

Increasing Endurance by Building Fluency: Precision Teaching Attention Span

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Precision Teaching (PT) uses timed and charted measures of students' performance on instructional and practice activities to support a curriculum-based decision-making process. Many precision teachers and their students use 1-minute timings when measuring and charting performance. This is a short but sufficient interval for measuring performance on many academic and simple nonacademic tasks. Moreover, by measuring for exactly 1 minute, teachers and students can avoid the need to calculate count-per-minute frequencies based on longer timings before recording results on a standard celeration chart, which is the basic PT decision-making tool.

However, it may be a good idea to measure performance for either more or less than 1 minute when dealing with the problem of attention span, a common concern among educators. How long can students maintain reasonable levels of performance on a given task? How can teachers increase students' ability to work productively over extended periods? How can educators deal with what are often called *attention deficits*? Precision teachers can provide answers to these questions by systematically varying practice and measurement durations.

By timing and charting students' performance across a range of different durations, educators can learn to deal more effectively with individual differences in attention span. This will also promote a better general understanding of the problem of attention (which precision teachers prefer to call endurance) in terms of the relationship between how long a student performs and his or her performance level.

The Mystery of Attention Span

The concept of attention span: often assumed an almost mystical quality in the thinking of educators. Teachers and clinicians have developed explanatory theories and a diagnostic language about so-called attentional deficits and the problems of inattentive students. Many professionals hypothesize various brain dysfunctions to account for students' inability to maintain focused activities for significant periods of time. Others, willing to assume a greater degree of responsibility for students' learning arrange positive consequences when students remain on task for increasing periods of time (Ferritor, Buckholdt, Hamblin, & Smith, 1972) or they vary instructional content (Krupski, 1979), situations (Wacker, Berg, & Moore, 1984), or level of difficulty (Krupski, 1985) in attempting to improve attention to task.

Precision Teaching offers an alternative way of understanding attention span. The key ingredients of this perspective are count-per-minute measures of performance (Lindsley, 1972); time-based aims, or mastery criteria (Haughton, 1972), and a definition of mastery as behavioral fluency—speed plus accuracy (Binder, 1988). The literature of cognitive psychology contains references to *automaticity* and its relationship to attention span (Bloom, 1986; LaBerge & Samuels, 1974), paralleling PT concern with behavioral fluency.

In general, data from PT classrooms suggest that, until students attain certain minimum levels of speed and accuracy on individual curriculum tasks, they typically lack the ability to maintain steady performance levels for extended periods of time. On the other hand,

when learners approach fluency—accurate, nonhesitant performance—they become able to work steadily for significant durations. Endurance, or attention span, thus follows, or is a byproduct of behavioral fluency. This notion of attention span is very different from the theories suggested by brain state theories or time-on-task definitions.

In addition, accurate but hesitant (nonfluent) performance, when carried on for extended periods, is often accompanied by increased error rates and negative emotional behaviors. This is particularly obvious in students with special needs, although just about anyone has experienced negative feelings when required to perform new skills that were not yet fluent for relatively long periods of time.

Finally, evidence suggests that requiring students to work for relatively long durations before they have attained minimum levels of speed and accuracy may actually depress learning rates.

Effects of Performance Duration on Performance Level

Some of our early observations about endurance were made during the late 1970s in prevocational programs for adolescents with severe developmental handicaps at the Behavior Prosthesis Laboratory of the Fernald State School in Waltham, Massachusetts. In one case, students practiced counting out quantities of small objects to match numerals printed on the outsides of containers. After several weeks of practice for 3 minutes at a time, the teacher changed to 15-minute practice durations. Students who had been counting out between 30 and 50 objects per minute for 3 minutes maintained approximately the same levels of performance for 15 minutes. However, students who performed at between 10 and 30 per minute for 3 minutes fell to below 10 per minute after the change. These observations caused us to look more carefully at the relationship between performance level and duration.

In a series of previously unpublished studies in the Hastings County, Ontario, schools, we attempted to clarify results reported in an article by Van Houten and Thompson (1976). These

researchers were measuring the effects on performance of telling students that they were being timed versus timing them covertly. Unfortunately, Van Houten and Thompson changed from explicit to covert timing at the same time as they changed the duration of timings, thereby precluding an unequivocal conclusion about the relationship of either variable to performance. In their study, second graders wrote answers to single-digit addition problems under two conditions. First, without explicit timing, they worked continuously for 30 minutes. Then the teacher broke the 30-minute intervals into as many separate 1-minute timings as would fit and told students they were being timed. The results were that, even though the total for the successive 1-minute timings was less than 30 minutes, students completed more than twice as many problems as when they worked continuously for 30 minutes.

We suspected that the change from continuous performance to brief intervals may have had a powerful effect on performance independent of whether or not students knew they were being timed. In other words, a series of 1-minute "sprints" caused them to complete many more problems than a single 30-minute "marathon."

In our research, teachers changed performance durations without altering any other conditions. In the study, 75 Hastings County students in kindergarten through eighth grade practiced writing the digits 0 through 9 as fast as they could. On different days they wrote digits for 15 seconds, 30 seconds, 1 minute, 2 minutes, 4 minutes, 8 minutes, or 16 minutes. Those who could write more than about 70 digits per minute for 15 seconds were very close to the same performance levels for up to 16 minutes. The performance of those who wrote more slowly for 15 seconds fell off rapidly as they worked for longer periods. In fact, some students who wrote at about 20 digits per minute for 15 seconds actually stopped writing before the end of 16 minutes. These results show that students who have not yet attained minimal levels of performance cannot be expected to continue working for longer than a brief interval without slowing down considerably or even stopping work.

Effects on Error Rates

When nonfluent performance is extended for longer durations, error rates sometimes increase. Figure 1 shows a Standard Celeration Chart from Nancy, a 7-year-old girl diagnosed as having severe retardation. She lived at home and attended a day-school program, and she was often, aggressive or noncompliant in demand situations. In the charted program, she grasped and released an object, with physical guidance as needed, for 1 minute practice intervals. The incorrect responses were occasions on which she pulled away from the teacher's guidance. After a change to 15-second practice intervals, she continued to improve her fine motor skill, without pulling away during the practice.

Roy, a 9-year-old boy in a day-school program who was diagnosed as having behavior disorders and severe mental retardation, was charted as he practiced putting pieces into a puzzle with prompts from the teacher (see Figure 2). When he worked for 1 minute at a time, there were many instances in which he either placed the puzzle piece incorrectly or threw the piece away from the table. The rate of correct responding was variable between 1 and 30 per minute, with no consistent pattern of progress. When the teacher shifted to working for only 15 seconds at a time, correct responding began to show less day-to-day variability, with errors and noncompliant responses virtually disappearing.

These cases are typical of what we see in many children for whom continuous activity of more than 15 or 30 seconds at a time can stretch endurance, resulting in variable and non-compliant behavior with high error rates. With such students, changing to very brief practice periods can improve performance, eliminate errors, and increase compliance.

Effects on Learning Rates

Another study shifted first-grade students writing to 20 by 2's (a premultiplication skill) from 2-minute timings to 10 minutes and back again. The general finding was a decrease in average performance with the longer duration, as well as a reduction in learning rate. There was a flattening of learning during the 2 weeks of 10-minute practices and an increase in

learning during weeks with 2-minute sessions. Thus, requiring lengthy performance before students achieve sufficient performance levels may actually retard learning. Unfortunately, long practice sessions are common in many classrooms, and they may well be a cause of many behaviors diagnosed as attention disorders.

Implications for Classroom Practice

The practical implication of these findings is that in order to build endurance, or attention span, teachers should first build fluency. Teachers need to be aware that changes in practice and measurement duration may affect students' performance levels, error frequencies, emotional dispositions, and learning rates. Likewise, students who lack fluency in a given skill or knowledge area will tend to have very short endurance in that area.

Teachers can try using timings longer or shorter than 1 minute and comparing performance levels across the different durations. Sometimes shifting to practice durations as short as 15 or 30 seconds can be effective when students are not progressing with other interventions. Practice periods can be increased systematically as students achieve fluency at each duration, thereby building their endurance.

Especially in the beginning of a student's work on a given skill, several brief timings may be more fruitful than one or two long ones. For example, when practicing writing alphabet letters, students can be asked to write *c*'s for 30 seconds, then *l*'s, then *m*'s, and so forth in successive intervals. When they need a rest, they can stop for 30 seconds before continuing on to the next letter. This routine gives students control over their overall practice duration while building fluency and endurance.

Students who lack fluency in prerequisite skills or knowledge are often diagnosed as having attention deficits. Instead of focusing on establishing on-task behavior, teachers should check these students' performance on such basics as grasping and releasing, writing numbers and letters, reading digits, and basic facts

Figure 1

STANDARD CELEATION CHART-NANCY

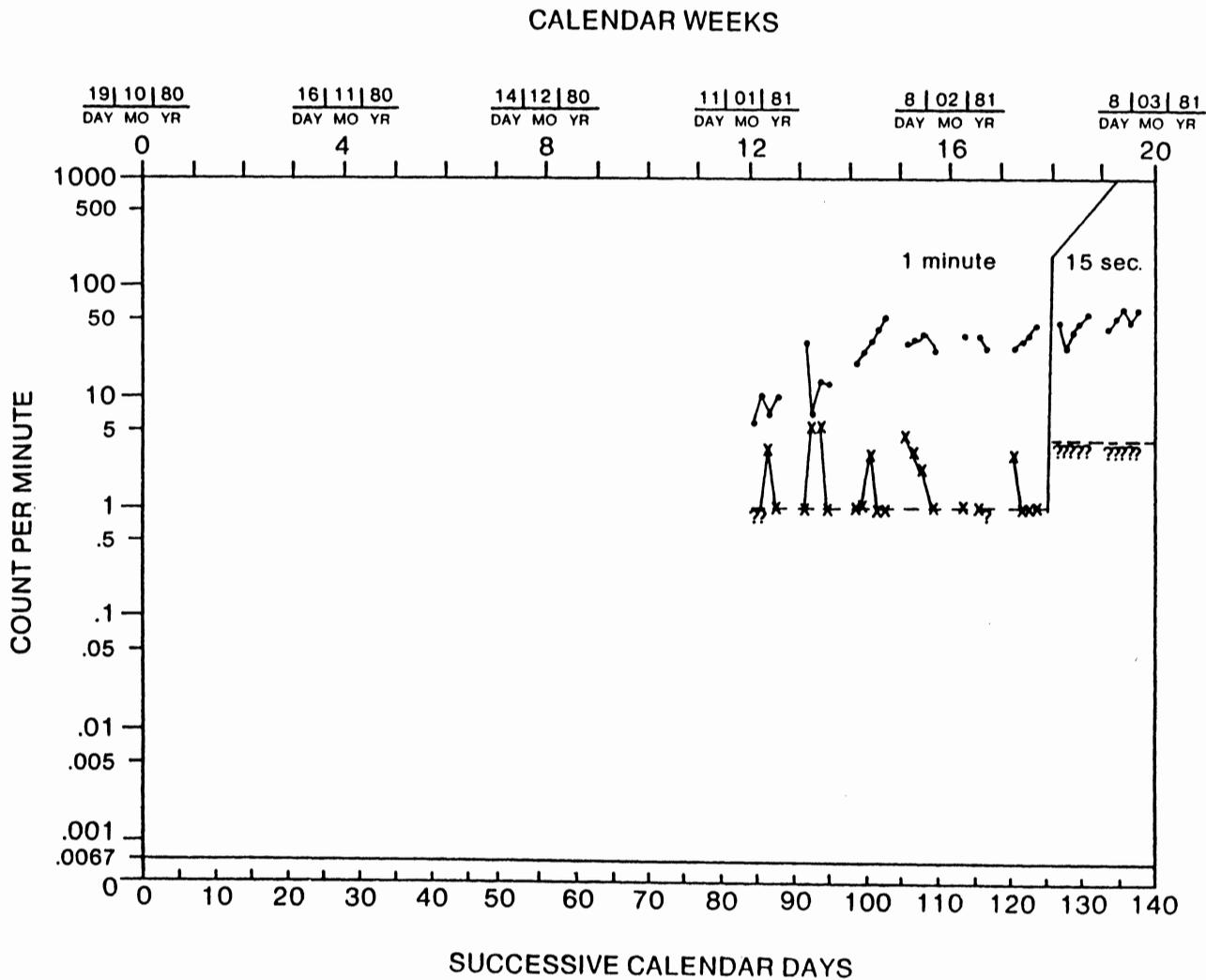
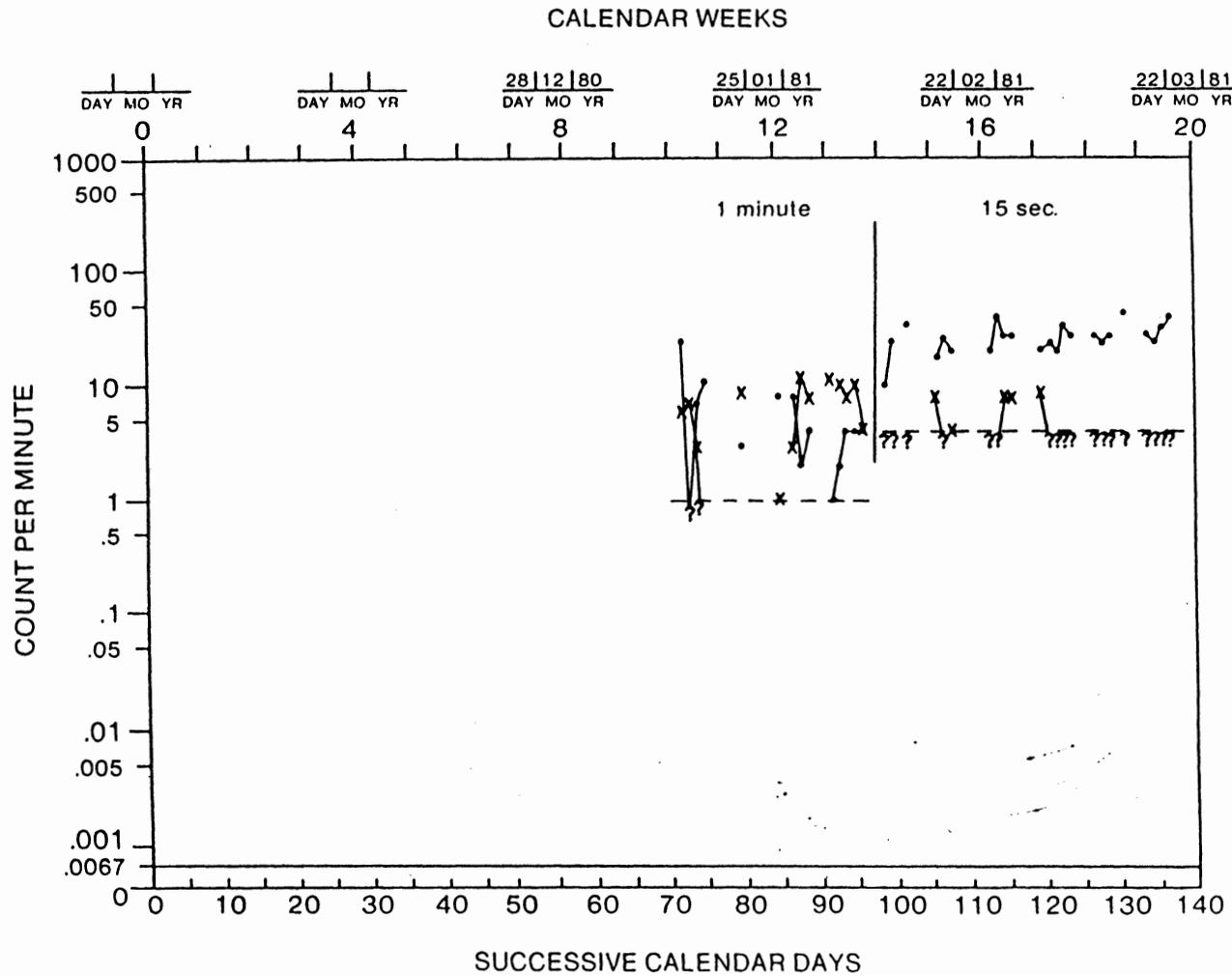


Figure 2

STANDARD CELEBRATION CHART - ROY



(Haughton, 1972). When these skills fall below fluency (e . g., below 50 to 70 facts correct per minute in basic arithmetic), students often have difficulty becoming fluent in, or attending to, more advanced skills. Often, practice on elementary skills to the point of fluency will do wonders for attention span on more advanced work.

Performance should always be evaluated at the duration that will be required in real life, whether in applying skills or knowledge to more advanced curriculum, performing on tests, or using skills and knowledge outside the classroom. If long durations cause problems, teachers can help students become fluent for shorter durations and gradually work up to the required endurance.

Duration changes also should be included among behavior management tools. Sometimes shifting to repeated shorter practice durations so that students can perform at their peak levels for brief intervals will keep them engaged while reducing problem behaviors. Practice durations are then increased as students achieve higher performance levels.

Conclusion

In the final analysis, the goal is to help students perform their best, for however long they are able, and then to provide support and practice that will enable them to maintain that performance for as long as they need to do so. Precision Teaching is a valuable tool for helping teachers achieve that goal.

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