Data Literacy for Student Achievement

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Abstract

Schools are under increasing pressure to address issues of student achievement. These issues include teaching ways to make data driven instructional choices. Teachers must be able to comprehend, interpret and use assessment data to make instructional choices. This article discusses how to promote data literacy for teacher candidates. A seven step process aimed at increasing student achievement through data literacy is provided.
Background

Since the passage of the No Child Left Behind legislation (2001), school districts have used student assessment scores to track and report areas of strength and weakness to the public. More recently, the U.S. Department of Education announced its hope to increase state-wide initiatives that promote data-informed decision making in public schools. In November 2009 Education Secretary Arne Duncan announced the final application for the Race to the Top Fund, a statewide competition to link student performance data with student achievement (U.S. Department of Education, 2009a). States responded to the competition by creating longitudinal data systems that track student achievement (Aarons, 2009). In January 2010, the House and Senate of the Tennessee General Assembly passed a bill that allows Tennessee’s Value Added student achievement data (TVASS) to be used as part of teachers’ evaluations. In March 2010, The U.S. Department of Education announced that two states, Tennessee and Delaware, won the first round of Race to the Top grant money, an award based partially on their use of student achievement data in school reform.

In October 2009, Duncan had focused his comments on teacher education programs. In an October 2009 press release (U.S. Department of Education, 2009b) Duncan suggested that teacher education programs should be accountable for student outcomes. He cited the accountability model used in Louisiana in which student test scores could be linked to teachers, who are then linked with the institution in which they received their teacher training (Noell & Burns, 2006). Accountability for student test scores, it seems, has come home to teacher training institutions. As a result, teacher education programs will benefit by directly addressing student achievement as an intended outcome of the training they provide to candidates.

This article examines a practice to implement data-informed decision making strategies within a teacher education program. The Data Literacy Project is a performance based assessment used in an assessment course. It models school district practices for analyzing high-stakes testing student performance data. The intent of the Data Literacy Project is to engage in a data-informed decision making practice so that when teacher candidates enter school systems as first year teachers, they are familiar with implementing data-informed decision making into their daily instructional choices. The Data Literacy Project promotes data comprehension, interpretation and use. Using local school district student achievement data, teacher educators learn to create formative and summative assessments and instructional strategies as interventions to increase student achievement. For the purposes of this article, “teacher candidates” refer to the students in the teacher education assessment course. “Students” refers to the students in the local school district whose achievement data are being analyzed. “Instructor” refers to the university assessment course teacher.

Data Comprehension, Interpretation and Use

The U.S. Department of Education supports the use of data-driven instructional choices to improve student achievement. In a recent report, the U.S. Department of Education examined the ways in which school staffs use data systems to inform instruction in the United States. The research found that while data informed-decision making is occurring in schools, those decisions have little effect on teachers’ daily instructional decisions (U.S. Department of Education, 2009c). Practicing teachers may not have the training to bridge their analysis of the data and the changes required in instruction based upon that data. Their school districts may not provide the needed supports and educators’ own teacher training may not have provided instruction in making data driven instructional interventions. Teacher training on effective uses of data-supported decisions may help to bridge this gap and support daily use of data to inform instruction.

Possessing competence in data comprehension, interpretation and use are central skills of making data informed decisions in schools. The U.S. Department of Education (2009c) analyzed which data systems were available to teachers and how teacher use the data. Along with knowing where data can be
found and asking good questions about data, their research cited the following essential skills for data informed decision making by teachers:

*Data Literacy Skills*

<table>
<thead>
<tr>
<th>Data Comprehension</th>
<th>Manipulates data from a complex graph to support reasoning.</th>
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<tbody>
<tr>
<td></td>
<td>Maps between the data and a prose representation of the data.</td>
</tr>
<tr>
<td></td>
<td>Maps between a figure and a prose representation of the data.</td>
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<tr>
<td></td>
<td>Understands a histogram as distinct from a bar graph.</td>
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<tr>
<td></td>
<td>Interprets a contingency table.</td>
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<td></td>
<td>Evidences data comprehension monitoring.</td>
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<tr>
<td>Data Interpretation</td>
<td>Understands the advantages and disadvantages of using disaggregated subgroup data vs. individual student data.</td>
</tr>
<tr>
<td></td>
<td>Attends to distribution and extreme quartiles, not just mean or portion above cut score.</td>
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<tr>
<td></td>
<td>Appreciates effect of a few extreme scores on the mean.</td>
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<tr>
<td></td>
<td>Realizes that more items on a scale or members in a sample produce more precise, reliable estimates.</td>
</tr>
<tr>
<td></td>
<td>Understands measurement error and variability; results not identical on every testing.</td>
</tr>
<tr>
<td></td>
<td>Understands that student cohorts differ from year to year.</td>
</tr>
<tr>
<td>Data Use</td>
<td>Understands how to differentiate instruction based on data.</td>
</tr>
<tr>
<td></td>
<td>Seeks subscale and item data that can be mapped to the curriculum.</td>
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<tr>
<td></td>
<td>Understands value of formative assessments.</td>
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*Modified from the U. S. Department of Education, 2009c*

Comprehending, interpreting and understanding the ways data should be used for instructional interventions are all necessary to make informed data driven decisions in schools. Teacher candidates need to practice each skill within their education programs so that new teachers begin their careers with data use literacy and competence. Colleges of education can make these skills a priority in their programs by addressing them in their assessment courses.

*Seven Steps to the Data Literacy Project*
How can teacher education faculty teach future teachers to practice the three skills of data comprehension, interpretation and use? One way is to use the Data Literacy Project in teacher candidate assessment courses. The Data Literacy Project requires that teacher candidates analyze current student assessment data, discover the strengths and weaknesses of the data set, determine which formative and summative assessments should be used in the upcoming year before the next district or state assessment is given and create a plan for instructional strategies to deal with weaknesses. The Data Literacy Project allows teacher candidates to collaborate in a group to reach competencies in data comprehension, interpretation and use. There are seven easy steps to the Data Literacy Project:

1. **Enlist support from the local school districts.** Local educational agencies collect data annually on their students. Data that can be rendered anonymous or public use data are appropriate for teacher educator candidates. Data sets may include district, school or individual classes. Create positive relationships with school personnel who understand the value of data use literacy in teacher education and recognize that such literacy will enhance the competency of incoming teachers. Provide copies of those data sets to teacher candidates in the assessment course for review.

2. **Create grade level or content oriented teams.** In practice, teachers in local school districts may meet in grade level or content level teams to analyze school data. Replicate this process with teacher candidates, allowing for elementary and secondary divisions, or teams based upon content for teacher candidates at the secondary level. Teams of 4-5 people are ideal as they simulate grade or content level teams. Students will collaboratively analyze the data set that was selected for their grade level/content area. In contrast, the instructor may provide several content areas and grades and ask the teacher candidates to take several days to generate a general understanding of all the data sets provided, finally settling on one data set to analyze for the Data Literacy Project. The instructor might consider providing a research day for students to research the test itself. Allow time for teacher candidates to understand the nature of the assessment (Dibels, Stanford Achievement, End of Course Assessments, State Tests, etc.). Ask the teacher candidates to understand how the tests are used in schools, when they are given, and general characteristics of the test.

3. **Analyze the strengths and weaknesses of the data set.** The data sets from the school district may vary in reporting style, depending on the assessment. State assessments may designate standards and level of proficiency (advanced, proficient, below proficient). Other assessment data may include Average Reporting Category Performance Index (RCPI) where whole state data is compared to system or school data. Ask the teacher candidates to analyze the data for strengths and weaknesses, using numeric data to support their analyses. Ask them to provide numeric charts and graphs and a narrative, describing why they have chosen a particular strength or weakness. If a particular data set shows high proficiency, ask the teacher candidates to address areas that may be improved from proficient to expert levels. In addition, ask the teacher candidates to identify smaller groups of students who are exhibiting non-proficient student achievement levels and who may be targeted for instructional interventions. Ask teacher candidates to include sub-groups in their analyses of strengths and weaknesses.

4. **Use state standards and local curriculum guides.** Before the next step of creating assessments based upon weaknesses in student achievement data, teacher candidates must become familiar with the state standards that apply to their data set. Ask the teacher candidates to research the standards that apply to their data set generally and the sub-standards for weakness areas, if given. The assessment data they are analyzing may report specific content areas. Where are these content areas found in the state standards? Are there sub-standards? When should the standards be addressed according to local curriculum guide calendars or pacing requirements? These resources are often found online and are helpful for teacher candidates to practice working within a system that requires instructional interventions grounded in state and local standards and curriculum pacing guides.
5. **Create both formative and summative assessments.** Using formative assessments to inform teaching promotes student learning (Stiggins, 2005). In this step of the Data Literacy Project, students think about the assessment procedures they will incorporate as interventions based upon the strengths and weaknesses of the assessment data. After student weaknesses have been identified, teacher candidates create assessment ideas for the period leading up to the next high stakes testing period. Ask the teacher candidates to brainstorm weekly formative assessments and monthly summative assessments to gauge student learning in the determined weakness areas. The assessments they create serve the purpose of increasing student learning through the school year so that when the next standardized tests are given, perceived weak areas have been directly addressed through both summative and formative assessments. State standards should be correlated to each assessment.

6. **Create specific instructional strategies as interventions to address weaknesses.** Once weaknesses have been identified and assessments have been constructed to gauge student achievement, the teacher candidates must decide how they would address those weaknesses within the classroom. Which instructional strategies might be used to specifically address the weakness area? When will the district teachers use the instructional intervention? Determine a minimum amount of instructional strategies that each team must identify. Ask the teacher candidates to detail each instructional strategy and why that strategy will impact the designated area of weakness. The research supporting the instructional strategy choice should be cited, thus promoting the use of research based instructional strategies. Instructors might require teacher candidates to detail differentiated instruction for each identified weakness. Instructional strategies should be correlated to state standards.

7. **Write a final report.** Practicing teachers are often required to create a report of their data analyses and plan for their administrator. Require the same report for the teacher candidates. Teacher candidates may download a common report format and individually create a professional report, based upon the collaboration of their Data Literacy Project group. The report includes:

- data literacy group members
- the type of data set
- the specific test
- when the test was given
- strengths and weaknesses of student performance
- numeric, graphical and narrative descriptions of the weakness areas
- formative and summative assessments to be given prior to the next testing period and instructional strategies for interventions.
- the final report should include professional language. The instructor of the assessment course plays the role of the school administrator in evaluating the data analyses and instructional interventions.
This Data Literacy Project may best work as a capstone performance assessment, after students have mastered supporting concepts from the assessment class such as the use of standardized testing, measures of central tendency, validity and reliability, norm and criterion referenced tests, measurement data, and formative and summative assessments. In addition, the assessment course may best be sequenced concurrently with an instructional strategies course, as both content areas are necessary for successful data literacy competence. In many states, teacher candidates should also be versed in value-added data use. Analysis of these data offers a different perspective into achievement data accountability than the traditional criterion or norm referenced measures given in many states. Individual teacher effect data are not generally available but some districts report local and school-site valued added effects to the public and those reports provide rich data for teacher candidate analyses. Each data set offers unique insight into the varied ways the teacher candidates may be evaluated or evaluate their own students when they begin teaching.
Conclusion

Teachers may be the single most important factor in student achievement (Rivkin, Hanushek & Kain, 2005; Sanders & Rivers, 1996; Bransford, Darling-Hammond & LePage, 2005). Teachers who use student achievement data report an increase in the identification of student needs and increased self efficacy in the classroom (Heritage & Chen, 2005). Helping future teachers understand the impact they will have on their students’ achievement should be a central concern of teacher education. Teacher training programs should focus on preparing teacher candidates to learn the uses of data driven decision making in their classrooms. The Data Literacy Project is a capstone exercise aimed at promoting data comprehension, interpretation and use for the purpose of increasing student achievement. It uses a seven step process to enhance teacher candidate data use literacy. When teacher education addresses student achievement as a central outcome of their programs, their teacher graduates will enter the field of education with competency in data informed instructional interventions.
References


