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Beating the odds: Finding schools exceeding achievement expectations with high-risk students

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Summary

Many state education leaders are interested in finding schools that have demonstrated success in improving the achievement of students at the highest risk for difficulties. These schools are typically identified by comparing observed performance on an exam, such as a state assessment exam, with expected performance based on demographic characteristics, including the percentage of students classified as economically disadvantaged (proxied by eligibility for free or reduced-price lunch), as a racial/ethnic minority, or as an English language learner.

This study used data from the Florida Department of Education on public elementary schools for 2012/13 to demonstrate methods for answering two general research questions:

- Which schools are exceeding student achievement expectations, given the demographic characteristics of their students?
- What demographic similarities exist between schools that are exceeding expectations and other schools?

Using a multiple regression analysis, the study demonstrated that of Florida's roughly 2,000 public elementary schools, 43 (about 2 percent) are exceeding expectations in grade 3 reading (schools "beating the odds"). These schools had between 14 percent and 29 percent fewer students scoring at the lowest achievement level (level 1) on the statewide assessment than would be predicted when controlling for the demographic characteristics of their students. And in 2012/13 the average difference between a school's observed and expected percentage of students scoring at achievement level 1 was about ±7 percent, with a range of 29 percent fewer students observed than expected to 73 percent more students observed than expected.

Profile analysis was used to illustrate that the number of schools beating the odds in Florida varied by school demographic profile, with most having above-average percentages of Black students and economically disadvantaged students.

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Why this study?

Florida law requires that grade 3 students scoring at the lowest achievement level (level 1) on the Florida Comprehensive Assessment Test 2.0 (FCAT 2.0) in reading be retained, unless they can demonstrate the required reading level on an alternative nationally standardized reading assessment or through a portfolio assessment (Florida Department of Education, 2013). This requirement has made grade 3 reading performance highly visible, particularly for students who score at achievement level 1. The Regional Educational Laboratory Southeast Improving Literacy Alliance requested an analysis of the results of the 2013 grade 3 FCAT 2.0 reading assessment to identify schools with a lower-than-expected percentage of students scoring at achievement level 1 (schools "beating the odds"), with the intention of studying these schools to understand what practices might be able to further support grade 3 reading instruction.

This study was designed to address the specific request made by the Improving Literacy Alliance, and more broadly, demonstrate methods for answering two general research questions:

- Which schools are exceeding student achievement expectations, given the demographic characteristics of their students?
- What demographic similarities exist between schools that are exceeding expectations and other schools?

See box 1 for a description of the study data. See appendix A for details on the analyses.

About 2 percent of the roughly 2,000 Florida public elementary schools had a negative difference between the observed and predicted percentage of their students scoring at achievement level 1 that was large enough to be considered reliable

Study findings

This section describes the results of the regression analyses used to identify schools exceeding student achievement expectations, as well as the profile analysis used to describe the demographic characteristics of those schools.

About 2 percent of schools beat the odds for the expected percentage of students scoring at achievement level 1 on the grade 3 reading assessment, given the demographic characteristics of their students

Schools beating the odds can be identified by comparing how their students perform on an assessment with how those students would be expected to perform when accounting for their demographic characteristics. Negative differences indicate that a school had a lower-than-expected percentage of students scoring at achievement level 1; positive differences indicate a higher-than-expected percentage.

In 2012/13 the average difference between a school's observed and expected percentage of students scoring at achievement level 1 was about 7 percent. The range was 29 percent fewer students observed than expected to 73 percent more students observed than expected, with a standard error of ±7.27 percent.

In 2012/13, 1,096 of the roughly 2,000 Florida public elementary schools had a negative difference between the observed and predicted percentage of their students scoring at achievement level 1. Of these 1,096, 43 (about 2 percent of public elementary schools statewide) had a difference that was large enough to be considered reliable. (See appendix A for a discussion of the 95 percent confidence interval.) These 43 schools beat the odds in

Box 1. Study data

The Florida Department of Education provided data on each public elementary school for 2010/11–2012/13,[1] including:

- Number of students tested.
- Number of students scoring at achievement level 1 on the grade 3 Florida Comprehensive Assessment Test 2.0 (FCAT 2.0) in reading (outcome measure).
- Number of students classified as White, Black, and Hispanic.
- Number of students classified as eligible for free or reduced-price lunch (measure of economic disadvantage).
- Number of students classified as English language learner students.
- School number and name.
- District number and name.

State-level data on race/ethnicity, eligibility for free or reduced-price lunch, and English language learner status were downloaded from the Florida Department of Education's demographic database. The data show that Black students and English language learner students are over-represented among students scoring at achievement level 1 given their proportion of the state sample (see table).

Box table. Percentage of grade 3 students scoring at achievement level 1 on the Florida state reading assessment, by race/ethnicity, English language learner status, and eligibility for free or reduced-price lunch, 2012/13

Group	Number of students	Percentage of state sample	Percentage scoring at achievement level 1
White	82,265	40	10
Black	47,101	23	29
Hispanic	63,113	31	21
English language learner	24,011	12	46
Eligible for free or reduced-price lunch	133,004	65	24
Total	206,006	na	18

na is not applicable.

Source: Authors' analysis of data obtained from the Florida Department of Education's demographic database.

Comparisons were made using the grade 3 FCAT 2.0 reading test results, and the difference between the observed and expected percentages was the measure of a school's success in exceeding expectations with high-risk readers in grade 3. Negative differences indicate that a school had a lower-than-expected percentage of students scoring at achievement level 1; positive differences indicate a higher-than-expected percentage.

1. While three years of data were available and modeled, the results are based on data for 2012/13 due to stable results across years. See appendix A for information on the analyses.

grade 3 reading during the 2012/13 school year, with 14–29 percent fewer students scoring at achievement level 1 than would be predicted when controlling for the demographic characteristics of their students. Appendix B lists statistics for the 43 schools.

The number of schools beating the odds varied by school demographic profile. Most schools beating the odds had above-average percentages of Black students and economically disadvantaged students.

About 70 percent of the schools beating the odds had higher percentages of Black and economically disadvantaged students than the average for Florida schools

To determine what demographic similarities exist between schools beating the odds and other schools in Florida, the study used latent profile analysis (see appendix A) to identify school demographic profiles for all Florida elementary schools based on grade 3 students.

The results yielded five distinct profiles (table 1). Each profile was named for its predominant student demographic characteristic or characteristics, with the term "high" used when the percentage of students in the category was above the state average and exceeded 70 percent.

- *Profile 1.* High percentage of Hispanic students and high percentage of economically disadvantaged students (11 percent of schools). Schools fitting this profile also had a higher percentage of English language learner students than the state average.
- *Profile 2.* General population (29 percent of schools). Schools fitting this profile reflect the state averages.
- *Profile 3.* High percentage of Black students and high percentage of economically disadvantaged students (17 percent of schools).
- *Profile 4.* High percentage of White students (30 percent of schools).
- *Profile 5.* High percentage of economically disadvantaged students (13 percent of schools). Schools fitting this profile also had higher percentages of Hispanic and English language learner students than the state average.

Of the 43 schools identified as beating the odds, profile 3 (high percentage of Black students and high percentage of economically disadvantaged students) accounted for the highest percentage, at 70 percent

Of the 43 schools identified as beating the odds, profile 3 accounted for the highest percentage, at 70 percent, followed by profile 2 at 14 percent, profile 1 at 9 percent, and profile 5 at 7 percent (figure 1). None of the schools in profile 4 beat the odds.

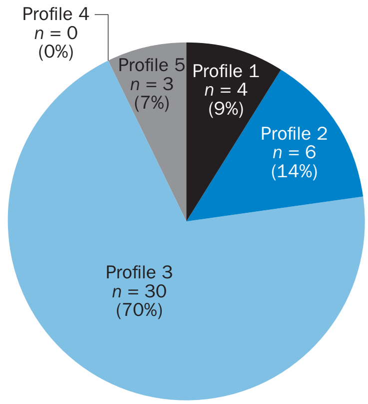
Table 1. Five demographic profiles of Florida public elementary schools, 2012/13

Mean percentages, unless otherwise noted

Demographic characteristic	1. High Hispanic and high economically disadvantaged	2. General population	3. High Black and high economically disadvantaged	4. High White	5. High economically disadvantaged
White	6	45	6	73	21
Black	7	21	77	8	23
Hispanic	84	25	13	12	50
English language learner	32	7	10	2	18
Eligible for free or reduced-price lunch	83	62	91	47	77
Number and percentage of schools					
Number	218	598	352	621	270
Percent	11	29	17	30	13

Source: Authors' analysis of data obtained by special request from the Florida Department of Education.

Figure 1. Most schools beating the odds for the expected percentage of students scoring at achievement level 1 on the grade 3 Florida Comprehensive Assessment Test 2.0 in reading in 2012/13 fit demographic profile 3



Note: Demographic profile 3 includes schools with percentages of Black students and students eligible for free or reduced-price lunch above the state average and exceeding 70 percent (see table 1).

Source: Authors' analysis of data obtained by special request from the Florida Department of Education.

Pairing schools with similar demographics based on their profile numbers would allow successful schools to mentor struggling schools with similar demographic characteristics

Appendix B provides information on the 43 schools identified as beating the odds, including demographic characteristics, residual estimate, 95 percent confidence interval for the residual, and demographic profile number.

Implications, limitations, and next steps

The methods used in this study can be replicated in different contexts to identify schools exceeding expectations. Schools that are beating the odds can be studied for promising school-level practices. The profile numbers can be used to match schools with similar demographics, in a "nearest neighbor" approach. For example, in Florida a school matching profile 3 with a greater-than-expected percentage of students scoring at achievement level 1 might be paired with a school in profile 3 that has been identified as beating the odds. Such a pairing would allow successful schools to mentor struggling schools with similar demographic characteristics.

Prior to applying these methods in other contexts, several study limitations should be considered. First, the analyses were conducted using school-level data instead of student-level data. Using student-level data would allow for a more rigorous evaluation. In addition, the analyses include results for grade 3 only. Expanding the analyses to include data for all tested grades would allow for a more comprehensive evaluation of each school's performance. Also, the analyses do not control for prior academic performance, which could identify advantaged or disadvantaged schools by the enrollment of higher or lower performing students in a given year. Analyses addressing these limitations might yield results different from those in this report. However, in Florida there are no statewide summative assessments of reading comprehension in grade 2 that could control for prior achievement.

A final consideration is that the beating the odds estimates and ranking of schools depend on the schools included in the analysis, many of which serve a specialized student population based on specified enrollment criteria (for example, a charter school serving high-performing students or a school whose population consists primarily of students with disabilities). Such schools have historically demonstrated higher or lower performance on statewide assessments. As a result, the inclusion of those schools may affect which schools are identified as beating the odds. Future work should include a sensitivity analysis to evaluate how the beating the odds scores change as particular schools are excluded, as well as which schools may be differentially identified as beating the odds.

Appendix A. Details on the analyses and results

This study entailed a two-stage analysis. In the first stage the proportion of grade 3 students scoring at achievement level 1 on the Florida Comprehensive Assessment Test 2.0 in reading was the outcome measure in a multiple linear regression prediction model using school demographic characteristics as predictors, represented by:

$$Y_j = B_0 + B_1(White)_j + B_2(Black)_j + B_3(Hispanic)_j + B_4(ELL)_j + B_5(FRL)_j + B_6(Year)_j + e_j,$$

where the dependent variable Y_j is the proportion of students scoring at achievement level 1 for school j, controlling for the proportion of students classified as White, Black, Hispanic, English language learner (ELL), and eligible for free or reduced-price lunch (FRL); $Year_j$ is a dummy coded variable for the assessment year; and e_j is the school-level residual. The school-level residual served as the measure of a school's success in exceeding expectations with grade 3 students at high risk of reading difficulty.

Model estimates

Several models were estimated. Model 1, which included data for the 2010/11, 2011/12, and 2012/13 school years, was estimated to judge the stability of the results over time. Model 2 included data for 2012/13 only, so it did not require the addition of the dummy variable $Year_j$. Before the analyses were run, mean differences across years for each predictor were tested and found to be nonsignificant; therefore, interaction terms were not included in model 1. There were no missing data for the variables of interest.

Model 1's R^2 of 0.61, reflecting the strength of the relationship between the proportion of students scoring at achievement level 1 and the independent variables, was statistically significant at the 0.05 level ($p < .0001$). All predictors were statistically significant, except $Year_j$. Dropping $Year_j$ from model 1 was supported by an analysis of the reduction in Akaike information criteria by the best combination of predictors. This analysis showed the most parsimonious model to be one that included all predictors except $Year_j$. That $Year_j$ was not significant indicates that there are no differences in the intercept across years, controlling for school demographic characteristics.

Model 1 was revised and re-estimated, resulting in an R^2 of 0.61. The effects of the independent variables on the proportion of students scoring at achievement level 1 are summarized in table A1.

Model 2's R^2 of 0.61, reflecting a relationship as strong as that in model 1, was also found to be statistically significant at the 0.05 level ($p < .0001$). All predictors were found to be significant, which was supported by an analysis of the reduction in Akaike information criteria. No revisions to the model were necessary. The effects of the independent variables on the proportion of students scoring at achievement level 1 are summarized in table A2.

The mean and standard deviation of the residuals of model 1 were compared with those of model 2. The nearly identical results (table A3), as well as a statistically significant correlation coeffient ($r = 0.998$) between model residuals, demonstrated model stability over time. Given this stability, model 2 was selected for use in subsequent analyses.

Table A1. Model 1 results summary

Variable	Effect estimate	Standard error
Intercept	–0.188**	0.018
White	0.195**	0.021
Black	0.319**	0.020
Hispanic	0.139**	0.020
English language learner	0.247**	0.012
Eligible for free or reduced-price lunch	0.206**	0.005

** Significant at the .05 level.

n = 6,099.

Source: Authors' analysis of data obtained by special request from the Florida Department of Education.

Table A2. Model 2 results summary

Variable	Effect estimate	Standard error
Intercept	–0.208**	0.031
White	0.222**	0.035
Black	0.345**	0.035
Hispanic	0.153**	0.034
English language learner	0.298**	0.021
Eligible for free or reduced-price lunch	0.195**	0.009

** Significant at the .05 level.

n = 2,059.

Source: Authors' analysis of data obtained by special request from the Florida Department of Education.

Table A3. Model 1 and model 2 residuals

Model	Mean	Standard deviation
Model 1 residuals (pooled sample)	–0.001	0.073
Model 2 residuals	0.000	0.073

Source: Authors' analysis of data obtained by special request from the Florida Department of Education.

The model 2 residuals were used to evaluate which schools' observed estimates were greater than expected (they performed worse than expected by having a greater-than-expected percentage of students scoring at achievement level 1) and which schools' observed estimates were lower than expected (they performed better than expected by having a lower-than-expected percentage of students scoring at achievement level 1).

Because residuals have a mean of zero, the range of residuals was important for contextualizing the differences between the observed and predicted percentages for the full sample of schools. Additionally, the standard error of the residuals—a measure of their precision—provides information for identifying which schools could reliably be identified as beating the odds given the data. The range of the residuals was –29 percent to 73 percent, with a standard error of ±7.27 percent.

A 95 percent confidence interval was constructed around each school's residual, using the formula:

95 percent confidence interval = School residual ±1.96 × Residual standard error.

This confidence interval allowed for the determination of whether a value of zero was just as plausible as the estimated residual. If zero is contained within a school's 95 percent confidence interval, whether a school is beating the odds cannot be determined reliably. Schools were identified as beating the odds if the 95 percent confidence interval did not include zero. Of the 1,096 schools with a negative residual, 43 had a negative residual with a 95 percent confidence interval that did not include zero (a residual less than –14.3 percent). The residuals of these schools ranged from –28.76 percent to –14.34 percent.

To illustrate, the school with the largest negative residual was predicted to have 29 percent of its students scoring at achievement level 1. The observed percentage in 2013 was 0 percent, resulting in a residual of –29 percent. The 95 percent confidence interval for this school was –14 percent to –43 percent. The 95 percent confidence interval did not include zero, indicating a significant difference between the observed and predicted scores. Using this approach, it can be estimated that any school with a negative residual greater than –0.143 would no longer be considered as having beat the odds because its 95 percent confidence interval would include zero.

Latent profile analysis of school demographic characteristics

The second stage of the analysis featured a latent profile analysis of school demographic characteristics. This clustering of schools provides a "nearest neighbor" comparison, allowing the Florida Department of Education to compare the residual scores from the first stage with those that are most similar based on demographic characteristics.

Latent profile analysis is typically used to classify individuals into groups based on their responses on a single exam or on their scores on multiple exams. And though it has been used predominantly for diagnostic purposes in psychology, it is an emerging descriptive classification technique in education (Logan & Petscher, 2010). While latent profile analysis is descriptive, its utility lies in an ability to empirically categorize participants (in this case, schools) into similar groups based on variables of interest (in this case, school demographic characteristics). For example, if the latent profile analysis was used to identify two profiles (or groups) of schools, there would most likely be one group of schools with high percentages of students with high risk of reading difficulty and one group with low percentages. The schools with high percentages would be considered high-risk, while those with low percentages would be considered low-risk. Then, within a profile, the variation in individual school outcomes can be described (for example, school residual scores).

The equation below shows the basic representation of a multivariate latent profile analysis model (Pastor, Barron, Miller, & Davis, 2007):

$$f(y_i|\theta) = \sum_{k=1}^{K} \pi_k f_k(y_i|u_k \Sigma_k),$$

where y_i represents the multivariate distribution of cluster indicators (school demographics) for school i (with the number of clusters represented by k), θ represents the unique set of model parameters to be estimated within each cluster, and π_k is the weight given to each cluster. The weights are constrained to be non-negative and must sum to 1. Each cluster distribution is defined by u_k (the mean vector) and Σ_k (the covariance matrix).

Multiple indices were used to determine which number of profiles was the most appropriate for the data (table A4). The indices include Akaike information criteria (Kaplan, 2000), Bayesian information criteria (Kaplan, 2000), entropy (Ramaswamy, DeSarbo, Reibstein, & Robinson, 1993), and two tests reported in the MPlus program (Muthén & Muthén, 1998–2012)—the Lo-Mendell-Rubin likelihood ratio test (Lo, Mendell, & Rubin, 2001) and a parametric bootstrapped likelihood ratio test (McLachlan & Peel, 2000).

A five-class model was selected as the best fit to the data. Moving to six classes resulted in a nonsignificant *p*-value for the Lo-Mendell-Rubin likelihood ratio test. In addition to fitting the data well, the five-class model resulted in a solution that lent itself well to interpretation.

Table A4. Summary of latent profile analysis model fit indices

Number of classes	Degrees of freedom	Akaike information criteria	Bayesian information criteria	Adjusted Bayesian information criteria	Entropy	Adjusted LMR	LMR (*p*-value)	BLRT (*p*-value)
1	10	–1,444.36	–1,388.07	–1,419.84				
2	16	–4,629.27	–4,539.19	–4,590.02	0.88	3,128.56	.0000	.0000
3	22	–8,221.30	–8,097.47	–8,167.37	0.95	3,930.02	.0000	.0000
4	28	–9,807.50	–9,649.87	–9,738.82	0.92	1,564.01	.0000	.0000
5	34	–10,524.19	–10,332.77	–10,440.79	0.91	713.11	.0001	.0000
6	40	–11,203.29	–10,978.09	–11,105.18	0.91	676.33	.0737	.0000

LMR is Lo-Mendell-Rubin likelihood ratio test. BLRT is boot-strapped likelihood ratio test.

Source: Authors' analysis of data obtained by special request from the Florida Department of Education.

Appendix B. Statistics for schools beating the odds

Table B1. Florida public elementary schools beating the odds in grade 3 reading, by demographic characteristic and residual magnitude, 2012/13

Percent, unless otherwise noted

School number	Number of students tested	White	Black	Hispanic	English language learner student	Eligible for free or reduced-price lunch	Observed achievement level 1	Predicted achievement level 1	Residual	Residual, lower confidence interval	Residual, upper confidence interval	Profile number
1	21	0	95	0	0	86	0.00	28.76	–28.76	–43.00	–14.52	3
2	36	0	81	19	17	100	8.33	34.44	–26.10	–40.35	–11.85	3
3	40	5	95	0	0	98	7.50	32.08	–24.58	–38.82	–10.35	3
4	18	6	72	17	0	78	0.00	23.06	–23.06	–37.30	–8.81	3
5	91	0	92	3	38	97	19.78	41.87	–22.09	–36.28	–7.90	3
6	14	0	100	0	0	79	7.14	29.00	–21.86	–36.09	–7.63	3
7	30	0	67	30	7	83	3.33	25.03	–21.69	–35.94	–7.44	3
8	126	12	44	44	32	91	9.52	30.98	–21.45	–35.70	–7.20	5
9	31	6	87	3	0	100	9.68	30.66	–20.99	–35.23	–6.74	3
10	23	0	70	22	26	100	13.04	33.81	–20.77	–35.01	–6.52	3
11	34	0	91	6	3	100	11.76	31.92	–20.16	–34.40	–5.92	3
12	16	0	88	6	0	81	6.25	26.17	–19.92	–34.17	–5.68	3
13	89	1	83	16	29	94	17.98	37.66	–19.68	–33.91	–5.45	3
14	82	0	91	7	32	98	20.73	40.35	–19.62	–33.83	–5.40	3
15	75	4	61	33	15	91	9.33	28.40	–19.07	–33.33	–4.81	3
16	62	24	40	27	8	85	3.23	21.75	–18.53	–32.79	–4.26	2
17	81	2	48	49	4	81	2.47	20.91	–18.44	–32.68	–4.20	5
18	26	54	35	8	0	92	3.85	22.26	–18.42	–32.67	–4.17	2
19	63	2	86	6	8	62	6.35	24.51	–18.16	–32.40	–3.93	3
20	14	7	86	7	14	86	14.29	32.41	–18.13	–32.37	–3.89	3
21	37	35	54	3	0	89	5.41	23.44	–18.04	–32.29	–3.78	2
22	63	0	95	2	5	94	14.29	31.97	–17.68	–31.93	–3.44	3
23	96	6	63	24	13	82	8.33	25.59	–17.25	–31.51	–2.99	3
24	35	0	97	0	0	94	14.29	31.09	–16.80	–31.04	–2.56	3
25	126	10	71	14	27	89	16.67	33.42	–16.76	–30.99	–2.52	3
26	89	37	51	11	1	62	2.25	18.96	–16.71	–30.97	–2.46	2
27	77	49	8	42	18	95	6.49	23.12	–16.63	–30.88	–2.38	2

(continued)

Table B1. Florida public elementary schools beating the odds in grade 3 reading, by demographic characteristic and residual magnitude, 2012/13 *(continued)*

School number	Number of students tested	White	Black	Hispanic	English language learner student	Eligible for free or reduced-price lunch	Observed achievement level 1	Predicted achievement level 1	Residual	Residual, lower confidence interval	Residual, upper confidence interval	Profile number
28	45	11	76	9	0	96	11.11	27.72	–16.61	–30.86	–2.36	3
29	52	2	71	19	21	85	13.46	29.92	–16.46	–30.71	–2.21	3
30	26	23	58	15	0	88	7.69	23.82	–16.13	–30.39	–1.88	3
31	80	3	3	93	28	93	5.00	21.04	–16.04	–30.28	–1.80	1
32	65	0	94	3	2	95	15.38	31.09	–15.71	–29.95	–1.47	3
33	64	9	66	20	9	94	12.50	28.10	–15.60	–29.86	–1.35	3
34	69	0	94	3	4	100	17.39	32.93	–15.54	–29.78	–1.30	3
35	65	5	18	57	68	94	18.46	33.82	–15.36	–29.45	–1.26	1
36	135	10	53	33	40	84	17.78	33.03	–15.26	–29.48	–1.03	5
37	74	3	0	96	39	93	9.46	24.38	–14.92	–29.16	–0.69	1
38	46	7	78	13	4	98	15.22	30.01	–14.79	–29.04	–0.54	3
39	41	0	100	0	0	80	14.63	29.38	–14.74	–28.97	–0.51	3
40	42	29	36	29	0	88	4.76	19.41	–14.65	–28.90	–0.40	2
41	121	2	10	87	60	100	19.01	33.55	–14.54	–28.74	–0.34	1
42	128	4	65	26	16	86	13.28	27.80	–14.52	–28.78	–0.26	3
43	69	14	55	20	7	91	10.14	24.49	–14.34	–28.60	–0.09	3

Note: Schools beating the odds had a lower-than-expected percentage of grade 3 students scoring at the lowest achievement level (level 1) on the Florida Comprehensive Assessment Test 2.0 in reading.

Source: Authors' analysis of data obtained by special request from the Florida Department of Education.

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