 | 40 | 139.069 |
| Teachers | | | | | | |
| PCSD | 0 | 0 | 2 | 28 | 70 | 167 |
| Online | 17 | 0 | 0 | 6 | 76 | 161 |
| Non-PCSD | 0 | 2 | 4 | 27 | 67 | 40,187 |
| Parents | | | | | | |
| PCSD | 5 | 3 | 10 | 52 | 30 | 215 |
| Online | 2 | 2 | 4 | 43 | 49 | 302 |
| Non-PCSD | 4 | 3 | 10 | 54 | 2 | 64,658 |

Results for respondents' perceptions of home and school relations are presented in Table 12. Among students, respondents in the online setting have the most favorable response as indicated by the percentage of respondents that strongly agree. Among teachers, the percentage of respondents from the Public Charter School District brick and mortar schools and online schools who either agree or strongly agree are nearly the same. This is the single occasion where respondents in the online setting were not clearly more satisfied with their school than all other respondents. Among parents, the most favorable response was again given by respondents in the online setting.

Table 12. Percentage of respondents in each group indicating they are satisfied with home and school relations.

| Repondents | No Response | Strongly Disagree | Disagree | Agree | Strongly Agree | Number of Responses |
|---|---|---|---|---|---|---|
| Students | | | | | | |
| PCSD | 2 | 5 | 5 | 30 | 57 | 534 |
| Online | 4 | 2 | 4 | 16 | 74 | 441 |
| Non-PCSD | 1 | 7 | 6 | 29 | 57 | 139.069 |
| Teachers | | | | | | |
| PCSD | 1 | 0 | 7 | 30 | 62 | 167 |
| Online | 0 | 1 | 5 | 29 | 65 | 160 |
| Non-PCSD | 0 | 5 | 12 | 39 | 44 | 40,424 |
| Parents | | | | | | |
| PCSD | 2 | 4 | 7 | 57 | 29 | 215 |
| Online | 17 | 1 | 6 | 35 | 42 | 266 |
| Non-PCSD | 4 | 3 | 9 | 56 | 28 | 64,849 |

## Conclusions

In this study, analyses were performed to evaluate the academic progress made by students in an online setting compared to students in a traditional face-to-face learning setting. Analyses were performed for students in elementary and middle school, and separate analyses were performed for students in high school. Two different methodologies were utilized in both settings to evaluate students' academic progress. An analysis was also conducted of the attitudes of students, teachers, and parents toward their learning environment. Based on these analyses the following conclusions can be stated:

- In the elementary and middle grades, students who move from an online to a traditional learning setting make more progress than all other students by learning setting, for both Reading & Research or Mathematics.
- In the elementary and middle grades, there are no differences in student progress for students who were in a traditional learning setting compared to students who were in an online learning setting, for both Reading & Research and Mathematics.
- In the elementary and middle grades, students who move from a traditional to an online learning setting make less progress than all other student group by learning setting, for both Reading & Research and Mathematics.
- In high school, there are no differences in student progress for students who were in a traditional learning setting compared to students who were in an online learning setting, for both English I and Algebra I.
- In high school, students who change their learning setting, either from online to traditional or from traditional to online, make less progress than do students who remain in the same learning setting, for both English I and Algebra I.
- Students, teachers, and parents who are associated with an online learning environment view their learning setting more favorably than do students, teachers, and parents in a traditional learning setting.

## References


Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.

D'Agostina, Jr., R.B. (1998). Tutorial in Biostatistics. Propensity score methods for bias reduction in the comparison of a treatment to a non-randomized control group. Statistics in Medicine, 17, 2265-2281.

Glass, G. V & Welner, K.G. (2011). Online K-12 Schooling in the U.S.: Uncertain Private Ventures in Need of Public Regulation. Boulder, CO: National Education Policy Center. Retrieved April 29, 2014 from http://nepc.colorado.edu/publication/online-k-12-schooling.

Molnar, A. (Ed.); Rice, J.K., Huerta, I., Shafer, S.R., Barbour, M.K., Miron, G., Gulosino, C., & Horvitz, B. (2014). *Virtual Schools in the U.S. 2014: Politics, Performance, Policy, and Research Evidence*. Boulder, CO: National Education Policy Center. Retrieved April 15, 2014 from http://nepc.colorado.edu/publication/virtual-schools-annual-2014.

Saul, S (2011, December 12). Profits and questions at online charter schools. *New York Times*. Retrieved April 15, 2014, from http://www.nytimes.com/2011/12/13/education/online-schools-score-better-on-wall-street-than-in-classrooms.html.

U. S. Department of Education, Office of Planning, Evaluation, and Policy Development. *Evaluation of Evident-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies.* Washington, D.C., 2010.

**The Education Oversight Committee does not discriminate on the basis of race, color, national origin, religion, sex, or handicap in its practices relating to employment or establishment and administration of its programs and initiatives. Inquiries regarding employment, programs and initiatives of the Committee should be directed to the Executive Director 803.734.6148.**