Does Our District "Overidentify" Gifted Students?

Background Briefing

April 2013

Jefferson County Association for Gifted Children

Agenda

- The Issue
- How Colorado Defines a Gifted Student
- Background on Psychometric Testing
- Psychometric Testing Example
- The Impact of Using Multiple Criteria to Identify Gifted Students
- Testing the Overidentifiction Conjecture
- Conclusions

The Issue

- At a recent Board of Education meeting, a question was raised about whether our District is "overidentifying" students as gifted
- JAGC performed this analysis to test that conjecture

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 cognitive ability
  - E.g., the COGAT, WISC, or Stanford-Binet tests
  - Jeffco 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 Stanford-Binet 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 and Stanford-Binet, 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 Jeffco Identifies as Gifted

- As previously noted, regulations set a score at or above the 95th percentile on a test as one criteria that can be used to identify a student as gifted
- However, we also know that, because of the standard error of measurement, there is a confidence interval around any student's test score
- A critical identification issue is how we take standard errors into account
- Philosophically, this question is directly related to whether Jeffco is (or should be) more interested in avoiding "Type 1" or "Type 2" Errors when it comes to 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

A Specific COGAT Example

- Let's begin with a baseline scenario in which we do not take the standard error of measurement into account, and set the threshold criteria for gifted identification as a score equal to or greater than the mean COGAT score plus two standard deviations (i.e., 132)
  - This results in the identification of identify 2.3% of students as gifted
- If we reduce this threshold score by one standard error (= 5) to 127, we would identify 4.6% of students as gifted
  - This policy puts more emphasis on avoiding false negative/type 2 errors than it does on avoiding false positive/type 1 errors
  - This policy is implied by the 95% percentile threshold score used in Colorado's state criteria for identifying gifted students
- If we reduce further reduce the the threshold score by two standard errors (= 10) to 122, we would identify 8.5% of students as gifted using just the COGAT test
  - This policy would minimize the probability of false negative/type 2 errors, but would also result in more false positive/type 1 errors

The Use of Multiple Criteria Increases the Percentage of Students Identified as Gifted

- Colorado regulations provide for the use of five different criteria/tests, and not just COGAT, to identify gifted students
  - This is an additional means of reducing the probability of type 2/false negative errors – that is, not providing gifted education programming to a child who actually needs it
- If the average correlation between the results of these five tests is less than perfect (i.e., less than 1.0), the result will be more students being classified as gifted than if only the COGAT test is used
- Consider the following example: Assume five different tests are used, with each one having an average score of 100, a standard deviation of 16, and a standard error of 5. Further assume that the average correlation between the test results is .82. Finally, assume that a score of 127 or higher (i.e., the 95th percentile or greater) is required on one or more of the tests in order for a student to be identified as gifted.
  - We simulated the administration of these five tests to 100,000 students
  - The result was that 10% of the population was identified as gifted – approximately the percentage of students that our District currently identifies as gifted
  - If the average correlation is .71, then 12% of students are identified as gifted

Testing the Overidentification Conjecture

- Based on the result of our simulation analysis, to reject the conjecture that our District overidentifies students as gifted, JAGC has to demonstrate that the average correlation between the different tests used to implement the five Colorado criteria for giftedness is less than or equal to .82 (when 10% of students are identified as gifted) or .71 (when 12% of students are identified as gifted)
- The evidence we have collected suggests rejection of the overidentification conjecture. Consider these reported correlations between COGAT scores and scores on other tests:
  - Iowa Test of Educational Development: .81 verbal; .75 quantitative; .70 non-verbal
  - Woodcock Johnson: .69
- Also consider the very low reported correlations between IQ and leadership (.27, as reported in "A Meta-Analysis of the Relationship Between Intelligence and Leadership" by Judge, Colbert and Ilies), and between IQ and creativity (.17, as reported in "Can Only Intelligent People Be Creative? A Meta-Analysis" by Kyung Hee Kim)
  - Since exceptional leadership and creativity are two of the five criteria for gifted identification, the average correlation between the five tests used to identify gifted students in Colorado must be well below .71

Conclusions

- Rather than being evidence of "overidentification", the percentage of District students currently identified as gifted is a logical outcome of the multiple criteria and tests that are used to identify them
- Based on the statistical analysis we have conducted, and the evidence we have presented, the overidentification conjecture should be soundly rejected