

# Draft

## Quality Management in the Classroom

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### Quality Measurement vs. Quality Management

A simple definition of quality is “adherence to specification”. The realization of the principle that quality requires a formal standard was the beginning of a revolution in thinking. Basing education quality on standards is a recognition of that principle.

But the revolution in thinking was not translated into effective action until a second idea was added: *continual process improvement*. Continual process improvement transformed *quality measurement* into *quality management*.

Without continuous process improvement the ability to measure quality cannot effectively be translated into action. Consider the case of automobile manufacturing. In the 1970s, before the deluge of high-quality Japanese automobiles hit the U.S., Detroit was already practicing standards-based manufacturing. There was a standard that defined a 100% specification-compliant automobile, and some sample of the output of each production line was tested against that standard. As a practical matter, final inspection was performed by customers, who would compile their lists of a dozen or two defects in the first few weeks they had their new car, in the hope (of both the customer and the manufacturer) that most of the defects could be fixed by the dealer.

Before the introduction of continual process improvement into automobile manufacturing, final inspection could not be translated into quality assurance for two reasons: Firstly, it was too expensive to test every vehicle and to remediate every defect. Secondly, there was no feedback loop that reached back into the production process that could translate the *discovery* of an error into the *future elimination* of that error.

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### **Continual Process Improvement in the Classroom**

The parallels between automobile manufacturing and education are clear. We are implementing quality measurement by instituting standards, but quality management through continual process improvement in the classroom is not yet on the horizon.

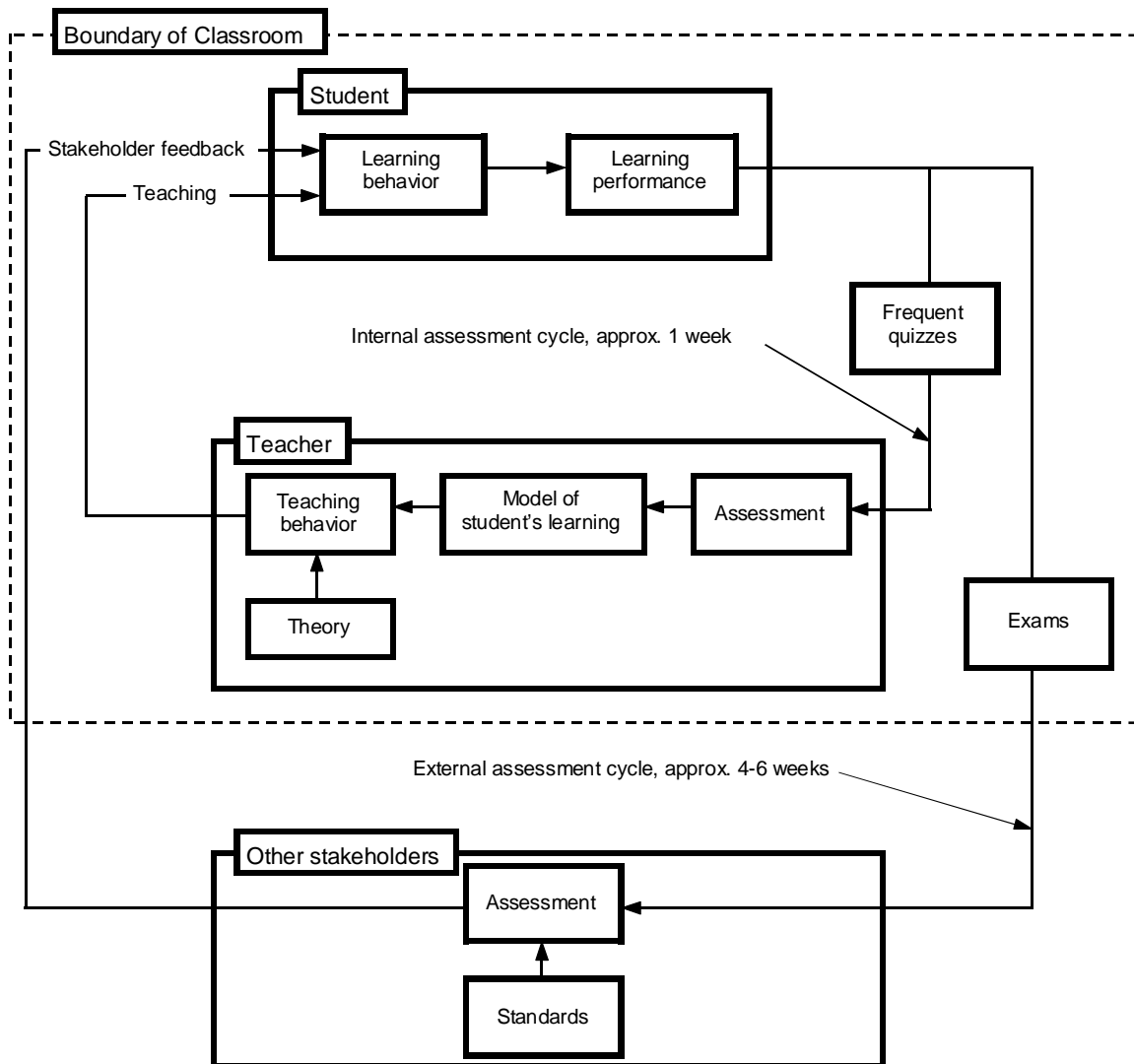
It is my intent to create a classroom in which techniques of continual process improvement will be continually sought and then implemented.

In order to put continual process improvement into practice, the classroom process must be understood; I use a flow model for this purpose. The model must contain feedback by means of which quality issues are discovered and the process is modified to resolve these issues.

### A Model of the Classroom Process

This figure shows a simple flow model of the teaching/learning process.

There are three large vertically arranged rectangles with heavy solid borders, representing the three participants: the student, the teacher, and other stakeholders such as parents and administrators. The flow arrows represent cause-effect relationships, with the flow going from cause to effect.



A model of the student-teacher interaction

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The principal assumptions are:

- changes in the student's learning performance are driven by changes in his/her learning behavior;
- changes in the teacher's teaching behavior are driven by changes in the teacher's model of the student's learning, plus the teacher's understanding of the craft of teaching and of the subject matter;
- the teacher's model of the student's learning behavior correctly diagnoses the learning needs of the student; and
- changes in teaching behavior cause changes in learning behavior.

### **Feedback Loops Improve the Performance of the Student *and* the Teacher**

There are two feedback loops. The top loop runs from the student to the teacher and back. The bottom loop runs from the student to the other stakeholders and back.

The top feedback loop is called the internal assessment cycle; it is driven by frequent quizzes occurring approximately weekly. The bottom feedback loop is called the external assessment cycle; it is driven by examinations occurring approximately every 4 to 6 weeks.

The internal assessment cycle is primarily for the benefit of the teacher; it provides him with the data he needs to make midcourse corrections to the way he is presenting the material to the student. Of course the student also benefits from this frequent feedback, but the value of the information is not primarily for evaluation of the student but for the evaluation of the *teaching process*, for which the teacher is accountable. The student is not to be punished for poor quiz results if they lead to responsible midcourse corrections in the student's learning behavior. This policy is made real to the student by using not all the quiz scores in the student's final grade, but perhaps only the scores of the best two-thirds of the quizzes. This policy is transparent to the student; she knows (1) how she is doing and (2) that the teacher is actively working on her behalf.

The external assessment cycle is primarily for the benefit of the other stakeholders; it is the grading cycle. The longer period of the external cycle is meant to smooth out the midcourse corrections that the teacher and student make as the result of the internal assessment cycle. The intent is that the teacher and the student work together to optimize the student's learning behavior and hence his/her learning performance. The internal assessment cycle occurs entirely within the classroom and has several chances to get things right before the student is evaluated by any audience outside the classroom.

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The fact that there is a model should not suggest that the teacher's responses are mechanistic. "Teaching behavior" means everything it has always meant, *enhanced by current knowledge* of the state of the student's understanding, and *supported by resources* that enable the teacher to make full use of that knowledge.

Quality can only be measured against objectives. The objective of the teacher is to maximize the opportunities to learn effectively that are presented to each student. The objective of each student is to maximize his/her performance, given these opportunities. As a practical matter, these maximizations occur incrementally, on a day-by-day basis. Absolute standards may be of interest to the other stakeholders but the teacher and the student are driven continually to improve on previous performance.

In the model shown here the teacher can analyze quiz data to evaluate and improve his own performance. In my experience the interpretation of such data is not necessarily straightforward; sometimes the data can be paradoxical. Either way, it is the teacher's responsibility to draw the right conclusions and to apply them toward the continual improvement of his own work.

### Implications of the Model

This discussion may look more like a research proposal than a strategy statement. The reason is that I don't see much in the way of support—in curriculum design, books, or other materials—for the model presented above.

If continual process improvement is to be put into practice according to the above model, the teacher needs to evaluate the performance of every student weekly and, in the most extreme case, needs to make a pedagogical midcourse correction for each student each week. If the teacher is responsible for 100 students the demands on the teacher are well beyond the current state of the teaching art. What is needed to bring the state of the teaching art in line with the demands?

- **Fine-grained learning units.** The subject material must be divided into concepts fine-grained enough so that a concept can be mastered by an average student in a week (or less) and an evaluation can be performed as a part of that week to determine whether the student has successfully mastered that concept. Ideally this should be a go/no-go evaluation containing some diagnostic information so that the decision can be made to make another pass at the same concept from another direction.
- **Non-labor-intensive diagnosis.** The weekly evaluation of concept mastery cannot be the usual

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small problem set designed by the teacher for the whole class. In the extreme case, the weekly quiz is individualized for each student. Thus, the concept mastery evaluation should be an integral part of the package that presents the concept material.

- **Alternative approaches for each learning unit.** Each concept is ideally supported by at least one mode of presentation and evaluation that favors every learning style, including cooperative learning.
- **Individualized hands-on experimental apparatus.** Primary-school math, with its Cuisenaire Rods, is ahead of high school physics in the practice of self-directed individualized learning. We need an approach to the design of individualized *desktop lab equipment* that supports the fine-grained learning units.
- **Low-overhead classroom.** There must be a social contract in the classroom that places the responsibility for learning and for the management of the learning process on the student, not the teacher. (This is not an appeal for the over-application of computers to classroom management. That does not work for all learning styles.)

The classroom model nearest to what I have in mind is the Montessori pre-school, in which the teacher has the freedom to apply his/her talent to the child representing the greatest learning opportunity at the moment and the teacher can make the rounds of the entire class in one class period.