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The Influence of Multiple Administrations of a State Achievement Test on Passing Rates for Student Groups

Joseph F. T. Nese
Gerald Tindal
Joseph J. Stevens
University of Oregon
United States of America
&
Stephen N. Elliott
Arizona State University
United States of America

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Abstract: The stakes of large-scale testing programs have grown considerably in the past decade with the enactment of the No Child Left Behind (NCLB) and Race To The Top (RTTT) legislations. A significant component of NCLB has been required reporting of annual yearly progress (AYP) of student subgroups disaggregated by sex, special education status, English language proficiency, and race/ethnicity. In this study we address the implications of a state policy that allows students to have multiple test opportunities to reach proficiency within an academic year, and its effect on passing rates. We found through logistic regression analyses that additional testing opportunities benefited specific majority student subgroups: White, non-free or reduced lunch program, non- limited English proficient, general education, and students close to the proficiency score. As states move to new achievement standards and assessments in 2015,

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policymakers may want to assess the potential benefits and costs of a multiple testing policy.
Keywords: Large scale testing; Accountability.

La Influencia de Múltiples Oportunidades de Examinación en la Aprobación y el Rendimiento de Estudiantes en Pruebas Estatales

Resumen: Las expectativas de los programas de pruebas a gran escala han crecido considerablemente en la última década con la promulgación de las legislaciones *No Child Left Behind* (NCLB) y *Race to the Top* (RTTT). Un componente importante de la ley NCLB ha requerido la presentación de informes de progreso anual (AYP) por subgrupos de estudiantes desglosados por sexo, educación especial, el dominio del idioma Inglés, y raza / etnia. En este estudio abordamos las implicaciones de una política de Estado que permite que los estudiantes tengan múltiples oportunidades de tomar el examen para aprobar dentro de un año académico, y su efecto sobre las tasas de aprobación. Encontramos a través de análisis de regresión logística que las oportunidades de tener oportunidades adicionales beneficiaron subgrupos específicos y mayoritarios de estudiantes: Blancos, que no recibían asistencia alimentaria, y que no estaban en grupos con bajos niveles de dominio del inglés, educación general y estudiantes cerca de obtener resultados de competencia. Como los estados están mudando a nuevos estándares de rendimiento y evaluaciones en 2015, las autoridades podrían querer evaluar los beneficios y los costos de una política de múltiples oportunidades de examinación.
Palabras clave: pruebas a gran escala; rendición de cuentas.

A Influência de ter Múltiplas Oportunidades para Exames na Aprovação e no Desempenho dos Alunos em Testes Estaduais

Resumo: As expectativas programas de testes em grande escala têm crescido consideravelmente na última década, com a promulgação da legislação *No Child Left Behind* (NCLB) e *Race to the Top* (RTTT). Um componente importante da lei NCLB exigiu relatórios de progresso anual (AYP) dos subgrupos de alunos por sexo, educação especial, proficiência em Inglês, e raça / etnia. Neste estudo discutimos as implicações de uma política de estado que permite que os alunos tenham várias oportunidades para fazer o exame para passar em um ano lectivo, e seu efeito sobre as taxas de aprovação. Descobrimos através de análise de regressão logística que oportunidades adicionais beneficiaram e subgrupos específicos maioritarios dos estudantes: brancos, não recebem ajuda alimentar, de ensino geral e estudantes perto de conseguir resultados de competição. Como os estados estão se movendo para novos padrões e avaliações de desempenho em 2015, as autoridades podem querer avaliar os benefícios e os custos de uma política de múltiplas oportunidades de exame.
Palavras-chave: testes em larga escala; prestação de contas.

Introduction[1]

In the past 15 years, development and implementation of large-scale achievement tests has not only increased but also come under increased scrutiny. With a focus on improving educational systems, such tests have been used to provide systems accountability through the reporting of proficiency for students overall and for disaggregated subgroups of students (No Child Left Behind [NCLB], 2001) and/or to establish requirements for graduation (Phillips, 2000; Schafer, 2000). In

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either use, both intended and unintended consequences need to be addressed, particularly in the meaning or interpretation of scores (Lane & Stone, 2002).

In a paper on validating high-stakes testing programs, Kane (2002, p. 30) makes the distinction between *descriptive interpretations*, which draw conclusions about a student based on the student's test performance, and *decision-based interpretations*, which involve assumptions supporting the decision procedure's suitability as a policy that are justified by claims about the consequences. Using Kane's argument-based approach to validation, proposed score interpretations require evidence for evaluating inferences and assumptions. In the context of year-end state achievement test programs, descriptive interpretations are applied through achievement standards that define requirements to meet state performance objective (by grade and content area) based on cut scores, and high-stakes decisions are often applied to aggregates (e.g., teachers, but more often schools and districts) of these ordinal proficiency levels. In this context, the central interpretations that users make are in reference to state standards or Common Core State Standards. Assuming the testing program has been appropriately designed and deployed, percent proficient results are reported overall and for various subgroups; the question is then how well these aggregated percentages of students' achievement accurately represent schools and districts, the building block of the ultimate AYP decision in NCLB. As Ho (2013, p. 65) articulated, "this aggregation can occur at a substantial distance in space and time from the design and development of the original test", which is "designed for individual-level inferences and uses," but "is likely to be extended to support trends, gaps, gap trends, as well as school, district, and state aggregates." In this distribution of students and subgroups into proficiency categories, it is possible that classifications are mis-specified, either with false negatives or false positives, and descriptive interpretations affect decision-based interpretations.

One strategy to determine the validity of assignment of students into various proficiency categories would be to use multiple measures, and/or multiple test administrations, theoretically increasing validity by increasing the amount of information associated with the construct measurement (Henderson-Montero, Julian, & Yen, 2003a, 2003b). One of the considerations with multiple measures is their integration into a decision, with any of four possible combinational strategies: conjunctive, where the attainment of a minimum standard on each of multiple measures; compensatory, where poorer performance on one measure can be offset by stronger performance on another; mixed conjunctive-compensatory, where multiple measures are combined by a compensatory rule and minimum performance on any of multiple measures can fulfill the proficiency requirement; and confirmatory, where information from one measure is used to validate or compare information from another (Chester, 2003). In the end "the manner by which the multiple measures are combined to reach a decision is as important as the measures themselves" (Henderson-Montero et al., 2003a, p. 8).

Multiple test administrations also provide a strategy in determining whether the percentages of subgroups in various proficiency categories are reliable and valid. On a single test administration, an examinee's score may be inaccurate for a number of reasons including measurement error; teacher/class coverage of curricular material at that point in time; inadequate opportunity to learn the tested material; unfamiliarity with test-taking procedures, equipment, or methods; or transient factors related to examinee state on the day of testing (e.g., attention, motivation, fatigue, illness). Multiple test administrations can potentially provide a mechanism to control for some of the sources of inaccuracy in which performance on any of the administrations can fulfill the achievement standard.

Two empirical summaries of major testing programs explicitly addressed the effects of multiple opportunities to take a test. In the GI Forum v. Texas Education Agency (Cruse & Twing, 2000), the critical issue was the use of test scores for determining high school graduation. Texas applied a conjunctive approach to support graduation decisions, using both multiple measures and multiple administrations; that is, in addition to passing the graduation test, students were expected to successfully complete all required course work and other graduation obligations imposed by their districts (Cruse & Twing, 2000; Phillips, 2000). Students had eight opportunities to take and pass the test so that "any unreliability works to the benefit of the examinees who have true scores below the actual standard" who may eventually pass because of positive random error, and "the probability of not passing due to random error is almost zero" (Mehrens, 2000, p. 389). It was reported that multiple test administrations decreased the possibility of false negative results and increased the possibility of false positive results, which arguably advantaged all students whose scores were near the proficiency cut point within a compensatory model (Mehrens, 2000). That is, in this example of high-stakes assessment for accountability, the cost of increased false-positives was outweighed by the benefit of decreased false-negatives. In addition, the high-stakes nature of the test were tethered directly to students such that students were arguably motivated to do well, and the interpretive argument gave way to the decision-based interpretation (Kane, 2002).

Research has shown, however, that repeated exposure to a test alone can result in increased scores (Hausknecht, Halpert, Di Paolo, & Moriarty Gerrard, 2007), confounding the score with a validity argument. The meta-analysis by Kulik, Kulik, and Bangert (1984) focused on practice effects on test performance (i.e., simple exposure to a test), separate from growth (i.e., learning) or errors in equating (i.e., noise around the signal that reflects learning). The authors found larger effects when the practice and criterion tests were identical (*ES* = 0.42) than they were when practice and criterion measures were parallel forms (*ES* = 0.23), and that these effect sizes increased with more practice tests (up to 1.89 with seven identical tests, and 0.74 for seven parallel tests). Lower ability students benefited more from multiple test opportunities than did higher ability students, whether or not the test was identical or parallel. Thus, multiple tests resulted in increased performance across testing administrations although the source of the improvement due to learning/maturation, practice, or other effects was unspecified (Hausknecht et al, 2007; Kulik et al., 1984). That is, performance generally increases across repeated test administrations but that does not necessarily imply improved learning.

As Chester (2003) noted, we need to understand how multiple administrations influence students and systems, the consequences of decisions based on such a policy, and the contribution to more effective instruction prior to that decision. Generally, accountability systems based on student test scores have been shown to affect classroom and school practices. "High-stakes testing systems influence what teachers and administrators do," including (presented here without value): targeting intervention for low-performing students, aligning curriculum to standards, affecting the scope of instruction, or shifting resources to tested subjects or standards (Hamilton, Stecher, & Yuan, 2008, p. 3). The latter is termed reallocation, or "shifting resources to better align instruction with the substantive content of the test used for accountability" (Koretz, 2015, p. 7; Koretz & Hamilton, 2006; Koretz, McCaffrey, & Hamilton, 2001). Although reallocation across content subjects does not bias inferences of achievement results, reallocation within a subject can inflate scores when teachers shift resources to material that is emphasized by the test at the expense of unrepresented material that is important for the intended inference (Kane, 2006; Koretz, 2015). Thus, reallocation of resources can affect validity inferences, and multiple test administrations can create space for reallocation.

Reback (2008) argued that an accountability system that aggregates student scores as pass rates incentivizes schools to improve the performance of students who are on the margin of passing (i.e., on the "bubble), and does not incentivizes schools to improve the performance of other students. In his study examining whether minimum competency school accountability systems (e.g., NCLB, 2001) influence the distribution of student achievement, Reback found that students performed better than expected when their test scores were important for the schools' accountability rating, and that low achieving students performed better than expected when their classmates' scores were important for the schools' rating (an effect not found for high achieving students). Reback reported that student score distributional effects were related to responses to yearly changes in schools' accountability incentives and efforts to improve the performance of specific students.

Multiple test administrations in an accountability setting provide the opportunity for resource reallocation (positive or negative effects) to low performing or marginal students and to the scope of instruction, with consequences (intended or not). The accountability interpretations (percentages of student subgroups in various proficiency categories) need to be supported by collecting evidence (outcomes from repeated opportunities for testing) for evaluating inferences and assumptions that the test reflects such standards and is sensitive to instruction that in turn is aligned to the standards with students given opportunity to learn them. Given this perspective of validation, we investigated a state policy allowing multiple test administrations to reach proficiency. Using state achievement test data, we were able to explore, given multiple test administrations, whether students (and targeted subgroups) met proficiency who otherwise would not have, and whether multiple test attempts or changes in proficiency were related to student characteristics.

Research Context

The Elementary and Secondary Education Act (ESEA) does not reference the issue of multiple tests for AYP, only specifying that student proficiency be measured not less than once and that outcomes need to be disaggregated by specific student groups (sex, special education, English language learner, and race/ethnicity). A few states have allowed multiple tests on NCLB summative tests (e.g., Delaware, Oregon), some allow multiple tests and broad testing windows for interim assessments (e.g., South Dakota), and perhaps as many as 26 states allow retests at some future date on end-of course exams at the middle and high school levels (Blank & Stillman, 2010; Domaleski, 2011). In Oregon, the policy allowing multiple tests on the state NCLB summative assessment was designed to alleviate resource demands when testing the majority of students in the spring (Oregon Department of Education, 2012c). According to state policy in 2011-12, all students in eligible grades were tested at least once per year, with each student in Grades 3–8 allowed up to two additional opportunities during the October to May testing window to retake the state online mathematics and reading tests (Oregon Department of Education, 2012b). According to a guide published in 2012:

> ...students who have received accelerated instruction and have had adequate opportunity to learn the assessed content standard may be tested in the fall or early winter to help the district alleviate resource demands (e.g., computer labs, internet bandwidth, instructional assistants, IT staff) when testing the majority of students later in the school year. (Oregon Department of Education, 2012c, p. 4)

Testing in late winter and spring, however, "helps to ensure each student has had sufficient instructional time and allows for the provision of adequate instructional supports and interventions as appropriate" (Oregon Department of Education, 2012b, p. 5), for the purposes of meeting accountability requirements and measuring year-to-year growth in a cohort of students. Students who did not pass the state test could be retested after being provided with "additional instruction only if the district expects a different outcome based on additional classroom-derived evidence and if retesting is consistent with district procedures" (Oregon Department of Education, 2012b, p. 5). Schools can choose which students will be retested and how instruction will be delivered.

Immediately upon test completion the overall scale score is available to the teacher, and within two days teachers can access subscores.

The purpose of this study was to explore whether and when students pass the state achievement test given multiple opportunities. We asked two primary questions in this study: (a) Are student characteristics associated with how many times a student takes the state test? And (b) For various student subgroups, what is the likelihood of passing the test given previous failure(s)? We asked these questions with an interest in the performance of students on the "bubble" of proficiency, who were potentially false-negatives (i.e., one standard error of measurement below the proficiency cut score).

Method

We analyzed several subgroups of students who participated in the statewide testing program. Our analysis focused on documenting incremental changes in passing rates for these student subgroups when they retested. We conducted the same analyses for all students in Grades 3–8, for both mathematics and reading tests; however, in the interest of brevity we describe the Grade 3 mathematics sample throughout this article as an explication of the methods and a demonstration of the results. More detailed statistical results are available upon request to the first author.

Sample

The original sample for this study included all students in Grades 3–8 who took the 2011–2012 Oregon Assessment of Knowledge and Skills (OAKS) mathematics or reading test. To prepare the sample data, we excluded students who took the state alternate assessment (Grade 3 math, *n* = 5,721). Because the state policy allowed only three annual testing opportunities per student, we also excluded students who were tested more than three times (Grade 3 math, *n* = 1), and those students reported to have taken multiple tests on the same day (Grade 3 math, *n* = 2). We excluded student scores that were not included in the adequate yearly progress (AYP) district performance calculations, so that all students in the analyses recorded a score that was used for district accountability purposes (Grade 3 math, *n* = 8,403).

Approximately half of the population in each grade received a second test, and almost a quarter received a third test (about 45% of those tested twice). For the Grade 3 sample, the composition of students becomes descriptively more female, Hispanic, participating in free or reduced lunch program (FRL), and limited English proficient (LEP) across mathematics test occasions, and descriptively more Hispanic, Minority, FRL, and LEP across reading occasions.

We created indicator variables for students who had failed the previous test administration. We labeled "bubble" students those who were within one standard error of measurement (SEM; 3 scaled points) below the proficiency cut score on the previous test (equivalent to the lower half of a 68% confidence interval). Those students who scored lower than one SEM below the proficiency cut score (BelowBubble) were coded as the reference group. Those above the proficiency cut score, of course, did not receive additional testing opportunities. Table 1 shows the percentages of Bubble and BelowBubble students in Grades 3-8 for mathematics to demonstrate the prevalence of multiple tests. For example, for math Test 2, 19% of the 21,947 Grade 3 students were within one SEM below the proficiency cut score for Test 1 (i.e., Bubble1 students), and for math Test 3, 25% were within one SEM below the proficiency cut score of Test 2 (i.e., Bubble2 students).

Table 1
Percentages of Bubble Students with One, Two, or Three Mathematics Tests for Grades 3-8

Grade		n	Bubble1	BelowBubble1	Bubble2	BelowBubble2
3	Test 1	39,839	10.5	49.1	8.6[a]	29.8[a]
	Test 2	21,947	18.7	81.3	14.5	53.2
	Test 3	10,040	10.7	89.3	25.4	74.6
4	Test 1	39,528	9.9	43.8	7.7[b]	27.9[b]
	Test 2	19,597	19.5	80.5	14.1	55.1
	Test 3	9,072	11.1	88.8	24.3	75.7
5	Test 1	40,568	10.9	47.7	9.1[c]	33.3[c]
	Test 2	22,100	19.6	80.4	15.0	59.9
	Test 3	11,175	12.7	87.3	24.1	75.9
6	Test 1	40,673	11.1	47.3	8.9[d]	32.6[d]
	Test 2	21,842	20.2	79.7	14.6	59.2
	Test 3	9,584	13.0	87.0	24.1	75.9
7	Test 1	41,008	12.3	40.6	9.2[e]	28.0[e]
	Test 2	19,420	24.7	75.2	16.4	56.8
	Test 3	8,275	18.1	81.9	27.1	72.9
8	Test 1	41,071	10.2	40.5	8.0[f]	26.6[f]
	Test 2	18,765	21.4	78.6	15.0	56.2
	Test 3	8,090	13.4	86.6	25.3	74.7

Note. Bubble students were within one standard error of measurement (SEM; 3 scaled points) below the proficiency cut score on the previous attempt (1 or 2), and BelowBubble students scored lower than one SEM below the proficiency cut score on the previous attempt (1 or 2).
[a] $n = 26,805$. [b] $n = 25,671$. [c] $n = 28,643$. [d] $n = 29,763$. [e] $n = 27,558$. [f] $n = 26,842$.

All demographic information we report was taken directly from state test data files. Grade 3 student demographic characteristics included the following: sex (49% female); race-ethnicity, categorized as White (non-Hispanic; 64%), Hispanic (22%), and non-Hispanic Racial Minority (14% Asian, Black/African American, American Indian/Alaskan Native, Multi-racial, and Pacific Islander); free or reduced price lunch recipient (FRL; 56%); Limited English Proficiency (LEP; 16%); and special education recipient (SpEd; 12%; Author, 2014).

Measures

For all analyses the outcome measures were the student developmental scale scores on the standardized Oregon Assessment of Knowledge and Skills (OAKS; Oregon Department of Education, 2012a) mathematics or reading tests. The 2011-12 OAKS was a summative, computer-adaptive assessment based on the Oregon Content Standards. OAKS raw scores were converted to scale scores using one parameter item response theory (IRT) modeling. Rasch unit scale scores were based on the number of items answered correctly while taking item difficulty into account (students were not penalized for guessing). Information on the technical adequacy of the test is publicly available and the tests were administered under standard conditions (Oregon Department of Education, 2012a; 2012b).

The test specifications varied by grade and subject, and were intended to measure the core content standards in the state curriculum. For example, the Grade 3 math test consisted of approximately 40 multiple-choice items composed of the following: (a) 35% of items on *Number and*

Operations, the understanding of fractions and fraction equivalence; (b) 35% of items on *Number and Operations, Algebra, and Data Analysis*, the understandings of multiplication and division, and strategies for basic multiplication facts and related division facts; and (c) 30% of items on *Geometry and Measurement*, the understanding of properties of two-dimensional shapes, including perimeters. The Grade 3 reading and literature test consisted of approximately 50 items with the following score reporting categories: vocabulary (28%); read to perform a task (16%); demonstrate general understanding (28%); and develop an interpretation (28%).

Analyses

To determine whether student characteristics were associated with number of tests taken, we conducted a pair of logistic regression analyses in which the presence of an additional test (Test 2 or Test 3, conditioned on failing previous test opportunities) was regressed on student characteristics (i.e., sex, race-ethnicity, FRL, LEP, SpEd, and bubble status from prior test). To determine the likelihood of passing the test given previous failures for various student subgroups, we conducted a discrete-time survival analysis (Singer & Willett, 2003) that modeled the conditional probability of passing the test on a given occasion, conditioned upon failing all previous tests. All analyses were conducted using Mplus version 7.11 (Muthén & Muthén, 1998-2014) maximum likelihood estimation with standard errors computed using a sandwich estimator that is robust to non-normality and non-independence of observations.

Results

Table 3 shows the observed percentages of Grade 3 students and student subgroups that took and passed the mathematics test for AYP reporting purposes, and for Tests 1, 2, and 3. For AYP reporting purposes and across tests, descriptively, a greater proportion of White students passed the state math test than racial minority students, and a greater proportion of racial minority students passed than Hispanic students. A greater proportion of non-FRL, non-LEP, non-SpEd, and bubble students passed than their counterparts. For all student subgroups, the observed proportion passing the test decreased across test occasions, with the exception of Hispanic and LEP students whose proportions increased across occasions, and FRL and SpEd students whose proportions increased at the third test occasion.

Are Multiple Tests More Likely For Certain Students?

The results of the logistic regression analysis for the second test are presented in Table 2. The threshold (τ), analogous to the intercept, represents the reference group (male, White, non-FRL, non-LEP, non-SpEd, Below Bubble students). This value can be converted into a conditional probability ($\tau/1+ \tau$), so that the probability of receiving Test 2 upon not reaching proficiency on Test 1 for this group was above .90 for all grades on the mathematics test, and above .87 for all grades on the reading test. In general, these probabilities decreased slightly across grades, and were higher for mathematics than for reading. For Grade 3, only 5%-6% (math and reading, respectively) of non-proficient reference group students were not given an additional test opportunity, while for Grade 8, 10%-13% (math and reading, respectively) of non-proficient reference group students were not given an additional test opportunity. Thus, the students in the reference group were less likely to be given additional testing opportunities in reading than mathematics, and also less likely to be given additional opportunities as they aged.

Table 2

Odds Ratios of Math and Reading Logistic Regression Analyses for the Second Test for Grades 3-8

	Math					
	3	4	5	6	7	8
Threshold	17.73*	17.89*	19.83*	12.33*	9.55*	9.35*
Female	1.08	1.00	1.00	1.17	0.99	1.15
Hispanic (vs. White)	0.94	1.05	0.99	0.95	0.99	0.95
Racial Minority (vs. White)	1.01	0.96	1.00	0.87	1.00	1.08
FRL	0.85	0.93	0.91	1.07	1.01	0.98
LEP	0.75*	0.69*	0.66*	0.60*	0.73*	0.86
SpEd	0.26*	0.25*	0.27*	0.41*	0.45*	0.48*
Bubble	3.22*	3.48*	3.68*	3.30*	2.44*	2.40*
	Reading					
Threshold	15.49*	15.55*	19.71*	10.67*	7.64*	6.63*
Female	1.11	1.11	1.06	1.27*	1.11	1.09
Hispanic (vs. White)	1.16	1.17	1.24	1.06	1.20	1.13
Racial Minority (vs. White)	0.99	1.11	1.04	0.92	1.15	1.07
FRL	0.79	0.84	0.83	1.12	1.08	1.04
LEP	0.57*	0.64*	0.58*	0.56*	0.62*	0.64*
SpEd	0.26*	0.25*	0.23*	0.34*	0.42*	0.57*
Bubble	4.41*	3.39*	3.18*	2.53*	1.89*	2.27*

Note. The relation between the intercept (β_0) and threshold (τ) is: $\beta_0 = -\tau$; odds ratios and probabilities have been adjusted to reflect this relation. Bubble students were within one standard error of measurement (SEM; 3 scale score points) below the proficiency cut score on the previous attempt (Test 1).

* $p < .001$. The p value reflects the significance of the estimated parameters in logits (not the odds ratios reported here.

The relation of student predictors with the probability of retesting are presented in Table 2 as log odds for the focal group versus the reference group. Note that conditional probabilities can be calculated in the same way as for the threshold parameter above; however, care must be given to specify the appropriate comparison groups. In general, across grades and subjects, LEP, SpEd, and Bubble statuses were statistically significant predictors of a second test. That is, all else constant, a second test was more likely for non-LEP students vs. LEP students; GenEd students vs. SpEd students; and Bubble students vs. Below Bubble students. Specifically for Grade 3 math, non-LEP students were 1.33 times more likely than LEP students, GenEd students 3.83 times more likely than SpEd students, and Bubble students 3.22 times more likely than Below Bubble students to take Test 2.[2] The results described for the Grade 3 mathematics sample were consistent across grades and subjects in direction, magnitude, and with very few exceptions, *p* values (Table 2). The exceptions included: mathematics Grade 8 LEP status was not statistically significant, and reading Grade 6 sex which was statistically significant in comparison to the pattern of results for other grades.

The results of the logistic regression for Test 3 have been presented in Table 3. Across grades and subjects, parameters were similar in direction, magnitude, and with very few exceptions, statistical significance. In general, SpEd, and Bubble statuses were statistically significant predictors

[2] For ease of interpretation, results are described in text such that the comparison group is that whose odds ratio was above 1.0. For odds ratios reported in tables as less than 1.0, we reversed the sign of the logit parameters (□ ; not presented for brevity) and transformed to odds ratios (i.e., $e^{□}$).

of a third test administration. Thus, all else constant, a third test administration was more likely for GenEd students vs. SpEd students, and Bubble students vs. Below Bubble students. Specifically for Grade 3 math, non-LEP students were 1.23 times more likely than LEP students, GenEd students 1.82 times more likely than SpEd students, and Bubble students 2.19 times more likely than Below Bubble students to receive Test 3. Similar to the Test 2 logistic regression results, the LEP and sex predictors provided exceptions to the pattern of results across grades. That is, math Grades 3 and 5 LEP status were statistically significant; reading Grades 5 and 6 LEP status were statistically significant; reading Grade 6 sex was statistically significant; and math Grade 6 FRL status was statistically significant in contrast to results found in other grades.

Table 3
Odds Ratios of Math and Reading Logistic Regression Analyses for the Third Test for Grades 3-8

	Math					
	3	4	5	6	7	8
Threshold	2.03*	2.23*	2.31*	1.36*	1.29*	1.42*
Female	0.95	1.00	0.97	1.06	1.05	1.01
Hispanic (vs. White)	0.91	0.88	0.91	0.90	0.92	0.92
Racial Minority (vs. White)	0.97	0.91	0.90	0.87	0.94	0.91
FRL	1.15	0.96	1.03	1.15*	1.06	1.13
LEP	0.82*	0.85	0.74*	0.85	0.87	0.88
SpEd	0.55*	0.59*	0.53*	0.66*	0.73*	0.70*
Bubble	2.19*	2.07*	2.17*	1.91*	1.84*	1.85*
	Reading					
Threshold	1.69*	2.00*	2.12*	1.35*	1.13	1.11
Female	0.96	0.98	0.99	1.17*	1.03	1.01
Hispanic (vs. White)	0.99	0.96	0.96	0.96	1.00	1.06
Racial Minority (vs. White)	1.16	1.05	0.98	0.93	0.96	1.05
FRL	1.10	0.97	1.07	1.13	1.09	1.17
LEP	0.94	0.83	0.70*	0.73*	0.90	0.85
SpEd	0.56*	0.58*	0.49*	0.68*	0.73*	0.72*
Bubble	2.09*	2.02*	1.93*	1.45*	1.68*	1.86*

Note. The relation between the intercept (β_0) and threshold (τ) is: $\square_0 = -\tau$; odds ratios and probabilities have been adjusted to reflect this relation. Bubble students were within one standard error of measurement (SEM; 3 scale score points) below the proficiency cut score on the previous attempt (Test 2).
* $p < .001$. The p value reflects the significance of the estimated parameters in logits (not the odds ratios reported here.

Likelihood of Passing the Test on Successive Attempts by Student Subgroup

Two discrete-time survival analyses, one for mathematics and one for reading, were conducted to examine the probability of reaching proficiency at each test occasion and to determine whether student characteristics were related the time at which a student reached proficiency. Results of the analyses are displayed in Table 4.

Table 4

Odds Ratios for Math and Reading Discrete-time Survival Analyses for Grades 3-8

	Math					
	3	4	5	6	7	8
Threshold 1	0.73*	0.54*	0.69*	0.70*	0.57*	0.55*
Threshold 2	1.27*	1.37*	2.05*	1.92*	1.92*	1.74*
Threshold 3	1.42*	1.51*	2.34*	2.32*	2.19*	2.18*
Female	0.84*	0.81*	0.87*	0.87*	0.92*	0.94
Hispanic (vs. White)	0.84*	0.90*	0.90*	0.82*	0.80*	0.80*
Racial Minority (vs. White)	0.99	1.02	1.01	1.09	1.03	1.00
FRL	0.47*	0.46*	0.47*	0.46*	0.48*	0.49
LEP	0.51*	0.52*	0.35*	0.32*	0.31*	0.30*
SpEd	0.44*	0.37*	0.32*	0.26*	0.24*	0.23*
Bubble on 1	4.66*	5.61*	5.73*	5.29*	4.00*	4.73*
Bubble on 2	4.01*	4.02*	4.48*	4.60*	3.35*	3.77*
	Reading					
Threshold 1	0.39*	0.29*	0.37*	0.40*	0.23*	0.41*
Threshold 2	1.32*	1.20*	1.58*	2.17*	1.49*	2.20*
Threshold 3	1.60*	1.34*	1.95*	3.08*	2.49*	3.19*
Female	1.13*	1.10*	1.11*	1.10*	1.19	1.26*
Hispanic (vs. White)	0.82*	0.84*	0.83*	0.65*	0.61*	0.63*
Racial Minority (vs. White)	0.93	0.89*	0.90*	0.87*	0.84*	0.84*
FRL	0.47*	0.47*	0.46*	0.46*	0.47*	0.48*
LEP	0.32*	0.30*	0.19*	0.11*	0.13*	0.11*
SpEd	0.34*	0.27*	0.26*	0.21*	0.18*	0.19*
Bubble on 1	4.45*	4.43*	4.25*	3.98*	3.26*	3.85*
Bubble on 2	3.56*	3.43*	2.94*	3.44*	3.23*	3.36*

Note. Bubble students were within one standard error of measurement (SEM; 3 scale score points) below the proficiency cut score on the previous attempt (1 or 2).

* *p* < .001. The *p* value reflects the significance of the estimated parameters in logits (not the odds ratios reported here.

Mathematics. Across grades, the predictors of passing the state math test were similar in magnitude, direction, and level of statistical significance, with the exception of Racial Minority status across grades, and sex for Grade 8 only. Using Grade 3 as an example and all else constant and with failure to reach proficiency on previous tests, males were 1.19 times more likely to pass the state math test than females; White students were 1.20 times more likely to pass than Hispanic students; non-FRL students were 2.11 times more likely to pass than FRL students; non-LEP students were 1.94 times more likely to pass than LEP students; and GenEd students were 2.28 times more likely to pass than SpEd students. All else constant, Bubble students were more than four times more likely to pass Tests 2 and 3 than students below the bubble on those test administrations. Figure 1 shows the estimated probability of passing the math or reading test for select subgroups of Grade 3 students, in which the benefit of multiple opportunities for Bubble students is clear.

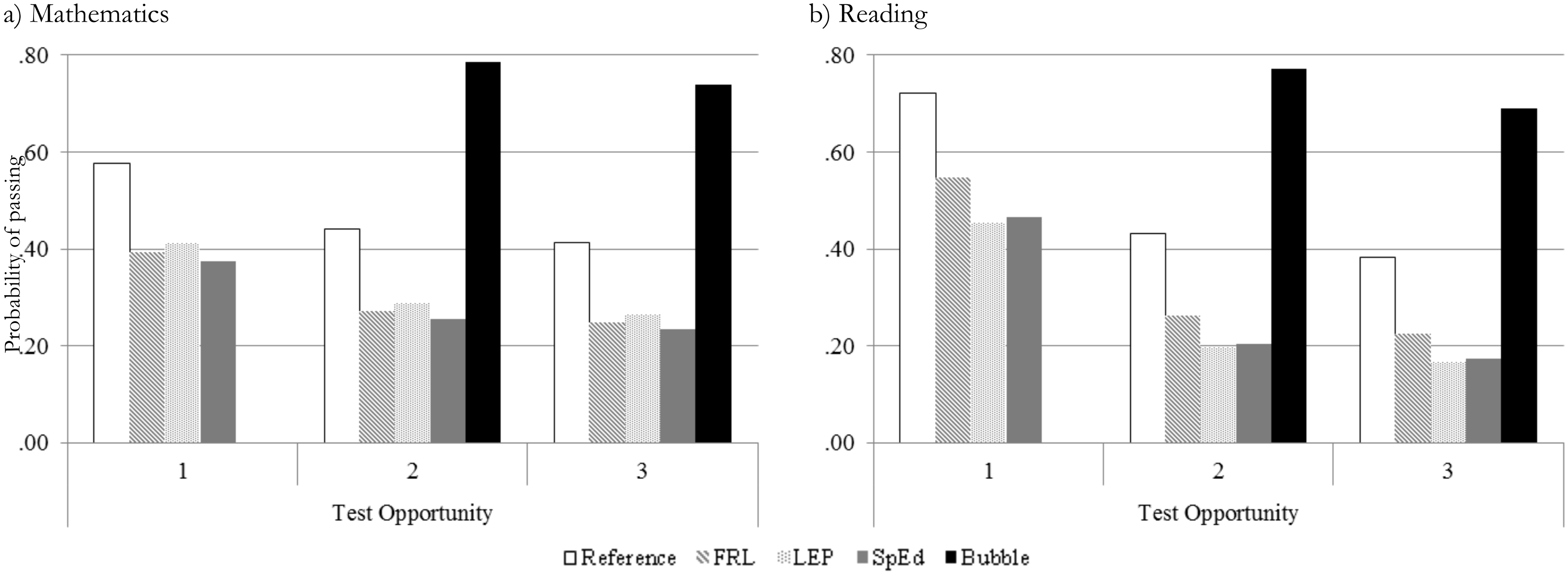


Figure 1. The estimated probabilities of passing the Grade 3 math or reading test for specific student subgroups.
Reference = White, male, non-FRL (free/reduced priced lunch recipient), non-LEP (limited English proficiency status), GenEd (general education), BelowBubble (lower than one standard error of measurement below the proficiency cut score on the previous test). FRL = White, male, FRL, non-LEP, GenEd, BelowBubble. LEP = White, male, non-FRL, LEP, GenEd, BelowBubble. SpEd = White, male, non-FRL, non-LEP, Special Education, BelowBubble. Bubble = White, male, non-FRL, non-LEP, GenEd, Bubble (one standard error of measurement below the proficiency cut score on the previous test).

In the survival analysis, there was some variability in the magnitude of odds ratios for math predictors across grades. The odds ratio for LEP increased across grades, such that non-LEP students were substantially more likely to pass the math test at Grade 8 (3.29) than at Grade 3 (1.94). A similar trend was seen for GenEd students, who were 2.28 times more likely to pass the math test than SpEd students at Grade 3 and 4.28 times more likely at Grade 8. The odds ratios for the Bubble students at both opportunities slightly increased and peaked at Grade 5, then slightly decreased.

Reading. In the survival analyses on the reading test at each grade, the predictors of passing the state reading test were similar in direction and statistically significant, with the exception of Racial Minority status for Grade 3 only. We use Grade 3 for more specific description of results as an example. All else constant and given failure to reach proficiency on previous tests, females were 1.13 times more likely to pass the state reading test than males; White students were 1.23 times more likely to pass than Hispanic students; non-FRL students were 2.13 times more likely to pass than FRL students; non-LEP students were 3.09 times more likely to pass than LEP students; and GenEd students were 2.95 times more likely to pass than SpEd students. All else constant, Bubble students were 4.45 times more likely to pass Test 2 and 3.56 times more likely to pass Test 3 than students below the bubble on those test administrations.

There was also some variability in the magnitude of odds ratios for the reading predictors across grades. The odds ratio for LEP sharply increased across grades, such that non-LEP students were much more likely to pass the reading test at Grade 8 (9.29) than at Grade 3 (3.09). This was true to a lesser extent for GenEd students, who were about 3 times more likely to pass the reading test than SpEd students at Grade 3, and more than 5 times more likely at Grade 8.

The results of the survival analyses for math and reading differed somewhat. Most notably, males were significantly more likely to pass the state math test than females, whereas females were more likely to pass the state reading test. And while there were generally no differences between Racial Minority and White students in the likelihood of passing the math test, White students were more likely to pass the reading test than Racial Minority students (excepting Grade 3). There were also some discrepancies in the magnitude of the odds ratios across subject. While non-LEP students were more likely than LEP students to pass either state test, the likelihood was much greater for reading. The same trend can be seen for GenEd versus SpEd students, but to a lesser extent.

Discussion

The purpose of this study was to explore the implications of a state accountability system that allowed multiple tests. Specifically, we examined the likelihood of passing the test given previous failure(s) to reach proficiency, and whether student characteristics were associated with multiple testing or the likelihood of passing.

Generally, we found across Grades 3-8 that LEP, SpEd, and Bubble status students were statistically significant predictors of additional test administrations. That is, all else constant, non-LEP students were about one and a half times more likely than LEP students to receive a second test, if they failed the first. General education students were more than three times more likely than SpEd students to receive a second test, if they failed the first, and more than one and a half times as likely to receive a third test, if they failed the second. Bubble students were about three times more likely than Below Bubble students to receive a second test, if they failed the first, and about twice as likely to receive a third test, if they failed the second. Furthermore, we found that, all else constant and given previous non-proficient test results, male, White, non-FRL, non-LEP, GenEd, and Bubble students were more likely to pass the state achievement test than their respective counterparts. However, White students were not more likely to pass the math test than Racial Minority students on succeeding tests. Taking the results of these two analyses, the non-LEP, GenEd, and Bubble students that were more likely to pass the state test given multiple opportunities (Figure 1) were also the students receiving additional opportunities to pass through a retest.

Practical Implications

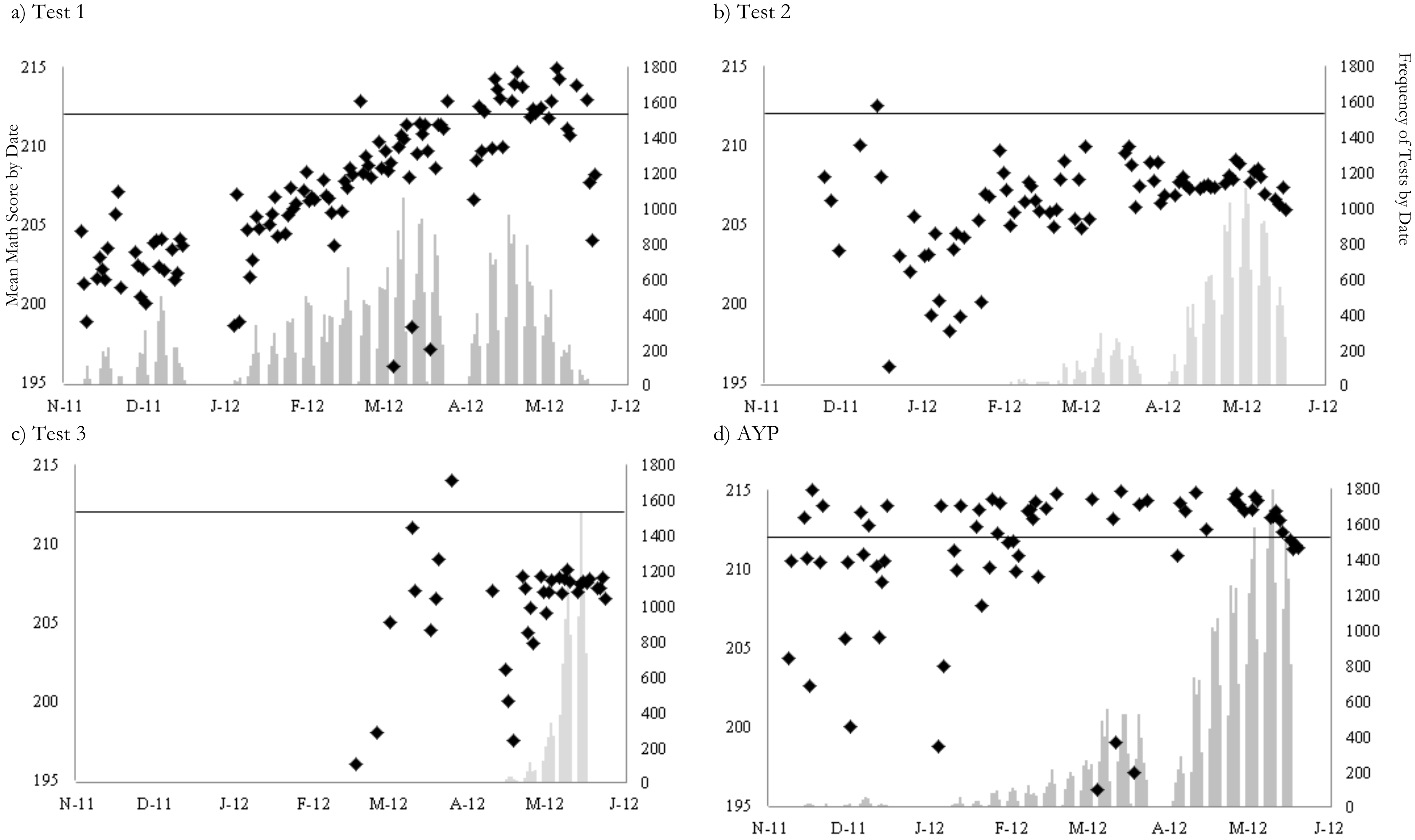
In order for a testing event to be a meaningful opportunity, testing needs to be aligned to learning objectives, and offer direct feedback about student performance that could connect to future learning materials (Kurz et al., 2014). Thus, testing can be an important part of learning for teachers and students who are aware of their own performances and competencies, but it remains uncertain whether large-scale state achievement are meaningful learning events. Furthermore, the state acknowledges that some students may benefit from retesting after receiving further instruction. Although testing later in the year helps "...ensure each student has had sufficient instructional time and allows for the provision of adequate instructional supports and interventions as appropriate" (Oregon Department of Education, 2012c, p. 5), multiple testing opportunities delivered prior to spring allow for identification of potential problem areas and targeted instructional supports in those areas to bring the student to proficiency. Nevertheless, state policy encourages districts to administer multiple tests less frequently than is current practice in Oregon (Oregon Department of Education, 2012c, p. 6). These practices fit well within the conceptions noted earlier, that multiple administrations set the stage for adjusting opportunity to learn (Crocker, 2003), and for revealing instructional sensitivity (Polikoff, 2010).

Nevertheless, research is scant on how teachers and school teams use state test results to inform instruction. A recent study surveyed the types of summative assessments teachers administer, how the data are analyzed, and the instructional responses developed as a result (Hoover & Abrams, 2013). Although summative state assessments were not included in the survey, the results suggested that most teachers reported using data to make instructional changes by differentiating instruction for remediation, re-teaching concepts, and changing the pace of future instruction (Hoover & Abrams, 2013). In addition, 31% of surveyed teachers reported never analyzing students' assessment data by AYP subgroups, which can show variation perhaps more useful to guide instruction for students such as those with disabilities. In many states, however, results are not available until the following summer or fall and thus cannot be applied to the students or curriculum during the school year tested. Furthermore, state tests may be too molar to provide teachers with useful information to inform instruction, as opposed to interim or formative assessments (Black & Wiliam, 1998).

Only those students who received accelerated instruction, had adequate opportunity to learn the assessed content standards, and demonstrated proficiency in the grade level content based on classroom-derived evidence were to be tested early (Oregon Department of Education, 2012c). One curious incidental finding was that early testing for those likely to pass does not appear to be the policy applied by districts and schools. Figure 2 overlays a scatterplot of mean test scores for each date of testing with a histogram of the frequency of tests for each date. The graph for Test 1 clearly shows the low average test scores (well below the proficiency cut score) for students tested early. Contrasted by the graph for AYP, in which very few early administrations were actually used for AYP reporting purposes (and many that were appeared to be, on average, close to or above the proficiency cut-score). Thus, we might speculate that teachers and administrators were using the multiple testing policy to provide diagnostic assessment of those students who would benefit from targeted instruction to reach proficiency and/or additional opportunity to learn. (Note that we presume teachers and/or administrators decide whether an additional testing opportunity is given, and not the student.) Because the multiple administration policy is designed to retest those students who may pass given an additional opportunity, it may be encouraging schools to implement educational triage, “the diversion of resources to students believed to be on the threshold of passing” (Booher-Jennings, 2005). Research on the influence of proficiency-based accountability systems has reported that educators do focus resources on students closest to proficiency (Jennings & Sohn, 2014), and also that educators, especially those in low-performing schools, engage in coaching (e.g., Koretz et al., 2001, 2006), emphasizing test preparation that focuses on specific attributes of the test (Jacobs, 2005; Jennings & Sohn, 2014). The Oregon policy was not intended to provide all students below proficiency with additional instruction and a retest opportunity. Although we found certain student subgroups were more likely to receive an additional administration, the intent of educators, application of the policy, and how it influenced instruction is beyond the scope of this study. A potential unintended consequence of this policy (in general and not specific to Oregon), is that resource allocation benefits students most likely to pass the test at the expense of traditionally lower achieving student groups such as those receiving LEP and special education services.

One important finding of the present study was that controlling for student characteristics, Bubble students (those nearest the proficiency cut-score) were more likely than students with lower scores to receive an additional test and also to pass the state math test. Referring back to the study by Kulik et al. (1984), the ES of the equating error of parallel forms for three test occasions (ES = .35) results in a swing of approximately 3.6 units on the Oregon math test for Grade 3 students, which is equivalent to the SEM around the cut score. Thus, as our results demonstrate, those bubble students with scores one SEM below the cut score, who have a higher probability of being false-negatives, benefit from multiple opportunities, and three opportunities are just enough to account for measurement error. We found that Bubble students are more than four times more likely to pass the state test given multiple opportunities compared to those more than one SEM below the cut-score. Perhaps more importantly, however, is the idea that multiple testing opportunities may ameliorate other sources of inaccuracy. Similar to the Texas graduation program litigated in the GI Forum, the risk of false-negatives is a concern when proficiency decisions are made based on imperfect measurement. In that case, a single attempt is a less certain evaluation because measurement error can cause a student with true achievement at or slightly above the proficiency cut-score to fail a single administration of the test (Phillips, 2000).

Unreliability can be ameliorated if a policy is adopted allowing a confidence interval surrounding the cut score used to judge proficiency. Many states allow schools to use confidence intervals around aggregations of proficiency (Fulton, 2006; NCLB, 2001), and some are as large as large as 99% (±2.58 SEM). In that case, false negative due to unreliability of measurement are unlikely. However, other sources of inaccurate estimation (e.g., curricular coverage at the time of test, opportunity to learn, test-taking, or transient state factors of the examinee) are not necessarily controlled through the use of confidence intervals but can be ameliorated through multiple test administrations. Of course, the margin of error is afforded to the accountability unit (e.g., schools), and not to student scores, but it can be argued that individual student results also carry consequence and as such deserve to be recognized as estimates, which performance standards generally do not provide.



a) Test 1

b) Test 2

c) Test 3

d) AYP

Figure 2. These figures overlay a scatterplot of the mean test scores for each date of testing, with a histogram of the frequencies of tests for each date by Test Opportunities 1, 2, 3, and AYP.

The left y-axis represents the mean math scores by date, the y-axis on the right represents the number of students tested by date, and the x-axis represents the dates of the 2011-12 school year. The horizontal line represents the proficiency cut-score (212). (Note that the mean score axis was formatted for readability and does not show outlier means.) The *median* (min, max) dates were as follows: 1: 3/8/12 (11/8/11, 5/17/12); 2: 4/26/12 (11/8/11, 5/17/12); 3: 5/11/12 (2/14/12, 5/17/12); AYP: 4/25/12 (11/8/11, 5/17/12).

The potential consequences of multiple test administrations, (e.g., educational triage, resource reallocation, opportunity to learn, increased reliability) are presented as issues that affect the inferences and assumptions of scores in an accountability framework. In addition, multiple testing opportunities can mitigate the effects of several sources of imprecision in test scores. Scores and/or proficiency categories may not accurately reflect students' true knowledge and abilities as a result of test unreliability. Given our findings, a single test policy may raise equity issues for particular subgroups of students, especially students with disabilities (SWD). A recent report provided information about the inclusion of students with disabilities in school accountability systems, the use of school practices that may relate to their educational outcomes, and their achievement in relation to school accountability status (Harr-Robins et al., 2012). Among other results, the researchers found that in 16 states over 4 years, 35% to 40% of schools missed AYP either partially or solely due to the performance of SWD. Because disadvantaged groups are disproportionately lower performers, perhaps every opportunity should be made to ensure that they have every chance to meet proficiency standards. This includes multiple test opportunities related to opportunity to learn (which arguably reflects interim assessment as opposed to summative assessment). Under Title IX, disproportionality in and of itself is evidence of discrimination (Title IX of the Education Amendments of 1972), so to help promote equity, every available opportunity should be provided for protected subgroups.

For example, Oregon's multiple testing policy is changing in preparation for the implementation of SMARTER Balanced Assessment Consortium (SBAC). In Oregon, the SBAC assessment is planned for implementation in 2014-15 with students given only one test in the spring; as a result, the state changed testing practices to allow two testing opportunities for 2012-13 and one in 2013-14 to prepare for the single administration SBAC test (Oregon Department of Education, 2012c, p. 5). In the year analyzed for this study (2011-2012), all of the Grade 3 subgroups benefited from multiple testing opportunities; descriptively, the proficiency rates for the subgroups we analyzed increased by at least 50% from Test 1 to AYP reporting. But AYP subgroups specifically benefitted, as the proficiency rates for Test 1 compared to that reported for AYP increased by 83% for SpEd students, 99% for FRL students, 119% for Hispanic students, and 181% for LEP students. In 2012-13, when only two testing opportunities were allowed, proficiency rates also increased, but to a lesser degree. Specifically, proficiency rates increased 37% for SpEd students, 47% for FRL students, 56% for Hispanic students, and 79% for LEP students. Because this comparison is across cohorts, these differences may be in part due to cohort variation. For example, the 2011-12 Grade 3 cohort had a proficiency rate on Test 1 of 40%, while the 2012-13 Grade 3 cohort had a Test 1 proficiency rate of 48%. Both cohorts, however, had a similar Test 2 proficiency rate around 32%, and for final AYP reporting, the 2011-12 cohort actually had a slightly higher overall proficiency rate (65.9%) than did the 2012-13 cohort (63.1%). Thus, it can be argued that the third test had a meaningful influence on testing practice, as it raised the proficiency rate of the 2011-12 cohort beyond that of the comparison cohort despite the large initial discrepancy. Projecting to 2014-15 in which only one test will be administered, all else equal, we can speculate that proficiency rates are likely to fall further. Of course, attending to disproportionality was not the intent of the policy examined in this study, which did not make a provision to retest all students who did not meet achievement standards and in practice benefited higher-performing students.

Limitations

The implications of the results presented here should be tempered by the following meaningful limitations. In a multiple test administration setting in general, regression to the mean represents a threat to validity. In this study's setting in particular, all retested students failed to meet achievement standards and thus were exhibited lower scores and thus regression to the mean is more likely and may have been more influential. Of course, not all students who met achievement standards on subsequent administrations were false-negatives on the first, just as some marginal students who met achievement standards could be considered false positives. Given opportunity and meaningful learning, the score gain to reach proficiency was consequential and not regression to the mean. In a study on practice effects and coaching, Hauscknecth, et al. (2007) found that less than 10% of the total gain effect size could be attributed to regression to the mean; however, this only considered two studies. Here, we could not partition observed score gains between regression to the mean and learning; future research could explore the relation between test scores and instruction (e.g., academic standards covered at the time of and between testing) to understand how LEA's and teachers use the data. This targets the junction of learning and accountability in large-scale state testing programs. Additionally, although the sample reported here represents the operational accountability population of one state, specific results are likely to differ across states with varying demographics, other assessments, and other accountability systems and administration procedures.

Conclusion

The consequences of large-scale testing programs (Lane & Stone, 2002) are influenced by a single testing administration with accountability implications for both students and LEAs (Thomas, 2005). Students, particularly those on the proficiency margin (within one SEM below the proficiency cut-score), benefit from multiple tests, and SpEd students whom we found to be less likely to pass the state test than GenEd students, are negatively affected by a single administration. Schools are most commonly identified as not meeting AYP due to the pass rates of SWD students (Eckes & Swando, 2009), and use of a single test administration policy increases the risk of false negatives (more palatable is the risk of false positives). Whitehurst and Lindquist (2014) articulated the negative implications of reducing testing across grades, particularly for "vulnerable groups," and the conclusions may apply to within-year testing as well. As scaled test scores are being reduced to dichotomous proficiency categories, a multiple testing policy must be weighed in potential benefits and costs. A multiple test policy may increase the reliability of decision-making (Chester, 2003), and provide improved prospects for additional instruction, opportunity to learn, student development, and concomitant success for students and schools (Harr-Robins, et al., 2012). On the other hand, such a policy may also increase the likelihood of educational or instructional triage (e.g., Jennings & Sohn, 2014), reallocation and coaching (Koretz et al., 2001, 2006), resource demands, educator response to and public opinion of additional testing, and student testing fatigue. In light of our results, we believe there are important research questions to be addressed examining the effects of multiple tests on the accuracy of proficiency estimation as well as the effects of single versus multiple testing opportunities on accountability, and the effect of multiple tests on the assessment of student subgroups.

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About the Authors

Joseph F. T. Nese
University of Oregon
jnese@uoregon.edu
Joseph F. T. Nese, PhD, is a Research Associate at Behavioral Research and Teaching (BRT) at the University of Oregon. He conducts research in educational assessment and applied measurement, focusing on developing and improving systems that support data-based decision-making and using advanced statistical methods to measure and monitor student growth.
0000-0002-9878-7395

Gerald Tindal
University of Oregon
geraldt@uoregon.edu
Dr. Tindal is currently the Castle-McIntosh-Knight Professor in the College of Education – University of Oregon. He is the Department Head of Educational Methodology, Policy, and Leadership and directs Behavioral Research and Teaching (BRT). His research focuses on integrating students with disabilities in general education classrooms using curriculum-based measurement for screening students at risk, monitoring student progress, and evaluating instructional programs. Dr. Tindal also has conducts research on large scale testing and development of alternate assessments. This work includes investigations of teacher decision-making on test participation, test accommodations, and extended assessments of basic skills. He publishes and reviews articles in many special education journals and has written several book chapters and books on curriculum-based measurement and large-scale testing. He teaches courses on assessment systems, data driven decision-making, research design, and program evaluation.
0000-0001-7381-0301

Joseph J. Stevens
University of Oregon
stevensj@uoregon.edu
Joseph Stevens, PhD, joined the University of Oregon in 2005 and is currently a Professor in the department of Educational Methodology, Policy, and Leadership. He is a Co-Principal Investigator with the National Center on Assessment and Accountability (NCAASE) at the University of Oregon. His doctoral degree is in Psychology and Quantitative Methods from the University of Arizona. He was formerly Professor of Education at the University of New Mexico. He also worked at the Psychological Corporation and as a measurement statistician at Educational Testing Service. His interests are in measurement, validity, research design, and longitudinal modeling and individual differences in academic achievement especially for special education students and language learners. He teaches courses in advanced statistical methods and research design.
0000-0003-3717-164X

Stephen N. Elliott
Arizona State University
steve_elliott@asu.edu

Stephen N. Elliott, PhD, is the Mickelson Foundation Professor in the Sanford School of Social and Family Dynamics at Arizona State University. His research focuses on scale development and educational assessment practices with students with disabilities or at risk for educational difficulties. Assessment tools he has developed include the *Social Skills Improvement System (SSiS), Academic Competence Evaluation Scales (ACES), Vanderbilt Assessment of Leadership in Education,* and *My Instructional Learning Opportunities Guidance System (MyiLOGS).* He has published numerous articles, chapters, and books on (a) the assessment of children's social and academic competence, (b) the design and evaluation of methods that increase students' access to learning and large-scale achievement test, and (c) the assessment of school leadership. Steve is a co-PI of the National Center on Assessment and Accountability for Special Education, a United States Department of Education funded research center.
0000-0003-1643-0489

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