HIGH SCHOOL GRADUATION RATE—A PROPOSED MODEL FOR GRADUATING CLASS 2008

Xiaoping Wang, Administrative Consultant

Mary Sullivan, Consultant

Abstract—Graduation rate is one of the most important indicators used to measure high school success. Currently, three years of statewide individual student data are available in Iowa. This study uses the student data for the 2004-2005 10th grade cohort to examine the differences between the current NCES Leaver Rate formula and proposed cohort rate models, to identify potential issues, and to build the "best fit" graduation rate model(s) for future graduating classes and for subgroups, such as students with disabilities.

Background and Objectives—The No Child Left Behind (NCLB) Accountability System is based primarily on academic assessments and requires graduation rate as one of the additional indicators for public high schools. Two primary parameters are needed to calculate four-year high school graduation rate. One parameter is the count of students who enter the high school in a given year (as a denominator) and the other parameter is the number of students who complete the high school four years later (as a numerator). However, there are other factors (such as migration, retention, early graduation, dropout, illness and death) that complicate the situation.

It is difficult to determine actual graduation rate without a student-based data system. The statewide student information system, Project EASIER (Electronic Access System for Iowa Education Records), has been in place in the state of Iowa since 2004, along with the statewide student ID system. Iowa needs at least one more year of individual student data collected for four consecutive years to calculate the actual graduation rate for the Class of 2008. The importance that is placed on graduation rates as a measure of academic achievement (success) warrants the ongoing research into understanding the impact of the formula used to calculate graduation rate. This study compares the current method to estimate high school graduation rates based on existing data to a new formula for reporting actual graduation rate for the graduating class 2007. The main goal in analyzing three-year graduation rates for the Class of 2007 is to finalize a suitable four-year graduation rate model for the Class of 2008.

Definitions and Formulas—When people talk about graduation rate, they may think of senior graduation rate (a rate of the number of high school graduates vs. 12th grade enrollment). Senior graduation rate is not the high school graduation rate as defined by the NCLB Act, although the senior rates are reported for subgroup graduation rates based on available data. Several other estimates of graduation rate are based on the number

of graduates vs. grade nine enrollment four years previous, or the average enrollments of grades eight to 10. The main problem associated with using 9th grade enrollment or estimated 9th grade enrollment to estimate graduation rate is that it is misleading to assume the number difference between the high school graduates and freshmen four years previous is the number of students who failed school. This estimate does not account for the number of high school students transferring in and out of a school system.

To account for migration and other factors, the National Center for Education Statistics (NCES) estimates graduation rates based on high school dropouts and graduates by using the Common Core of Data (CCD). The longitudinal model, also called NCES Leaver Rate, is close to the true cohort rate, but not a true cohort approach in which students are followed through four years of high school. Iowa and 37 other states have enough years of data to adopt the NCES Leaver Rate for the NCLB accountability plans.
NCES Leaver Rate:

$$GR_i = \frac{G_i}{G_i + D_i + D_{(i-1)} + D_{(i-2)} + D_{(i-3)}}$$

Where: GR_i is the graduation rate for a given year *i*.
G_i is the number of students achieving a regular high school diploma for year *i*.
D_i is the number of dropouts in grade 12 for year *i*.
$D_{(i-1)}$ is the number of dropouts in grade 11 for the first previous year (*i-1*).
$D_{(i-2)}$ is the number of dropouts in grade 10 for the second previous year (*i-2*).
$D_{(i-3)}$ is the number of dropouts in grade 9 for the third previous year (*i-3*).

There are problems in using the NCES Leaver Rates: The models control the migration factor to a certain degree by combining high school graduates and dropouts as the denominators. However, some districts or states that gain students from migration-IN may be at a slight advantage, since the graduates are from a bigger class than four years ago. And those districts or states that have a sizable net loss in students over time due to migration-OUT may be at a slight disadvantage, since their dropouts from four years ago were drawn from a larger student body than that providing the number of graduates in a given year. Iowa has reported special education senior graduation rate for the last couple of years due to the lack of four consecutive years of dropout data for this subgroup. For the last five years, the NCES Leaver Rates have been reported for public school all-student group, gender and racial/ethnic subgroups at district level and for the state.

In 2005, the National Governors Association (NGA) recommended the Graduation Compact Formula and made an unprecedented commitment to a common method for calculating each state's high school graduation rate.

The NGA Compact Formula:

GR = (students graduating in four years with a regular or advanced diploma)/
[(first-time entering ninth graders four years earlier) + (transfer in) – (transfer out)]

The NGA Compact Formula is not clear on the special education students who may be expected to take more than four years to graduate. A revised graduation rate formula is necessary for Iowa to include special education students who take more than four years to earn a high school diploma in the new cohort rather than the cohort with whom they entered ninth grade.

A proposed Iowa graduation rate model for the Class of 2008:

GR = (B / (A – C – SEout + SEin + D)) * 100

A is the number of 9th graders in 2004.

B is the number of graduates (with a regular diploma) in 2008 (including the on time graduates from the freshman class (A), the early graduates from later cohorts who graduated in fewer than four years, and the special education students from earlier cohorts who took five years or more to graduate (see SEin); not including the regular education students from earlier cohorts who took five years or more to graduate).

C is the number of students who transferred out, i.e., the number of students from the freshman class (A) who transferred to another school, state or country; students who were ill or deceased; and the students who left the Class (A) to earlier cohorts and graduated in fewer than four years.

SEout is the number of special education students from the freshman class (A) who did not graduate with the Class (A) and enrolled in later cohorts.

SEin is the number of special education students transferred in from other earlier cohorts (under age 22), took more than four years to finish high school, and graduated with the class (A).

D is the number of students who transferred in and students who graduated in fewer than four years from later cohorts.

Since SEin and D are included in the numerator, they also are counted in the denominator to ensure that the graduation rate does not exceed 100 percent. Students in groups of SEout and C are not included in both numerator and denominator.

Data and Analyses—The Iowa Department of Education has collected individual student data through Project EASIER since 2004. This study starts to identify the 10th grade students in the fall of 2004 and the students who left and joined the cohort in the last three years per the Project EASIER files. The student information contains student enrollment codes, attending district/school, resident district, grade level, and exit codes: such as transfer, dropout, and graduation. Student demographic variables, such as Individualized Education Plan (IEP) status, English Language Learners (ELL), free/reduced-price lunch eligibility, race/ethnicity and gender are documented across time. The Iowa Accountability Plan defines high school graduates as the students receiving a diploma from a high school/ school district.

Diploma recipients are those students completing unmodified graduation requirements, as well as those students completing modified graduation requirements due to alternate placement or modification in accordance with a disability.

Phase I applies basic descriptive analyses about the students in the study and answers questions such as: What percent of the Iowa 2004-2005 10th graders graduated on time and received diplomas from their original school districts? What percent of the students in the cohort transferred from one Iowa district to another and graduated on time? What percent of the students in the cohort did not graduate on time and enrolled in different cohort(s)? It also provides their demographic information. And what percent of students in the cohort who had an enrollment code four for 'tuitioned-in district paid'? The preliminary three-year graduation rates from different formulas are calculated and compared at the state level.

Phase II concentrates on district and school-level data to examine the relationship between the NCES Leaver Rate and the proposed cohort rate and examines how sensitive the formulas are to districts with more or less migrant students and to districts with more or less special education students and students in other subgroups. District size and cohort size are other variables to be investigated in Phase II. Regression analyses are employed to answer some of the above questions.

Results—Phase I

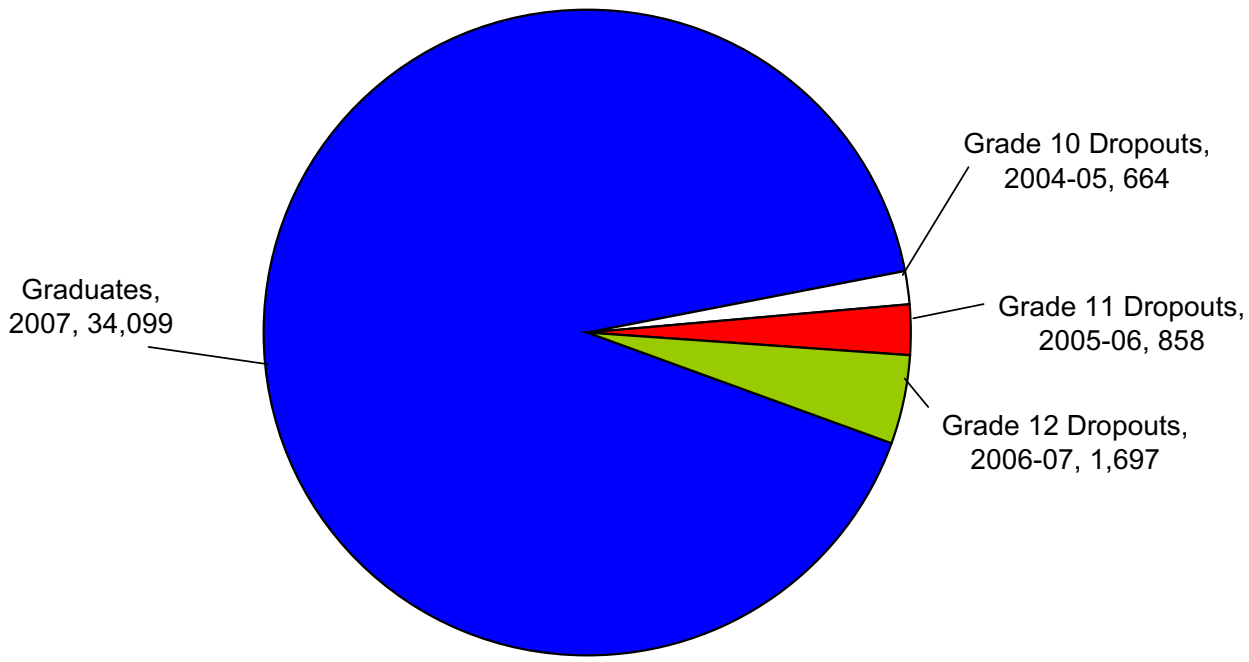
Graduation rate based on the NCES Leaver Rate (the current formula):
A total of 34,099 students graduated in 2007 with a regular high school diploma, and the dropout figures were 664 for grade 10 in 2004-2005, 858 for grade 11 in 2005-2006, and 1,697 for grade 12 in 2006-2007.

Table 1—Three-Year Graduation Rate for Class of 2007 - Current Formula/NCES Leaver Rate

	# STUDENTS	PERCENT
Graduates in 2007	34,099	91.37%
Grade 10 Dropouts, 2004-2005	**664**	**1.73%**
Grade 11 Dropouts, 2005-2006	858	2.30%
Grade 12 Dropouts, 2006-2007	**1,697**	**4.54%**
	37,318	
Graduation Rate (NCES Leaver Rate) = 34,099/(34,099+664+858+1,697)=91.4%		

Source: Iowa Department of Education, Project EASIER Files.

Figure 1—Three-Year Graduation Rate for Class of 2007 (NCES Leaver Rate)



Source: Iowa Department of Education, Project EASIER Files.

Original Cohort Graduation rate based on the NGA Compact Formula:

Table 2—Three-Year On-Time Graduation Rate for Class of 2007

	# STUDENTS
On-time graduates in 2007	31,248
Transferred OUT	**2,375**
Early graduates OUT (early graduates - left the 2004 fall grade 10 cohort and graduated in 2005 or 2006)	746
IEP students out the cohort - take longer to graduate	**663**
Non IEP students out the cohort - disappeared/take longer to graduate	929
Three-year dropouts (10th, 11th, 12th)	**2,373**
Number of Students in Grade 10, 2004-2005 (all six groups above)	38,334
Graduates in 2007 from other cohorts - early graduates IN	511
Graduates in 2007- transferred IN from other education systems	**1,425**
Graduates in 2007- IEP students IN - take longer to graduate	474
Graduates in 2007 from other cohorts (all three groups above)	**2,410**

Graduation Rate (NGA Compact Formula) =
(31,248+511+1,425)/(38,334+511+1,425-2,375-746) = **89.3%**

Source: Iowa Department of Education, Project EASIER Files.

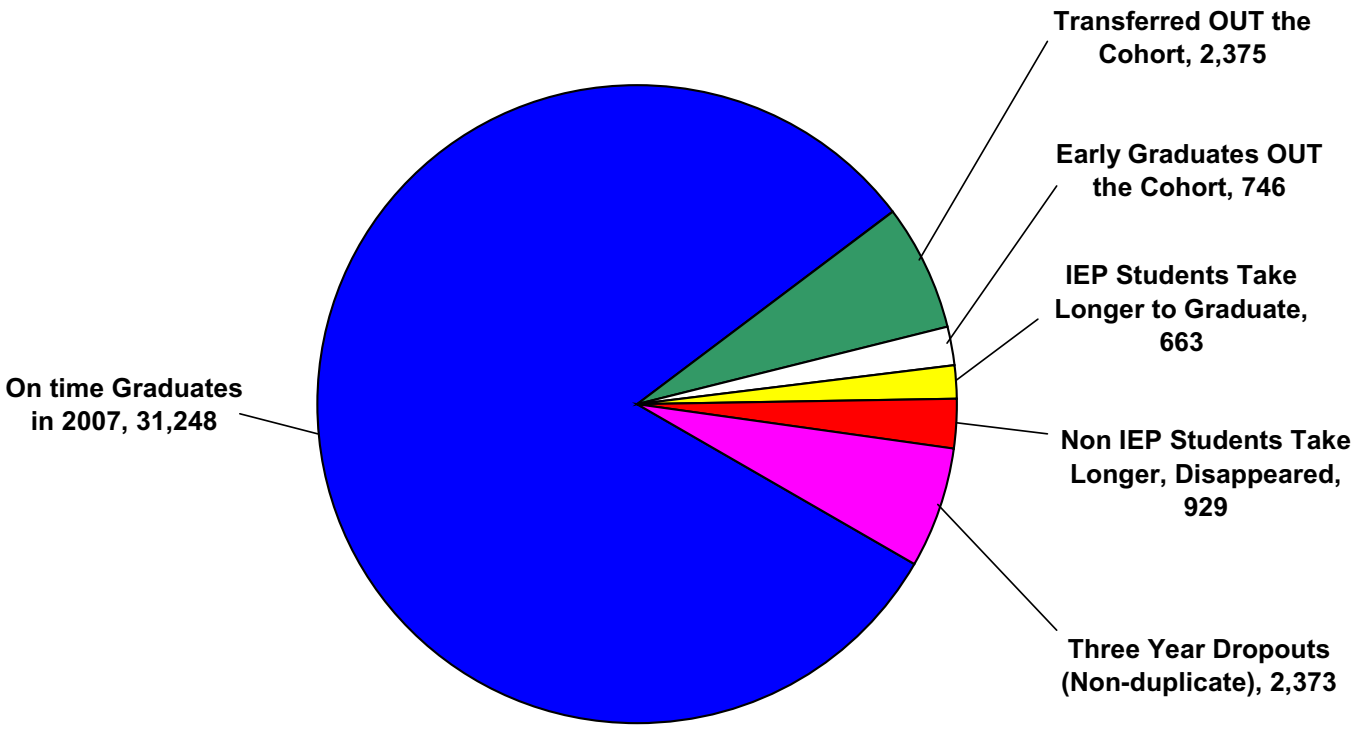
*Graduation rate based on the Revised NGA Compact Formula - a proposed mode*l:
In 2004-2005, the grade 10 enrollment in Iowa's public schools was 38,334. This enrollment figure did not include foreign exchange students and nonpublic school or home-schooled students who enrolled in public school for academic or extra-curricular activities. Between 2004 fall and 2007 spring, another 2,398 students joined and graduated with the 2004 fall 10th grade cohort. They included: 511 early graduates from future graduating classes, 462 IEP graduates from other cohorts who did not graduate in four years and finished in 2007, and 1,425 students transferred in from other states or school systems and graduated in 2007. A total of 453 regular education students from other cohorts who did not graduate in four years and finished in 2007 were not included in the calculation. The counts that would be excluded from the calculation are: 640 special education students from the 10th grade cohort who took more than four years to gain a regular diploma and were currently enrolled in lower grades, 2,375 students who transferred out or left the cohort due to other reasons (such as illness and deceased), and 746 students who left the cohort for other classes due to early graduation. The students who dropped out (2,373) from the 2004 fall grade 10 original cohort and the regular education students who did not graduate on time and are still enrolled in Iowa public schools (952) are counted against the cohort graduation rate.

Table 3—Three-Year Cohort Graduation Rate for Class of 2007 - Proposed Model

	# STUDENTS
On-time graduates in 2007	31,248
Graduates in 2007 from other cohorts (early graduates from 2004 fall 8th or 9th grades, IEP late graduates from 2004 fall 11th or 12th grades, and transferred in from other education systems)	**2,410**
Transferred OUT	2,375
IEP students left to other cohorts - take longer to graduate	**663**
Early graduates OUT (early graduates- left the 2004 fall grade 10 cohort and graduated in 2005 or 2006)	746
Non IEP students left to other cohorts - take longer, disappeared	**929**
Three-year dropouts (grade 10th, 11th, 12th)	2,373
Cohort Graduation Rate (Revised NGA Compact Formula) =	
(31,248+2,410)/(38,334+2,410+2,375-663-746) = **91.1%**	

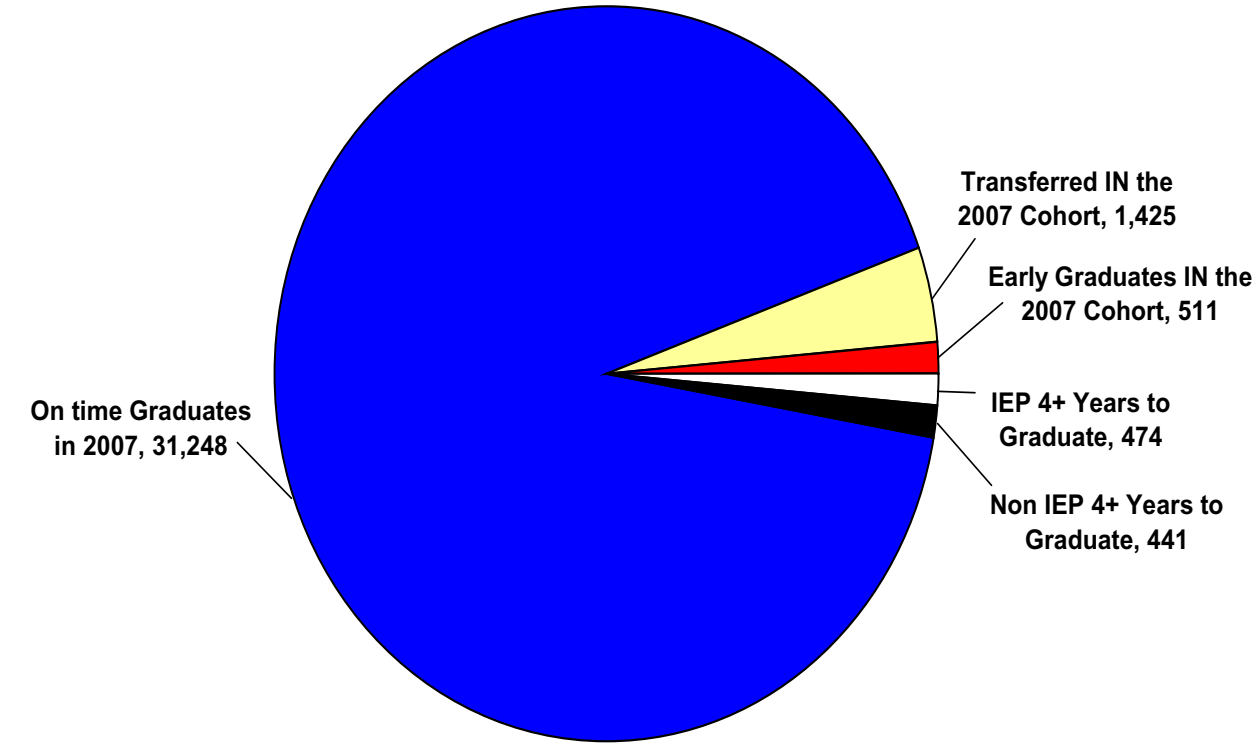
Source: Iowa Department of Education, Project EASIER Files.

Figure 2—Grade 10 Students in 2004-2005



Source: Iowa Department of Education, Project EASIER Files.

Figure 3—2007 Graduates



Source: Iowa Department of Education, Project EASIER Files.

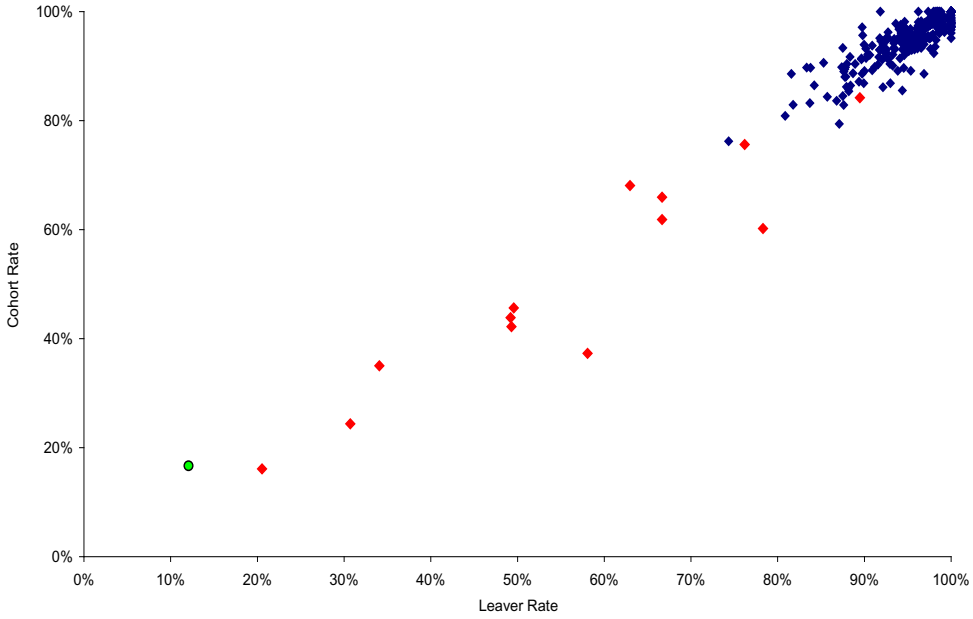
The only difference between the revised NGA Compact Formula – proposed and the original NGA Compact Formula is that the revised formula allows IEP students to take longer to graduate and does not count them against districts for their graduation rate.

At the state level, differences between the NCES Leaver Rate and the NGA Compact Rates are relatively small. Future state-level graduation rates will be more accurate since a better defined exit code will be in place this year to sort out the destinations for transferred students (such as out of state, out of country, or to a home schooling/nonpublic school vs. an in-state public school). Five years of student-level data are necessary to calculate a four-year graduation rate based on a true first-time freshmen cohort.

Phase II

Relationship between Different Graduation Rates:
The authors of this study have calculated two graduation rates for each district or school: one is the current NCES Leaver Rate (GR_1) and the other is based on the revised NGA Compact Formula – the proposed model (GR_2). A Pearson Correlation was processed between district GR_1 and GR_2, and the same method was applied to the school data. The correlation coefficient was 0.88 between the district GR_1 and GR_2, and the correlation coefficient between the two graduation rates for the school data was 0.97. A total of 298 districts with at least 30 students in the cohort were included in the data analysis, while 326 high schools that had at least 30 students in the cohort were in the calculations. The main reason for a higher school coefficient than the district coefficient is that the majority of the alternative high schools (Figure 4, red dots) had significant low graduation rates (for both GR_1 and GR_2) compared to the regular high schools. Therefore, the less homogeneous school data contributes a higher correlation coefficient (See Figure 4). On the other hand, the data for district graduation rates are more homogeneous.

Figure 4—Three-Year Leaver Rate vs. Cohort Rate, Class of 2007 by School



Source: Iowa Department of Education, Project EASIER Files.

District Size:
District size is one of the variables to be investigated in this study. The districts in the largest two enrollment categories (district enrollments were 2,500 students or more) had the correlation coefficients between GR_1 and GR_2 above the state value (0.88), while the districts with less than 2,500 students (in another three enrollment categories) had correlation coefficients equal to or less than the state value (Table 4). One of the main reasons small districts have less consistent graduation rates is that due to the small cohorts, one or two students with different enrollment codes or exit codes or few students transferred in or out of the cohort can increase or reduce the cohort graduation rate. The second reason is that small districts are more likely to send students to other districts to seek special education or/and alternative education services. At lease 42 percent of the tuitioned-in, district-paid students were from districts with enrollments of less than 600. The larger districts had a higher percent of dropouts and a higher percent of students who took longer to graduate. The smaller districts had a higher percent of students who graduated from their original schools, and the larger districts had more graduates transferred in from other districts/schools.

Table 4—Pearson Correlation Coefficients between GR_1 and GR_2 by District Size

DISTRICT ENROLLMENT	< 600	600 - 999	1,000 - 2,499	2,500 - 7,499	7,500+
Number of Districts	93	93	81	22	9
Coefficient	.77	.88	.83	.95	.94
P Value	<.0001	<.0001	<.0001	<.0001	=.0002

Source: Iowa Department of Education, Project EASIER Files.

District and School Characteristics:
Multiple regression analyses were conducted using the percent of students by race/ethnicity, IEP, ELL and free/reduced-price lunch eligibility as independent variables. GR_1 was the dependent variable for one regression and GR_2 was the dependent variable for another. The R squares were over 0.35 for all the models shown in Table 5 for district data and over 0.34 in Table 6 for school data. Besides the intercepts, the percent of free/reduced-price lunch eligibility was the most significant indicator (P<0.0001) for all the models in Tables 5 and 6. District size was another variable associated with the graduation rates at the districts level, and the percent of white students in the cohort was a significant variable associated with school graduation rates. For the district data, the percent of IEP students was more sensitive to the Leaver Rate and the percent of ELL students was more sensitive to the Cohort Rates. It might suggest that the Cohort Rate took care of the IEP students who took longer to graduate. The policymakers might need to consider allowing ELL students to graduate in five or more years for future classes. Another policy issue is: How long can an alternative school student work on a regular diploma? None of the 13 Iowa alternative high schools that had at least 30 students in the cohort had 90 percent or higher graduation rates. Is it right thing to put all alternative high schools on the NCLB watch list and SINA list based on their graduation rates?

Table 5—Significant Level for the Independent Variables to Estimate District Graduation Rates

VARIABLES	DISTRICT - LEAVER RATE WITH 7 INDEPENDENT VARIABLES	DISTRICT - COHORT RATE WITH 7 INDEPENDENT VARIABLES	DISTRICT - LEAVER RATE WITH 8 INDEPENDENT VARIABLES	DISTRICT - COHORT RATE WITH 8 INDEPENDENT VARIABLES
Intercept	< .0001	< .0001	< .0001	< .0001
% of IEP	**0.1395**	**0.8686**	**0.1376**	**0.8739**
% of F/R	< .0001	< .0001	< .0001	< .0001
% of ELL	**0.7201**	**0.0741**	**0.7162**	**0.0731**
% of White	0.0829	0.6351	0.0915	0.6678
% of Hispanic	**0.8900**	**0.4979**	**0.9266**	**0.4713**
% of African American	0.0065	0.0016	0.1559	0.0618
District Size	**<.0001**	**<.0001**	**0.001**	**<.0001**
Cohort Size			0.096	0.1317
R - Square	0.3517	0.3826	0.3579	0.3874

Source: Iowa Department of Education, Project EASIER Files.

Table 6—Significant Level for the Independent Variables to Estimate School Graduation Rates

VARIABLES	SCHOOL - LEAVER RATE WITH 6 INDEPENDENT VARIABLES	SCHOOL - COHORT RATE WITH 6 INDEPENDENT VARIABLES	SCHOOL- LEAVER RATE WITH 7 INDEPENDENT VARIABLES	SCHOOL - COHORT RATE WITH 7 INDEPENDENT VARIABLES
Intercept	< .0001	< .0001	< .0001	< .0001
% of IEP	**0.6731**	**0.4852**	**0.7456**	**0.3867**
% of F/R	< .0001	< .0001	< .0001	< .0001
% of ELL	**0.0948**	**0.1324**	**0.1333**	**0.2049**
% of White	0.0002	0.0012	0.0001	0.0007
% of Hispanic	**0.9379**	**0.7351**	**0.8108**	**0.4264**
% of African American	0.5496	0.2411	0.3960	0.1240
District Size	**<.0001**	**<.0001**	**0.001**	**<.0001**
Cohort Size			0.2284	0.0710
R - Square	0.3463	0.3494	0.3492	0.3560

Source: Iowa Department of Education, Project EASIER Files.

Significance/Impact—High school graduation rate is one of the indicators, along with the math and reading assessments and attendance, to measure school/district success and to identify schools/districts as being in need of improvement for the NCLB accountability system. To be ready to report the actual graduation rate for the 2008 Graduating Class and to examine the differences between the current formula and the "proposed models", the authors of the current study try to identify potential issues and to build best-fit graduation rate model(s) for future classes and for subgroups such as special education students. Encouragement has come from Margaret Spellings, the U.S. Secretary of Education, who announced that the U.S. Department of Education will move to a uniform graduation rate on April 1, 2008. In her statements, Ms. Spellings mentioned the NGA recommendations on graduation rates from all 50 governors in 2005. The current study uses real data to test the proposed model and uncovers many issues that need to be addressed.

REFERENCES

Clements, B. (2007). *Graduation Rates: Failing Schools or Failing Formulas?* ESP Solutions Group Optimal Reference Guide, white paper.

Dillon, S. (2008). *U.S. to Require States to Use a Single School Dropout Formula*. The New York Times.

Howley, C. & G. Huang (1991). *School Completion 2000: Dropout Rates and Their Implications for Meeting the National Goal*. Eric Digest.

Kaufman, P, & M. Frase (1990). *Dropout Rates in the United States: 1989*. Washington, DC: National Center for Education Statistics.

Cheek, D.W. *Calculation of the Rhode Island Cumulative Dropout and Graduation Rates*. Providence, Rhode Island.

National Center for Education Statistics, (2000). *A Recommended Approach to Providing High School Dropout and Completion Rates at the State Level*, Technical Report, NCES 2000-305.

National Governors Association Center for Best Practices (2006). *Implementing Graduation Counts*: State Process to Date. ISBN: 1-55877-403-3.

National Governors Association Center for Best Practices (2005). *Graduation Counts, A report of the national governors association task force on state high school graduation data. Redesigning the American high school*. ISBN: 1-55877-372-X.

U.S. Department of Education, (2003). *State Accountability Plans under the Consolidated Application Process*.

Zhou, Y. (2002). *A Comparison of Connecticut Four Cumulative Dropout Rates Using Different Formulas*. Paper presented at the Annual Meeting of the American Educational Research Association.