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Precision Teaching: Measuring and Attaining Exemplary Academic Achievement

By Carl Binder

How do students know when they've successfully mastered a skill or body of knowledge? How do their teachers or parents know? Alternatively, how do students and teachers decide when to change their approach to achieve a particular learning outcome because the current method is not working? As basic and objective as these questions seem, educators generally have not done a good job in providing answers. Moreover, the lack of adequate mastery criteria for most curriculum objectives is a primary cause of educational failure today.

Behavioral Fluency: The Goal of Teaching and Learning

For many years educators have spoken and written in great detail about "criterion-referenced instruction"--a process in which teachers and learners work to satisfy specific mastery criteria for each skill or knowledge objective in a curriculum. However, a hidden assumption that it is possible to define mastery of skills or knowledge by specifying only an accuracy or quality criterion (e.g., 100% correct) undermines what would otherwise be an effective educational strategy.

This assumption is faulty. *The true definition of mastery is fluency, a combination of accuracy (or quality) plus speed* which ensures that students will be able to perform easily in the presence of distraction, will be able to retain newly-learned skills and knowledge, and will be able to apply what they've learned to acquire new skills or to real-life situations. Fluency is "second nature" knowledge, near-automatic performance, the ability to perform without hesitation. In short, fluency is true mastery.

This conclusion relies on research from numerous fields of study, but it is also intuitively obvious. Clearly, the difference between a beginner (who will likely forget much of what he or she has recently learned, or have difficulty applying it) and a true expert, is not merely a matter of accuracy. *It is the speed or rate of performance which measurably distinguishes experts from beginners.*

Whether it be speaking a foreign language completing basic arithmetic calculations, reciting knowledge of American history, reading a story aloud, playing the guitar, dancing, or using computer software, masterful performance is quick and nearly automatic, rather than slow and hesitant. People can observe this difference in their own behavior and in the behavior of others. Yet conventional percentage correct scores, the standard in our educational system, cannot differentiate between these obviously different levels of achievement (Barrett, 1979). *Only fluency bridges the gap between mere acquisition of skills or knowledge and truly useful performance*. For example, given a sheet of 150 simple addition problems, most competent adults can write between about 90 and 110 correct answers in one minute, with perhaps one or two errors. This is a reliable, reproducible phenomenon which provides a basis for establishing a true mastery criterion. Compared with such an empirically established performance standard as this, mere percentage correct criteria are meaningless.

Research Background

Research from several different fields, including the study of verbal learning, human factors engineering, human information processing theory, perceptual-motor learning and applied behavior analysis, demonstrates the importance of using timed assessment procedures to define mastery. The findings are

remarkably consistent and confirm an intuitive appreciation that mastery implies speed as well as accuracy of performance in virtually every type of skill or knowledge.

The key findings divide into three broad categories (Binder, 1987): studies which link speed of responding to improved *retention or maintenance* of skills and knowledge; those which show that increased speed improves *attention span or resistance to distraction*; and those which indicate that fluency in prerequisite skills or knowledge supports the *application of new learning* to more advanced or complex performance. In addition, these studies all suggest that in order to achieve true mastery, students must have sufficient opportunities for *practice*, a component of instruction sadly lacking in most current-day educational settings (*see also the article by Carta & Greenwood, p. 16*).

Precision Teaching: A Systematic Approach

The method of instruction called Precision Teaching was first formulated by Ogden Lindsley, who left basic behavioral research at Harvard Medical School in 1964 to develop Precision Teaching at the University of Kansas (Lindsley, 1972). From the beginning, Lindsley set out to "put science in the hands of students and teachers" in the form of measurement procedures designed to support educational decision-making for individual students.

The key components of Precision Teaching are; to set time-based mastery, criteria for each curriculum step, to provide daily opportunities for practice and timed measurement to chart performance on a graph called the Standard Behavior Chart and to change procedures when the chart shows they're not working (Pennypacker, Koenig & Lindsley, 1972; White & Haring, 1980). In the most successful Precision Teaching classrooms, students assume responsibility for their own learning by measuring and charting the results of their own daily practice, and making decisions with their teachers' advice about when and how to change procedures or curriculum objectives. Through charted daily measures of individual students' performance, Precision Teachers have learned a great deal about curriculum, instruction, and the use of time-based mastery criteria as "aims" for teachers and students (Haughton, 1972). With high aims and student involvement in educational decisions, Precision Teachers have enabled students to attain exemplary levels of academic achievement.

A major Precision Teaching finding (Haughton, 1972) is that students must achieve fluency in "tool" skills in order to progress smoothly to more advanced material. A common reason for failure in basic math skills, for example, is that students have not been allowed to achieve fluency in basic number writing and digit reading, despite their being able to perform these skills *accurately*. When they do not achieve sufficient levels of basic arithmetic computation (e.g., 50 to 70 problems per minute), students usually experience difficulty learning long division, algebra and other advanced math skills. Thus, many so-called "learning disabilities" turn out to be no more than a failure of the schools to measure and to work toward fluency in basic skills. Precision Teachers have found that a few minutes per day of timed practice on carefully sequenced skills can often eliminate what were previously considered irremediable learning problems.

A number of Precision Teaching researchers, notably Kunzelmann and his colleagues (Magliocca, L. A., Rinaldi, R. T., Crew, J. L., & Kunzelmann, H. P., 1977), have worked to establish count per minute fluency standards for a wide range of academic skills. Using fluency standards and brief, timed assessment procedures, they've been able to identify students in need of special help with a higher degree of predictive validity, and greater cost-effectiveness than when using more traditional screening techniques. With regular (e.g., monthly) one-minute timings on clusters of skills throughout entire schools and school systems, administrators and curriculum specialists have been able to track students' progress (and program effectiveness) across curriculum areas, classrooms, grade levels, and schools with a remarkable degree of precision and objectivity.

Despite the research indicating the importance of rapid response, *many traditional materials and procedures actually prevent students from ever achieving fluency*. For example, many elementary school workbooks contain pages with so few examples that students receive neither the required amount of practice nor the opportunity to demonstrate fluent performance. Many computer-based aiming lessons restrict the pace at which students can move from one response to another. And common classroom teaching techniques provide such infrequent opportunities for individual responding that students are

unlikely to maintain attention or to become fluent. Precision Teaching has fostered development of materials and procedures which free students to respond as rapidly and as often as they are able.

Precision Teaching Results

Perhaps the most widely cited demonstration of this technology was the Precision Teaching Project in the Great Falls, Montana school district, accepted by the Office of Education Joint Dissemination Review Panel as an exemplary educational model for both regular and special education (Beck, 1979). Teachers engaged elementary school students in 20 to 30 minutes per day of timed practice, charting, and decision-making in a range of basic skills over a period of four years. The results were *improvements between 19 and 44 percentile points* on subtests of the Iowa Test of Basic Skills, as compared with children in control group classrooms elsewhere in the same school district. These are exceptionally large improvements with a comparatively small expenditure of time and effort. In addition, original copies of the materials used for these practice and measurement sessions were available at very low cost from the Precision Teaching Project for unlimited duplication by teachers.

One series of classroom studies (Binder, 1985) showed that simply by adding brief, timed practice periods to the class day, teachers can improve students' performance levels and learning rates. Such explicitly timed practice, independent of any other instructional intervention, may be among the most cost-effective educational methods available. Other less formal Precision Teaching results have shown that children can master entire years of curriculum in a few months, and can learn advanced skills far earlier than usually taught in public schools.

Precision Teaching Dissemination

Many teachers and administrators originally trained by Lindsley and his colleagues have trained others in both school districts and university settings. On the basis of the Great Falls results, Federal funding through the National Diffusion Network supported training by Great Falls staff of thousands of teachers throughout North America. Where local support (often by one or two strong administrators) was available, Precision Teaching flourished, at least temporarily. But in many cases, when new educational "fads" caught on, or when the supportive administrators moved elsewhere, undercurrents of resistance to time-based measurement surfaced. Substantial Precision Teaching efforts ended in these schools for many of the same reasons cited by Watkins (*see p. 10*) for the rejection Direct Instruction.

Nonetheless, there remain growing strongholds of Precision Teaching throughout the country. An important development in many schools has been to combine Precision Teaching as a practice and measurement strategy, with Direct Instruction, the approach proven so effective in the Project Follow-Through studies (*Watkins, p. 7*). Another trend has been toward privatization, the movement of trained Precision Teachers out of public education to form their own schools and tutoring agencies, competing in the private sector on the basis of educational effectiveness. For example, at the Morningside Academy in Seattle, which combines Precision Teaching and Direct Instruction, parents receive a money-back guarantee that their children will achieve at least one year's progress in their worst skill area during a two-month summer session.

Recommendations

The use of time-based mastery criteria by students and teachers provides a much-needed tool for defining, measuring and attaining exemplary academic achievement. Precision Teaching offers a cost-effective method for implementing true mastery-based learning and teaching programs. As a technology on its own, and in conjunction with other instructional methods, this approach offers solutions to a great many problems inherent in current educational practices.

Fluency standards and Precision Teaching make criterion-referenced instruction and testing meaningful and practical. With fluency criteria, it is possible to track individual progress on a daily basis. Ideally, all classrooms should include at least brief periods of timed practice, measurement and charting so that teachers and students can monitor progress toward mastery of basic skills on a daily basis. Because timed practice and measurement are simple to perform and require little if any interpretation of results, we should encourage both students and their parents to conduct timings at home. Even ten to twenty minutes per evening of such activity can serve as an effective practice strategy and as a basis for parents to monitor

their children's learning and to communicate with teachers about day-to-day progress. Unlike the results of achievement testing, daily measures enable teachers, their students and parents to know exactly how well they are doing in the teaching and learning process, and to adapt educational methods to individual strengths and needs before cumulative deficits create major skill deficiencies and learning problems.

Similar to Seeley (1988), who argues for a policy shift in education from "process accountability to product accountability," Precision Teachers tend to experiment fairly widely with instructional methods, while continuously measuring progress toward precisely defined fluency criteria. A key recommendation based on Precision Teaching results is that schools, no matter what instructional methods or curricula they choose, should use empirically-based fluency standards and (at least) monthly assessments on critical skills to define educational success, to compare the results of educational programs, to make curriculum and policy decisions and to conduct cost-effective educational diagnosis and placement.

Experience in the development and dissemination of Precision Teaching suggests that this approach must be mandated from above, and provided support at all levels within school systems. Alternatively, in evaluating agencies in a competitive educational marketplace (e.g., should a voucher system come into effect), both public agencies and educational consumers should use time-based mastery criteria to evaluate relative effectiveness among providers.

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