

Using Formative Testing at the Classroom, School, and District Levels

Formative tests administered periodically throughout the school year provide an effective way to discover and correct problems in teaching and learning.

KATHERINE CONNER,
JERALD HAIRSTON, INEZ HILL,
HENRY KOPPLE,
JOHN MARSHALL,
KAREN SCHOLNICK, AND
MARCIA SCHULMAN

Formative testing is a simple, highly effective tool that can profoundly affect both learning and the climate in which learning takes place. Formative measures are ones used during instruction to improve learning and teaching rather than after instruction to grade and rank. Use of the formative process is not limited to the classroom level; it can be extended to the school and district levels, where it is commonly called either formative evaluation or monitoring student progress.

In Philadelphia, the Affective Education Program, Office of Instructional Projects, Curriculum and Instructional Development, has used the formative process in the context of mastery learning and school improvement programs for the past eight years. The most extensive implementation has been carried out in mathematics for grades K-8, in collaboration with the Office of Mathematics Education. We describe here how Philadelphia employs the formative process at the classroom level in the context of mastery learning and briefly outline its application at the district level. We concentrate, however, on its use at the school level.

The Classroom Level

Teachers who use formative tests in their classrooms in the Philadelphia Mastery Learning Program have produced dramatic increases in the proportion of students mastering unit objectives. The unit failure rate has been reduced to 10 percent.

Like mastery teachers elsewhere, they begin by preparing formative tests that correspond to their unit goals before they begin teaching. After all the material has been presented to the students, with emphasis on the expectation that all of the students can master it, the teachers administer the first formative test, explaining to students that the test is being given so that both teacher and students can find out what has been mastered and what still needs to be worked on. During the next class period, students receive feedback: not just an overall score, but a report of what they have mastered and what they still need to learn. Then students who have mastered the material either do enrichment work or serve as peer tutors; those who did not achieve mastery work with the teacher in groups or individually. The last step is a second test, which is the basis for the unit grade. The entire sequence,

illustrated in Figure 1, usually takes from five to 12 class periods.

Use of the formative test enables teachers to organize instruction for the last part of the unit. The formative test also "forms" or "informs" future instruction, because its results will suggest more effective methods of teaching the unit in future years.

To ensure that teachers use the formative process as fully as possible, the Philadelphia Mastery Learning Program makes it a key part of staff development and classroom follow-up. Teachers are trained to analyze test scores for indications about successes, problems with particular units, and how the needs of individual students are being met. They also use staff development time to work with other teachers to find ways to help students who have not yet mastered the material. Program staff members also meet periodically with individual teachers to discuss their classroom implementation; included in these visits is a discussion of what can be learned from the scores of all the completed units. In all cases, the emphasis is on diagnosis, problem solving, and sup-

port—not on making excuses for failures or on blaming.

One way to examine the results of the Philadelphia Mastery Learning Program is to analyze the changes in students' performance between the formative and end-of-unit tests. These data come from teachers trained in any of three ways: in off-site training groups, faculty meetings led by staff members, or on-site cluster meetings led by experienced mastery teachers. Figure 2 is a summary of data collected from 1981 through 1985 that encompasses 11,700 units from grades K-12 in all major subject areas.

The School Level

Fifteen elementary schools in the Philadelphia Mastery Learning Program are now using Mastery Mathematics schoolwide. This means not only that the Mastery method is recommended for all these teachers, but also that the formative process is used at the school level as well. The schoolwide formative process begins with setting a schoolwide goal that reflects a high level of progress for virtually all stu-

dents. Progress is measured by student scores on the district's Mastery Mathematics Tests. For grades 1-8, Philadelphia employs a set of criterion-referenced mathematics tests with two or three levels per grade that correspond to the levels of the mathematics curriculum. The Mathematics Office has developed parallel sets of grade-level Mastery Mathematics Tests for each major topic (such as numeration, addition, fractions, and problem solving). This saves work for the teachers, provides instructional consistency, and facilitates schoolwide goal setting and monitoring of student progress.

The principal collects test scores periodically (usually twice each three-month marking period). Instead of filing the scores in a folder, the principal or mathematics specialist analyzes them to discover what is going well and areas where further help is needed by students or teachers. Feedback is provided, either by a brief note or collaborative conference, with emphasis on how school resources can be used to produce higher achievement. Later, there is follow-up to determine if the new strategies are working.

Figure 3 details how the formative process is carried out at the school level and suggests ways to make the process maximally effective. The process is formative in several senses:

1. If ways are found to help students master early units on which they didn't succeed (perhaps through the use of

Figure 1. Classroom Sequence of the Formative Process

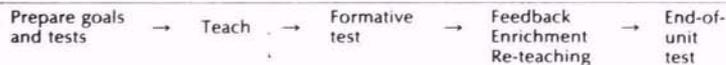


Figure 2. Change from Formative to Summative Tests: Summary, 1981-1985

	FORMATIVE			SUMMATIVE		
	Master (80-100)	Passing (70-79)	Failing (Below 70)	Mastery (80-100)	Passing (70-79)	Failing (Below 70)
Percent of Students' Unit Scores	61	15	24	81	9	10

Figure 3. The Formative Process at the School Level

Steps	More Effective When . . .	Less Effective When . . .
1. Stating the Belief System	<ul style="list-style-type: none"> ● Emphasis is on developing student ability. ● There is commitment to learning for all students. 	<ul style="list-style-type: none"> ● Emphasis is on identifying the "best" students.
2. Setting Goals and Measuring		
a. Goal	<ul style="list-style-type: none"> ● There is a shared goal (between principal and staff members). ● Goal is explicit and clear. ● Goal is significant. 	<ul style="list-style-type: none"> ● Goal is imposed. ● Goal is not explicit or clear. ● Goal is frivolous.
b. Measurement device	<ul style="list-style-type: none"> ● Test is criterion referenced (measures specific objectives). ● Criteria are objective. ● It is manageable. ● It is valid and systematic. 	<ul style="list-style-type: none"> ● Test is norm-referenced (separates students on curve). ● Criteria are subjective. ● Measure is difficult to score.
3. Collecting Data		
a. Recording form	<ul style="list-style-type: none"> ● The year's work is divided into small units that can show interim progress. ● The fewest possible entries are made. 	<ul style="list-style-type: none"> ● The year's work is divided into large units that cannot show interim progress. (The information is available only once or twice yearly and does not provide a way to take action that year). ● It is complicated and in an overwhelming form. ● Many entries are needed.
b. Collection	<ul style="list-style-type: none"> ● There is regular, periodic collection. ● There is a definite, explicit procedure as to who gets information. ● Forms are promptly returned to teachers. 	<ul style="list-style-type: none"> ● Data is collected only once or twice yearly. ● It is unclear who gets forms. ● There is a delay in returning forms to teachers.
4. Acting on Test information		
a. Data analysis	<ul style="list-style-type: none"> ● Data are analyzed promptly. ● Adequate pacing is considered. ● The percentage of students mastering each test is considered. ● Particular students having trouble are considered. ● Proper placement is considered. ● Positive and negative aspects are both considered. 	<ul style="list-style-type: none"> ● Data are collected but not analyzed. ● Only negative (or positive) aspects are considered. ● Coverage of material, but not mastery, is considered. ● Mastery, but not pacing, is considered. ● Individual students are not considered.
b. Feedback	<ul style="list-style-type: none"> ● Feedback is current, specific, and objective. ● There is a balance of positive and negative aspects. ● It is direct to individual teachers. ● The focus is kept on students. <i>In faculty meetings:</i> ● It is specific, but no teacher is identified—balanced. ● It is visible, clear, and current. 	<ul style="list-style-type: none"> ● It is general. ● It is not current. ● It is evaluative. ● It is punitive. ● Teachers feel blamed. <i>In faculty meetings:</i> ● Individual teachers are singled out in front of peers. ● It is difficult to understand or not current.
c. Support	<ul style="list-style-type: none"> ● It is goal-directed; the focus is on students who aren't making it rather than on teachers. ● Actual support is provided. ● Resources are redirected when needed. 	<ul style="list-style-type: none"> ● No help is provided to the teachers. ● Teachers see the process as blaming or checking up on them. ● Teachers are told when they are wrong, but no help is provided.
d. Follow-Up	<ul style="list-style-type: none"> ● The principal indicates at the initial conference that there will be follow-up. ● It is informal and casual at first. ● It is supportive. 	<ul style="list-style-type: none"> ● It is done by surprise. ● It is formal and impersonal. ● It is threatening.

tutoring or resource teachers), they receive credit for mastery.

2. Since each major mathematics topic is taught at least twice yearly, first-semester analysis can help "form" and "inform" the instruction for the second half of the year.

3. Most important, instead of receiving final scores in June for teacher and student evaluations, the principal or specialist is involved in a continuing collaborative relationship with teachers to help improve teaching and learning.

The actual strategies teachers and principals use vary widely. Examples

include using specialized teachers; employing peers, older students, or parents as tutors; instructing unprepared students in prerequisite skills before beginning new units; using computer instruction; and using special incentive systems. The key to success will not be found in a magical instructional method, but rather in belief in students' abilities and perseverance in the use of new strategies until success is achieved.

Figure 4 shows results from the schools that fully implemented Mastery Mathematics in the 1983-84 school year. Students' progress in the

mastery schools, a representative group of Chapter I schools, is compared with the progress of Chapter I 1st through 6th graders citywide. (In most grades, two levels represent a year's growth.)

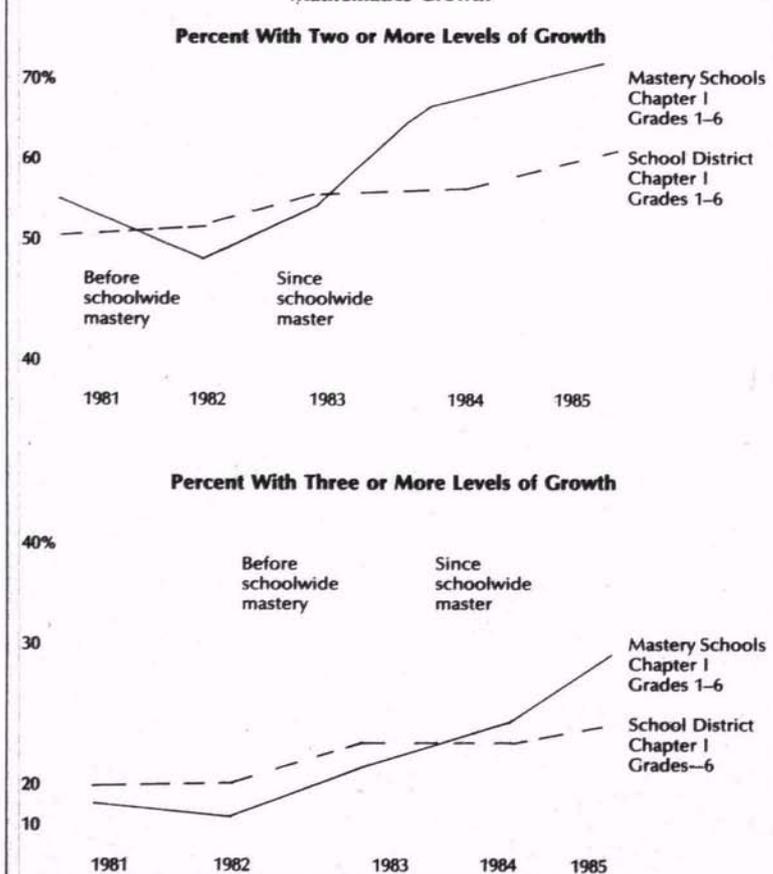
The schoolwide formative process in Philadelphia is not limited to mastery learning schools or mathematics. Schools in the Replicating Success program use the process for reading as well as mathematics in order to enhance student progress, and schools in the Affective Education Program's Communications Network program use it in relation to the five-step writing process. The formative process can be used at the school level even if all classroom measures are summative, as long as information is criterion-referenced and collected periodically during the year.

The District Level

It is also possible to apply the formative process at the district and sub-district levels. This requires a district goal, periodic data collection and analysis, and the application of district resources to solving problems indicated by data. The units of time will be longer at this level than at the school level (by marking period or semester) and the units of analysis larger (by school and classroom rather than by unit and student); however, the principles are the same. This process is now occurring in several of Philadelphia's sub-districts, and it includes reading as well as mathematics.

The Philadelphia School District is also moving from the California Achievement Test to a new districtwide testing program conducive to formative uses. The test in grades K-8 will provide reports on mastery of the curriculum's objectives as well as nationally norm-referenced comparisons, and it will be administered twice yearly so that the information can be used formatively. The secondary schools are also moving toward standard systemwide midterm and final examinations, which will be helpful at the system level for formative purposes.

Figure 4
Mathematics Growth



“... the emphasis is on diagnosis, problem solving, and support—not on making excuses for failures or on blaming.”

Figure 5. Essential Features of the Formative Testing Process

Stating the Belief System	<ul style="list-style-type: none"> • Virtually all students can learn what schools teach to a level of excellence. • The primary role of schools is to define learning goals and ensure that all students master them. 		
	Classroom	School	District
Setting Goals and Measuring	<ul style="list-style-type: none"> • Goals relate to unit content. • Two tests are given per unit (formative and end-of-unit). 	<ul style="list-style-type: none"> • Goals relate to school-wide achievement. • Tests are criterion-referenced and aligned with school curriculum. 	<ul style="list-style-type: none"> • Goals relate to district achievement. • Tests are criterion-referenced and aligned with district curriculum.
Data Collecting	<ul style="list-style-type: none"> • Administer formative test after instruction. 	<ul style="list-style-type: none"> • Collect test data (by class) periodically throughout the year. 	<ul style="list-style-type: none"> • Collect test data (by school) periodically throughout the year.
Acting on Test Information	<ul style="list-style-type: none"> • Teacher provides feedback and re-teaching based on results of formative test. 	<ul style="list-style-type: none"> • Principal (or delegate) analyzes test results, meets with teachers, engages resources to solve problems, and follows up on solutions. 	<ul style="list-style-type: none"> • Superintendent (or delegate) analyzes test results, meets with principals, engages resources to solve problems, and follows up on solutions.

Essential Features

We have found four features to be essential to the formative testing process at the classroom, school, and district levels:

1. *Stating the Belief System.* Underlying a methodology that uses the formative process is a fundamental belief that all students can learn what schools teach and the fundamental purpose of schooling, and hence of testing, is to

develop students' abilities (Bloom 1976). Without this belief, the formative process is reduced to a mechanical process.

2. *Setting Goals and Measuring.* Formative tests do not stand alone; they proceed from, and are used to measure, specific content objectives. Formative measures are designed to determine which objectives students have mas-

tered and which ones they still need to work on, or to identify classes or schools that need help. Formative measures are therefore criterion- or curriculum-referenced, rather than normed to produce a bell curve.

3. *Collecting Data.* In a formative process, information about students' progress toward stated goals is collected periodically *during* the instructional process so that problems can be identified while there is still time to correct them.

4. *Acting on Test Information.* Data are analyzed and problems diagnosed to find and engage the resources needed for resolution and follow-up. Strategies used vary with the needs of the students or school, but it is essential to believe that improvement is possible and to persevere until it is a reality.

Figure 5 summarizes how the essential features of the formative testing process are applied at the classroom, school, and district levels. If any of these four features is omitted, the process is probably better avoided. This is true not only because the process requires time and energy, but because the effort and hope it mobilizes in students and teachers are a trust that should not be betrayed. □

References

- Block, J. H., ed. *Schools, Society and Mastery Learning*. New York: Holt, Rinehart and Winston, 1974.
- Bloom, B. S. *Human Characteristics and School Learning*. New York: McGraw-Hill, 1976.
- Bloom, B. S., Hastings, J. T., and Madaus, G. F. *Handbook on Formative and Summative Evaluation of Student Learning*. New York: McGraw-Hill, 1971.

Katherine Conner is Supervisor, Affective Education; **Jerald Hairston, Inez Hill, John Marshall, and Karen Scholnick** are Teacher Trainers, Affective Education; **Henry Kopple** is Assistant Director, Replicating Success; and **Marcia Schulman** is Mastery Coordinator, Mathematics Education; all with the Philadelphia Mastery Learning Program, Affective Education Program/Instructional Projects, Room 321, Board of Education, 21st and Parkway, Philadelphia, Pennsylvania 19103.

Copyright © 1985 by the Association for Supervision and Curriculum Development. All rights reserved.