Does Colorado Over or Under Identify Gifted Students Today?

By Tom Coyne

(Former Member of the Colorado State Advisory Committee for Gifted Education)

tcoyne@k12accountability.org

Agenda

- The Issue
- How Colorado Defines a Gifted Student
- Background on Psychometric Testing
- Analysis Methodology
- Results From Just the COGAT
- What Happens When We Use Both COGAT and WISC?
- What Happens When We Use Both General Intellect and Achievement As Screening Criteria?
- And What Happens to the Percentage of Students Identifies As Gifted When We Add Tests for Exceptional Creativity and Leadership?
- Conclusions

The Issue

- HB 14-1102 will require each school district to employ universal screening to identify gifted students and provide them with appropriate gifted education programming
- Today, based on TCAP test demographic data, Colorado identifies about 11% of students in Grades 3 through 10 as gifted
- However, given that screening for giftedness varies widely across the state, and that universal screening will cost more money, it is important to understand the extent to which 11% is potentially an underestimate of the percentage of gifted students
- In other words, is the expected change in the gifted identification rate from additional screening greater than the additional cost?

How Does Colorado Define a Gifted Student?

- Under Colorado Law, "Gifted and Talented Children means those persons between the ages of five and twenty one whose abilities, talents, and potential for accomplishment are so exceptional or developmentally advanced that they require special provisions to meet their educational programming needs."

Colorado Gifted Identification Standards

- Under Colorado Law, "Gifted students are capable of high performance, exceptional production, or exceptional learning behavior by virtue of a combination of these areas of giftedness:"
  - General or Specific Intellectual Ability
    - "Demonstrated by advanced level on performance assessments or 95th percentile and above on standardized cognitive tests."
  - Specific Academic Aptitude
    - "Demonstrated by advanced level on performance assessments or 95th percentile and above on standardized cognitive tests."
  - Creative or Productive Thinking
    - "Demonstrated by advanced level on performance assessments or 95th percentile and above on standardized tests of creative/critical skills or creativity/critical thinking."
  - Leadership Abilities
    - "Demonstrated by advanced level on performance assessments or 95th percentile and above on standardized leadership tests."
  - Visual Arts, Performing Arts, Musical, or Psychomotor Abilities
    - "Demonstrated by an advanced level on performance talent assessments, or 95th percentile and above on standardized talent tests."

Psychometric Testing Issues

- Different tests can be used to identify a student's "general intellectual ability" – the first of Colorado's five criteria for giftedness
  - E.g., the COGAT or WISC test
  - Jeffco (which has universally screened students for the past five years) administers the COGAT test to all 2nd grade students
- A student's percentile score on these tests is a function of the distribution of scores of a large number of people who have previously taken the test
- Because these distributions are normal (i.e., shaped like a "bell curve"), they can be described with two variables
  - The average (mean) score describes the center of the distribution
  - The standard deviation is measure of the distribution of scores around the mean
    - E.g., in a normal distribution, about 68% of scores will fall in a range defined by the mean plus/minus one standard deviation, and approximately 95% of scores will be in a range defined by the mean plus/minus two standard deviations

Psychometric Testing Issues (cont'd)

- The WISC and Woodcock Johnson tests have a mean of 100 and a standard deviation of 15; the COGAT (for K-2nd grade) has a mean of 100 and a standard deviation of 16
- However, individual scores on all these tests are also subject to a degree of measurement error (technically, the standard error of measurement, or SEM)
  - For the WISC the SEM is 3; for the COGAT it is 5
- The SEM helps us define our confidence about an individual score
  - We can be 68% confident that a student's true score is within the range of the actual score plus or minus one standard error; we can be 95% confident it lies within a range defined by the actual score plus or minus two standard errors

How Testing Errors Relate to the Percentage of Students Colorado Identifies as Gifted

- As previously noted, regulations set a score at or above the 95th percentile on an appropriate assessment test (the mean plus 1.645 standard deviations) as the criteria that can be used to identify a student as gifted
- However, we also know that, because of the standard error of measurement (SEM), there is a confidence interval around any student's test score
- A critical identification issue is how we take standard errors of measurement (SEMs) into account
- Philosophically, this question is directly related to whether Colorado is (or should be) more interested in avoiding "Type 1" or "Type 2" errors when it comes to screening for Gifted Education programs
  - Type 1 Errors are "false positives" that incorrectly identify a student as gifted
  - Type 2 Errors are "false negatives" that incorrectly identify a student as not gifted
  - The more you seek to minimize the probability of one type of error, the more you must accept an offsetting increase in the probability of the other type of error

Analysis Methodology

- To examine the potential under-idenification of gifted students in Colorado, I performed a simulation analysis
- Each simulation involved screening 100,000 students for giftedness
- Different simulations were performed to approximate the universal testing criteria used today in Jeffco
  - The simplest simulation used just the COGAT test to assess general intellect (the first of Colorado's five criteria)
  - The second simulation used the COGAT and the WISC to assess general intellect
  - The third simulation used the COGAT and the WISC, plus achievement tests in math and reading
- While screening tests for leadership and creativity (the third and fourth criteria for giftedness in Colorado regulations) is generally not used, I drew on the available evidence to reach conclusions about their potential impact on gifted identification rates

A Simple Screening Example Using COGAT

- Let's begin with a baseline scenario in which we do not take the standard error of measurement into account, and we set the cut score for gifted identification to the mean COGAT score plus 1.645 standard deviations (i.e., 126)
  - This results in the identification of 5% (rounded) of students as gifted
- If we reduce this cut score by one SEM (= 5) to 121, we would identify 10% of students as gifted, and be 68% sure we had not missed not identifying as gifted a student who was, in fact, gifted
- If we reduce further reduce the the threshold score by two standard errors (= 10) to 116, we would identify 16% of students as gifted using just the COGAT test
  - This policy would minimize the probability of false negative/type 2 errors (not identifying a student as gifted who is gifted), but would also result in many more false positive/type 1 errors (identifying a student as gifted who is not gifted)
- On balance, the 95th percentile score less one SEM seems like a reasonable compromise

What Happens When We Use COGAT & WISC?

- Let's now assume that we use two different tests (the WISC and the COGAT) to assess "general intellectual ability", with each student in our simulation taking both tests
  - WISC is the test most often used by parents who seek independent testing for giftedness
  - For the WISC, the mean is 100, the standard deviation is 15, and the SEM is 3
- The reported correlation between COGAT and WISC scores is .79
- Because the correlation between the COGAT and the WISC tests is less than 1.0, we will identify more children as gifted than if we just used the COGAT alone
- We again set the gifted cut score at the 95th percentile for each test, and adjusted for possible double counting (i.e., a student who was above the cut score on both tests counted only once)
  - Without any SEM adjustment, we identify 8% as gifted
  - With a 1 SEM adjustment on each test (which lowers the cut scores), we identify 12% of students as gifted

Now Let's Test Using a Second Criteria for Giftedness

- In addition to the two tests to measure general intellect (Colorado's first criteria), we'll now add tests to measure achievement (Colorado's second criteria)
- To measure achievement, I've taken the state 2013 Grade 5 TCAP Scale Score on the math test (avg 520.19, std dev 74.89) and the reading test (avg 611.53, std dev 68.99) and converted them to a scale scores with a mean of 100 and standard deviation of 14 for the math test and 11 for the reading test. In both cases, I've assumed an SEM of 3
- For the correlation between the math and reading test scores, I've used .75, which is the conclusion reached by Larwin in "*Reading Ability is Fundamental in Predicting Math Achievement in 10th Graders*"
- For the correlation between these achievement tests and the COGAT and WISC, I reviewed the findings from a number of research papers
  - In "*Intelligence and Achievement*", Naglieri and Bornstein find that a good general estimate of the correlation between IQ and achievement tests is .70
  - In "*The Relationship Between Students' Performance on the Cognitive Abilities Test (COGAT) and the Fourth and Fifth Grade Reading and Math Achievement Tests in Ohio*", Warnimont finds an average correlation of .73 between the 3rd grade COGAT and the 5th grade Ohio Math Achievement Test, and a correlation of .66 for the Reading Test. These seem the most analogous to Colorado's situation
- Without any SEM adjustment, using these four tests we identify 11% as gifted (again using a 95% cut percentile, and eliminating double counting for students who are above the gifted cut score on more than one test)
- With a 1 SEM adjustment on each test (which lowers the cut scores), we identify 17% of students as gifted
  - Jeffco requires high achievement test scores for two successive years if they are the primary basis for gifted identification. That policy is not captured in this analysis; it should reduce the identification rates

What Happens When We Add Tests for Creativity and Leadership?

- Creativity and Leadership are the third and fourth criteria established in Colorado law for identifying gifted students
- We know that as the correlations between different test scores fall, the percentage of students identified as gifted will increase
- The evidence suggests that the correlations between creativity, leadership, and general intellect are quite low
  - In "*A Meta-Analysis of the Relationship Between Intelligence and Leadership*", Judge, Colbert and Ilies conclude that the correlation between these two is .27
  - And in "*Can Only Intelligent People Be Creative: A Meta Analysis*", Kyung Hee Kim finds that the correlation between IQ and the results on creativity tests is only .17
- The evidence also suggests that the correlation between leadership and creativity test results is also likely to be very low
  - See "*Leadership Styles and Creativity*" by Bosiok, et al, in which the average of correlations between different measures of leadership and creativity was only .09
- This evidence implies that if Colorado were to consistently test for outstanding creativity and leadership, the number of students identified as gifted would substantially increase

Conclusions

- Today, districts in Colorado predominantly uses tests of general intellectual ability and achievement as screening criteria for gifted education
- Many districts do not employ universal gifted screening
- 11% of Colorado students in Grades 3 through 10 have been identified as gifted
  - Based on the student demographic data for the 2013 Math TCAP
- This analysis shows that the current identification rate implies a significant under-identification of gifted students in Colorado
  - For example, in Jeffco, which has universally screened for five years using tests of general intellect and achievement, the same TCAP data show a 14% gifted identification rate
  - This implies that with universal screening, an additional 3% of Colorado students would likely be identified as gifted
- Jeffco's experience also indicates that students from at-risk populations are likely to have been disproportionately under-identified due due to the lack of universal screening
- The question facing legislators is whether the educational benefits of identifying as gifted an additional 3% of students who are now overlooked are greater than the additional costs associated with HR14-1102