Data-Driven Instruction

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by

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Table of Contents

Introduction ......................................................... 7

Collecting High-Quality Data ................................. 10
  Sources of Data ........................................... 11
  Data Quality ............................................. 13

Interpreting Data .................................................. 16

A Model for Data-Driven Instruction ...................... 19
  Pre-Assessment ......................................... 21
  State Tests .............................................. 22
  Formative Assessment .................................. 23
  Ancillary Data .......................................... 24
  Summative Assessment .................................. 28

Using the Data-Driven Instructional Model .............. 30

References ......................................................... 32
Introduction

We are in the midst of an assessment revolution. Many reformers feel that, in order to reform schools, we must develop local, state, and national standards for our students. The plan is to assess these standards with statewide testing programs and to make the results public in the name of accountability. If we do that, it is assumed, reform and improvements will ensue. This has resulted in reform by coercion.

Educators are coerced into becoming instruments of the statewide testing program in order to convince the public that all is well in the schools. This is allowed to happen because test scores are easy for the public to follow; therefore statewide testing programs, even those involving high stakes, are becoming the norm. All 50 states have statewide student testing, and graduation is contingent on performance on statewide exit exams or end-of-course examinations in 19 states (Doherty and Skinner 2003). However, most state tests do not provide trustworthy data on student achievement (Klein and Hamilton 1999).

Stiggins questions the “notion that intimidation by assessment will lead to more effective schools” (1999,
p. 192). Education improvement is much more likely to be manifested as a result of proper use of high-quality, classroom-level assessment. As Popham (2001) indicates, we must make student response to classroom assessments central to instructional decision making. It is very important to "ensure that every teacher is gathering dependable information about student learning day-to-day and week-to-week and knows how to use it to benefit students" (Stiggins 1999, p. 193). Meaningful reform will be much more likely under these conditions.

It can be argued that schools do not actually need drastic reform but merely steady improvement at the instructional level. Bracey makes the point quite well that schools in general are in much better condition than the reformers indicate and that many reformers have a political, rather than a school improvement, agenda (2002). The rise in popularity of charter schools and, perhaps, statewide testing provides evidence of public dissatisfaction fueled by politicians with politically motivated and often skewed data. Public opinion is overly influenced by single measures (such as a state test) and by politicians who tell the public what to believe. All this is done in the name of accountability.

Good teachers always have been accountable to themselves and their students. Such teachers tend to believe that teaching is learning and, therefore, continually improve their practice. Teachers who really learn in their classroom go on to become the very best teachers. Teaching is such a complex endeavor that it is likely never to be perfect, but the best teachers attain satisfaction from the effort of trying to continually improve.
Improvement may be defined and driven by the making and implementation of quality decisions.

Education improvement efforts should begin at the classroom level by striving to improve the knowledge and decision-making capabilities of teachers. If teachers make quality instructional decisions on a daily basis, then instruction will improve. Such high-quality decision making depends on the use of high-quality information or viable data. In other words, high-quality decision making is data-driven. Since instruction is a series of decisions, it follows that instruction should be data-driven.

Of course, teachers making decisions is nothing new; they make many decisions on a daily basis. What is needed is for teachers to become more systematic in the collection, analysis, and interpretation of data in order to facilitate high-quality decisions more consistently. If we are going to effect lasting improvements in K-12 schooling, teachers must take action and implement worthwhile, data-driven improvements in practice at the local level. McLean (1995) makes a very strong case supporting this argument, pointing out that a high-quality data-collection program is likely to do more to improve instruction than any other innovation. Thus it is necessary to the improvement process to make high-quality data-based decisions at the classroom instruction level. Teachers represent the group most able to do this.
Collecting High-Quality Data

Data should be thought of as information. In the context of the classroom, they should be thought of as information potentially useful in improving instruction, in addition to reporting student progress. Thus data can be any information that has the potential to diagnose problems and analyze solutions.

Teachers collect tremendous amounts of data by both informal and formal means. Just observing students as an activity progresses results in a very large quantity of information, much of it useful for improving instruction. Formal data collection through the use of such means as tests, quizzes, and projects adds even more useful information for the improvement of instruction. The many and varied means available to the classroom teacher to collect data help that teacher improve the overall instructional process, including the selection of goals, instructional activities, and assessment means. The teacher's task is to sort through the vast quantities available and to plan instruction that will aid individual student progress.
Sources of Data

The process for collecting and using data is called assessment. Assessment is used here in place of such expressions as measurement (data gathering) or evaluation (making judgments). Assessment is an ongoing process that incorporates both measurement and evaluation as they apply to the improvement of teaching and learning (Tanner 2001). Assessment involves the collection of data from many and varied sources, rather than being limited to only student performance information.

Assessment goes far beyond merely collecting information in order to calculate grades for students. It is a process that provides data for the improvement of instruction and the overall evaluation of education programs. Obviously, the quality of instruction is directly related to the performance of students; and student assessment data are a vital source of information for improvement in the quality of instruction.

The best assessments are developed by teachers, rather than imposed from outside. Teachers have better knowledge of the classroom situation; as a result, their assessments will reflect the classroom environment more accurately. The teacher also has the added benefit of receiving immediate feedback.

Assessment must be a continuous process because a continuing feedback loop is vital for facilitating communication. Quality communication is fundamental for productive teaching.

Considerable assessment is done informally in the typical classroom. Teachers make informal observations
(measurement) of students' reactions to instruction and then make judgments (evaluations) based on their impressions. Although much productive information is obtained in this fashion, individual teachers would fare better if they formalized more of the effort and thus increased the quality of their assessments.

Assessment can take many forms, ranging on a continuum from fixed choice to complex performance assessment (Linn and Gronlund 2000). Each represents a source of data. Fixed-choice assessment typically involves the more traditional approaches to assessment, such as chapter tests and quizzes requiring a selected response or a brief constructed response.

Multiple-choice tests are the most widely used form of fixed-choice assessment. In any form of fixed-choice assessment, the student is presented with a series of prompts and chooses a correct response. For example, in the true-false form of fixed-choice assessment, the student chooses whether the statement is true or false. Such measures can be used to assess a wide range of cognitive capabilities (Popham 1995). Such measures also are relatively easy to score and therefore often are used when a large number of students is taking an examination.

In performance assessments, students demonstrate that they have mastered skills and tasks by performing or producing something. For example, writing creative essays, building models, making collections, and conducting experiments. Performance-based assessments are, by their nature, less objective than are fixed-choice forms. In addition, the answers are seldom as clear cut as are the answers in a multiple-choice test.
Performance assessments offer many advantages. For example, such assessments encourage teachers to view assessment as an integral part of the learning process and not just as the end. Furthermore, teachers who make extensive use of performance assessments tend to involve students in their instruction. Performance assessments also provide teachers with the opportunity to involve students in the evaluation of their own work. This often leads to more meaningful student learning.

Performance assessment is not new. For decades, teachers have assessed student progress by asking them to complete a project or write an extensive essay. What is needed is for teachers to consider performance assessment, along with such other techniques as tests, as one of the many sources of assessment data that are useful for instructional improvement.

Data Quality

Every assessment that takes place in the classroom is not necessarily a high-quality assessment. Therefore one is not always assured of high-quality data. The quality of classroom assessment data is determined in large measure by their utility for improving instruction. If the assessment was completed just to produce a grade report, the data are unlikely to be of much use in improving instruction. High-quality assessments provide high-quality information to help make instructional decisions.

The quality of classroom assessment data is a function of reliability, validity, and objectivity, the three most
important attributes of measurement. Often these terms are applied incorrectly to the measuring instruments themselves, but they refer to the data and the quality of inferences based on the data.

Reliability refers to the consistency of the data one collects. Reliability is based on the amount of error in the measuring process and tools. The more error creeping into the results, the less reliable the information.

As a general rule, teacher-made measures produce rather unreliable results, while standardized measures tend to produce quite reliable results. The commercial test makers have had ample opportunity to correct many of the sources of error in their tests, but the typical teacher does not have much opportunity to rework measurement tools in a controlled setting to increase reliability. However, internal reliability errors, those that are inherent in the instrument, usually can be reduced by constructing longer instruments with diverse question types and levels and by making extensive use of questions that have been proven in previous measures.

The teacher also must concentrate on removing as many of the external sources of measurement error as possible. Examples of external sources of error during measurement are the noise level of the classroom and the number of interruptions during the administration of the instrument. Teachers can have some control over such factors.

Validity refers to how believable are the information and the inferences produced by examining the data. Validity is a function of the match between the measure and the knowledge and skills being measured. Teachers must work to ensure a very close match.
If one has valid data, valid instructional decisions are much more likely. The classroom teacher can help to ensure validity by making certain that assessment is focused on clearly defined objectives. In addition, the teacher must consider the validity of data in terms of their relationship to instruction. Data may be quite valid but not be of much use in developing instruction.

Objectivity is the third important characteristic of measurement. Objectivity is the degree to which equally competent scorers obtain the same results from the same measurement (Linn and Gronlund 2000). That is, it involves the degree to which the scorers' judgment or opinions influence the results.
Interpreting Data

In order to effectively interpret data for the improvement of instruction, one must score the results in a reliable, valid, and objective fashion. This usually presents little difficulty on classroom tests and quizzes, which are at the fixed-choice end of the assessment continuum. However, more complex performances often require additional scoring mechanisms.

One such scoring scheme that has become prevalent in recent years is the rubric. A rubric is a descriptive scoring scheme used to rate the level at which students are able to perform a task or demonstrate knowledge. Rubrics generally are organized around a scale containing four or five performance levels, each level ranging from poor to excellent. Various other terms may be applied to name each of the levels. Each of the levels has specific criteria for reaching that level. These levels often are identified with a letter grade or numerical score.

Rubrics help to make a judgment more objective; and they often are used for performances that are quite difficult to judge, such as writing samples. The use of rubrics helps to ensure that the judgment is more objective and valid. Thus rubrics should be simple to follow and, of
course, fair. To ensure fairness, each level of performance must be defined as clearly as possible. In addition, involving students in developing the rubrics helps classroom communication and develops ownership of the process by the students.

While rubrics contain criteria and a scale that may be used to make judgments about complex performances, checklists simply list the components that must be in a performance or product. The teacher merely checks those that are present. The primary difference between checklists and rubrics is that no judgment of quality is present in a checklist. Checklists are easy to use but are limited to determining only the presence or absence of a skill or performance.

Rating scales are another means of securing data about student performance. Like checklists, rating scales identify portions of the performance that have been completed. Unlike checklists, rating scales are not limited to determining only the presence or absence of a performance; rating scales are used to judge the degree to which particular parts of the expected performance are accomplished.

Regardless of the scoring method used, teachers must decide what the data mean and how to make use of the information. In order to interpret the data, the teacher needs to organize the data in some fashion, such as in graphs or tables. There are a variety of forms in which the data can be organized, such as frequencies or percentages. The form a teacher uses will depend on the nature of the assessment procedure.

Once the data is organized in a meaningful fashion, the teacher can analyze the results and decide what the
data seem to involve, what they do not involve, and what additional information will be needed to improve instruction.

Data may be classified as either criterion- or norm-referenced (Linn and Gronlund 2000). When it is norm-referenced, the students' work is described in terms of the performance of their peers. The data derived from standardized achievement tests are usually norm-referenced. Such data often are used by school administrators and school boards to compare local progress with other schools or districts, in which case the results are described in terms of group performance.

The classroom teacher is more interested in individual performance, rather than group performance. Thus the classroom teacher must make extensive use of criterion-referenced data. Criterion-referenced results are interpreted in terms of the number of criteria met or the degree to which one met a criterion. The performance of other individuals is not considered. The data describe what the student can or cannot do, not how well they performed compared to others. When a classroom teacher prepares an examination, it should be based on the instructional objectives and interpreted in terms of the progress of individual students.
A Model for Data-Driven Instruction

Data-driven instruction is the collection, analysis, and interpretation of meaningful data in order to facilitate high-quality decisions about instruction. Data-driven instruction constitutes a fundamental shift in the way educators view the purpose and nature of assessment. The primary purpose of data collection by schools should be to diagnose problems and to analyze possible solutions, rather than simply to evaluate students.

Many schools use the data collected on a schoolwide basis merely to assess student performance and to inform the public. Rarely do these schools take the necessary next step: to develop high-quality instruction based on that data. However, many schools are using data-driven instruction to great effect. For example, Carrie Martin Elementary School used their data effectively to score the second-highest gains on the 1998 Colorado State Assessment in reading and writing. According to Liddle (2000), they “used the assessment program to measure everything that affected student performance. Then, we changed or cut anything that didn’t improve achievement.” The school used the Northwest Evaluation Association (NWEA) achievement level tests, which are
custom designed to work with a given curriculum and to predict how well students will do on state tests. The school relied on pre-assessment and state content standards to identify student needs and learning styles. That information was used to plan and implement more appropriate instruction for each child (Liddle 2000).

The classic instructional model described by Popham and Baker (1970) begins with the statement of objectives followed by pre-assessment of the objectives. Then instruction is presented, followed by evaluation and any needed instructional revision. In today’s classroom, instruction begins with content area standards determined by the state or district, and the instructional objectives are derived from those standards. As in the classic model, the teacher is confronted with the problem of developing instruction to accomplish the objectives.

Assessment is the key to the instructional planning process, and the collection of high-quality data is the key to assessment. Because assessment is the key to planning high-quality instruction, it becomes very important to incorporate a variety of assessments in the classroom. Using a variety of data collection techniques enhances the validity, reliability, and objectivity of the measurements. Validity is enhanced by increased variety because any given student is more likely to find an assessment procedure that allows that student to demonstrate his or her degree of progress. For example, not all students are able to demonstrate proficiency through a paper-and-pencil test; many students can demonstrate that learning better through the use of an individual project.
Pre-Assessment

After determining objectives, the next step is pre-assessment of the objective. Pre-assessment is the first source of data in the data-driven instruction model. The procedure involves administering an assessment tool, usually a teacher-made, paper-and-pencil test that will identify the strengths and weaknesses of individual students. The purpose is to enable the teacher to determine which objectives to stress and, on occasion, which objectives to eliminate because the students already have mastered them.

The pre-assessment usually is a brief look at a sample of student performance on the objectives in order to plan instruction that incorporates the correct objectives in a logical order. If time is a concern, the pre-assessment may consist of a brief handout of the proposed objectives, followed by verbal questions from the teacher to assess student knowledge of the topic. The resulting classroom discussion can be quite revealing and can prove very effective for planning appropriate instruction.

In introducing a new set of objectives to the students, the teacher may decide that the material is sufficiently novel and forgo the pre-assessment. However, as a general rule, it is best to at least sample the objectives using some form of pre-assessment.

The use of pre-assessment provides the added benefit of having a benchmark to compare with a post-measure. This allows the teacher to demonstrate individual accountability. The successful teacher will demonstrate meaningful student gains based on a comparison of
measures taken before and after instruction. Often, this better demonstrates successful instruction than does student performance on a state-mandated examination. However, the state-mandated examinations, in some cases, provide information useful in planning instruction.

**State Tests**

A second source of data for data-driven instruction is feedback from state tests. These data can be used to improve instruction, though teachers should keep in mind that instructional improvement is not the purpose of these assessments. State-level assessments seldom offer suggestions for instructional improvement; instead, they are designed to evaluate individual schools, districts, and teachers and to inform the public of the results.

As a means of improving instruction, statewide testing programs often fall short for several reasons. First, the results of the testing program may not reach the classroom teacher in a timely fashion. Test scores that arrive months after the test is completed are unlikely to have an effect on instruction. In some instances, the teacher is working with a new group of students by the time the results are in for the original class. While teachers may like the state standards because of the direction they provide for instruction, such tests do not provide the much needed feedback for instructional improvement.

Data from some statewide tests can be used to identify strengths and weaknesses. If the statewide testing information is reported in terms of individual standards
mastered and not just a report of how well the student performed on the overall measure, the teacher should have usable information for future planning. Information concerning which standards were taught well can, of course, be quite useful in developing long-range instructional plans. Occasionally, the teacher may even be able to derive information concerning which topics were successfully taught and which were not.

**Formative Assessment**

A third source of data for instructional improvement is formative assessment. Formative assessment is an ongoing assessment of objectives in order to monitor student progress. Such assessment does not involve a letter grade but, instead, provides continuous feedback to the teacher and the student regarding the student's progress.

The purpose of formative assessment is to monitor and adjust instruction. Formative assessment may involve a variety of assessment strategies, such as weekly quizzes, examination of student work, listening to student responses, and observing the motivation level of the students as they work. Formative assessment may be particularly important when trying out a new instructional sequence.

Formative assessment can be formal, such as the use of frequent quizzes that are given for feedback only, or informal, such as careful monitoring of student verbal and nonverbal responses to the information and activities. In general, formalizing the process results in much more reliable and valid data.
Formative assessment may involve any of the many forms of assessment. The difference between formative assessment and other forms of assessment is in its purpose. Formative assessment provides feedback to teachers that allows them to adjust their teaching methods. For example, if the medium of instruction has consisted mostly of “telling” strategies that do not appear to be accomplishing instructional goals, the teacher can easily shift strategies in order to improve effectiveness.

Ancillary Data

Additional data, other than that directly related to the objectives, also should be collected. Teachers have access to very large quantities of data, and the task often becomes one of sorting data and collecting any additional information that is needed, then making appropriate use of the results. For example, a student’s permanent file usually contains information on classes taken and grades earned, various disciplinary reports, health information, and other data that are useful in planning instruction.

For convenience in organizing ancillary data, the following categories are suggested: 1) Ability to Learn, 2) Opportunity to Learn, and 3) Motivation to Learn.

*Ability to Learn.* If high-quality teaching is defined as leading students’ inquiry or facilitating their learning, teachers would be well advised to change their focus from teaching to learning. That is, their focus must change from “What is the best way to teach?” to “How do my students learn best?” This leads to the fundamental question: “How does one measure ability to
learn?” In order to answer this question, teachers must obtain data from a wide variety of sources, which may include examining student work, conducting interviews, administering questionnaires, and studying the previous achievement records of the students.

The teacher also may assess student learning styles and then attempt to match the type of instruction to each student’s learning style. For example, it can be very useful for the teacher to know whether a given student learns best through the visual or auditory modes. The goal of all such assessment activities should be to determine the ability of individual students to learn so that high-quality instruction may be planned accordingly.

*Opportunity to Learn.* Data in this category result primarily from an examination of possible roadblocks to student learning. It is useful to consider data from three areas that may contribute roadblocks to student learning: 1) the nature and quality of teaching resources; 2) the nature and quality of the classroom learning environment; and 3) the nature and quality of the school learning environment.

Investigating the nature and quality of teaching resources varies from simply counting supplies to trying to determine if an additional resource, such as a new classroom computer, would truly aid instruction or merely complicate it. Such an examination of the availability and effect of classroom resources is an ongoing task.

Teachers provide their students with an opportunity to learn by providing enough time and other resources to enable them to achieve to the best of their ability.
However, sometimes teachers inadvertently hold students responsible for learning material that they had little opportunity to learn. For example, teachers often limit the amount of time on a topic to the same amount for each learner, though it is obvious that we do not all learn at the same pace. Some students simply require more time to master a task.

Another obvious example of an instructional problem is when the written resources are not at the appropriate reading level for all, or even most, of the students. If it seems that reading comprehension is a problem, then the teacher must modify the resources. This could be accomplished in many ways, such as providing for a variety of reading levels or providing additional resources that do not rely heavily on reading comprehension.

The individual classroom environment and the total school environment are important variables affecting the opportunity of students to learn, and they should be investigated systematically. Teachers particularly should examine their individual classroom environment because it is more under the teachers' control than are most other factors. Personal interviews with selected students, classroom questionnaires, and class meetings are all methods of data collection in this area. The schoolwide environment can be carefully examined in a similar fashion.

*Motivation to Learn.* Most educators would agree that student motivation is one of the most important and powerful variables in the learning environment. But how does one measure motivation? In order to answer the question, the classroom teacher must realize that
student motivation is primarily a function of student attitudes and interests along with the rewards associated with learning.

No doubt tests and grades have an influence on student motivation. Likely the most common questions in many classrooms are “Does this count?” and “Will this be on the test?” While Stiggins (1999) points out that assessment itself can serve to motivate students, it must be remembered that assessments that intimidate students typically do not increase motivation. A more effective approach is to provide assessment in such a fashion as to ensure some success for every student. The fundamental task of a teacher is to learn each student’s capabilities, to reinforce those capabilities, and to lead the student to the next higher level. Increments of success, even small ones, tend to motivate most people. Therefore the teacher must design assessments so that all students can experience at least a small measure of true success. That is a very difficult job, indeed.

Educators have been measuring attitudes and interests for many years. The process usually involves questionnaires supplemented by teachers’ anecdotal records and, possibly, interviews. Through the collection of meaningful attitudinal data, along with information concerning student interests, the teacher attempts to design instruction that has the potential to be motivating.

Interest inventories are another tool to help the teacher prepare more meaningful instruction for students. The preparation of an interest inventory need not be a daunting task. Often an interest inventory will consist of one question in which students are asked to rank a selected
group of activities. Another option is to provide an open-response question regarding student likes and dislikes.

**Summative Assessment**

The collection of summative data provides information regarding how well each student completed the instructional sequence, as well as useful direction for the next instructional sequence. The purpose of summative assessment is to measure and subsequently evaluate the degree to which the instruction has been completed. Comparing pre-assessment with summative assessment enables the teacher to demonstrate accountability by examining the gains of students.

Summative assessment typically involves chapter or unit tests. Portfolios also can be an excellent tool to acquire summative data for the teacher's decision-making process. Portfolios are collections of student work that demonstrate quantity and quality over an extended period of time. Portfolios should be more than a folder filled with student work samples. To be useful in assessing instruction, portfolios must be a systematic collection of work that clearly indicates both student effort and progress.

A very useful means of acquiring comparison data has been described as the split and switch design (Popham 2001). The first step in this design is to prepare two forms of the test and to administer one form as a pretest to one-half of the class. The other form serves as the pretest for the other half of the class. Following instruction, the forms are switched and used for the
While the accountability movement has had some negative consequences, the data-driven instructional model may be one of its positive outcomes. If instruction is driven by valid, reliable, and objective data, the accountability movement will have made a very positive step toward meaningful reform.
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