Removing Ceilings on Performance
Early Discoveries and Important Implications

Carl Binder, Ph.D.
Binder Riha Associates
4966 Wilshire Drive
Santa Rosa, CA 95404
1-800-FLUENCY
www.Binder-Riha.com

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Overview

- Background
- Four Types of Ceilings: a Sequence of Discovery
  - Measurement-defined
  - Teacher-imposed (AKA Procedure-imposed)
  - Deficit-imposed
  - Handicap-defined …… *but still trying.*
- Another big one: *Endurance*
- The New Language: *Fluency Blockers & Builders*
- Discussion?

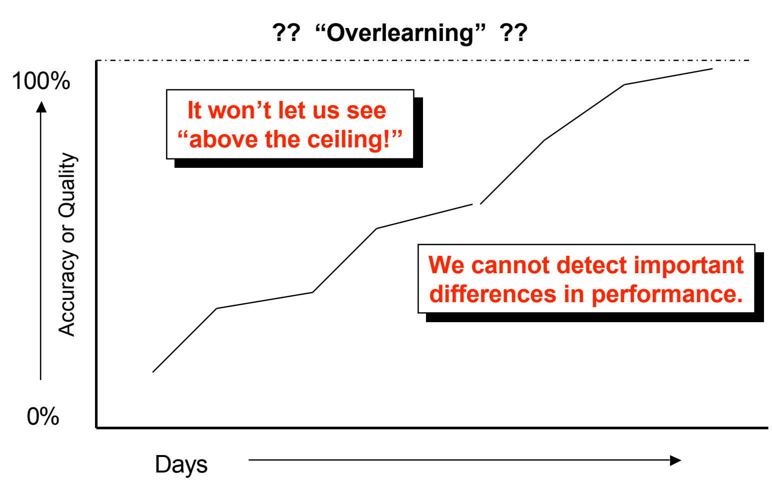
Background and Context

- From Experimental Psychology to the PT Classroom
  - B. F. Skinner and Rate of Response
  - Beatrice H. Barrett: Mother to Scientist-Practitioners
  - Og's "funny blue graph paper" – *and what a difference it made!*
  - Eric Haughton and his pervasive influence
- Synergistic Discoveries, Communications & Applications
  - Boston, Ontario, Kansas, Florida, and elsewhere
  - *The Data Sharing Newsletter*
- From Discrete Trials to Parameters of Pupil Freedom

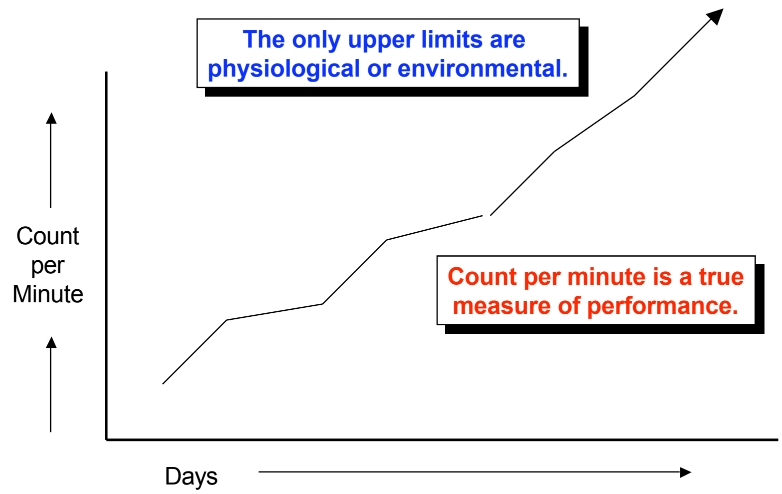
Measurement-Defined Ceilings

- Behavioral checklists – *absence/presence*
- Trapped in the 100% Correct Box!
- Removing the measurement-defined ceiling: *timing, counting and using the Standard Chart*

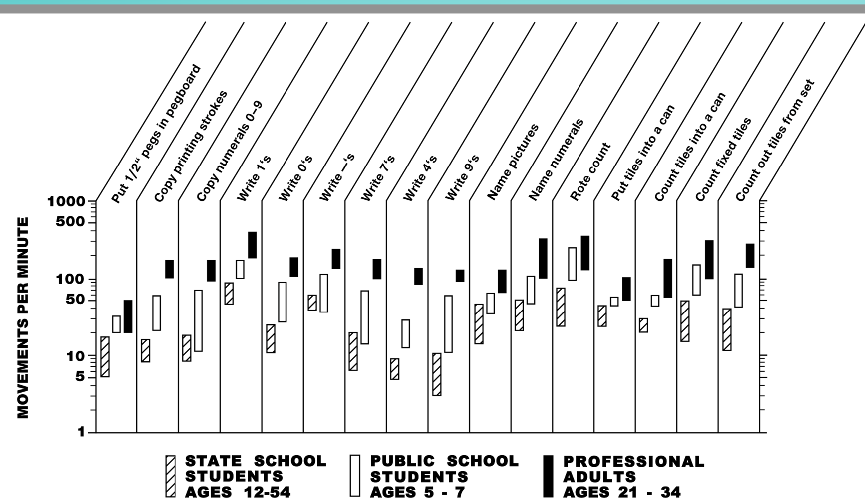
Trapped in the 100% Box!
We've All Grown Up in A Percent Correct World



NO Ceiling on Time-based Measures!

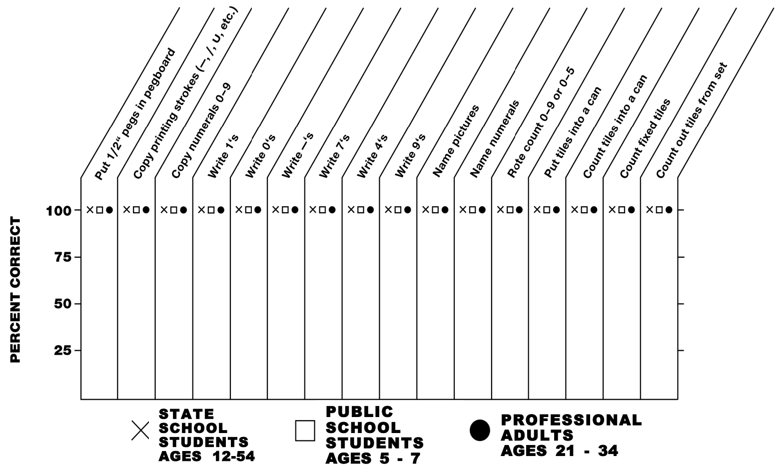


The difference between competence and incompetence is ...



Frequency comparisons on some components and prerequisites of elementary skills
(based on an unpublished pilot study conducted by Frances George and Deborah Pease).

We can't tell the difference with % correct!



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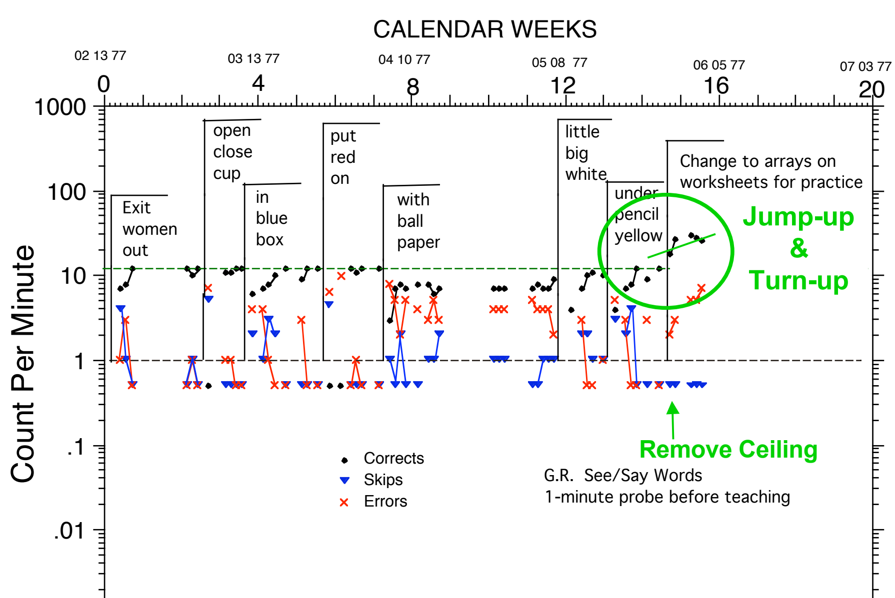


Removing the Measurement-defined Ceiling: *Now We Can **See** a **Teacher-imposed Ceiling!***

Teacher-imposed Ceilings (discrete trials)….

- Prevent us from seeing our students' deficits.
- Prevent students from moving at their own pace.
- Enforce dependence on teachers.
- Discourage self-initiation or continuous behavior.
- Keep students at performance levels far below fluency.
- Repeatedly interrupt students' attention with *"Wait!"*
- Unintentionally cause problem behavior.

*Teacher-imposed ceilings **handicap** our students!*

Removing Teacher-imposed Ceilings

- From cards "trials" to arrays to practice sheets.
- From single opportunities to continuous opportunities (e.g., from imitation "trials" to continuous imitation).
- From single sets of materials to multiple sets (e.g., from counting "trials" to counting beans into multiple numbered cups).
- From teacher-presented to teacher-prompted and "coached."
- Breaking through to "do another one" or "keep going."
- Other strategies?

Whoops!
Removing Teacher-imposed Ceilings revealed Deficit-imposed Ceilings

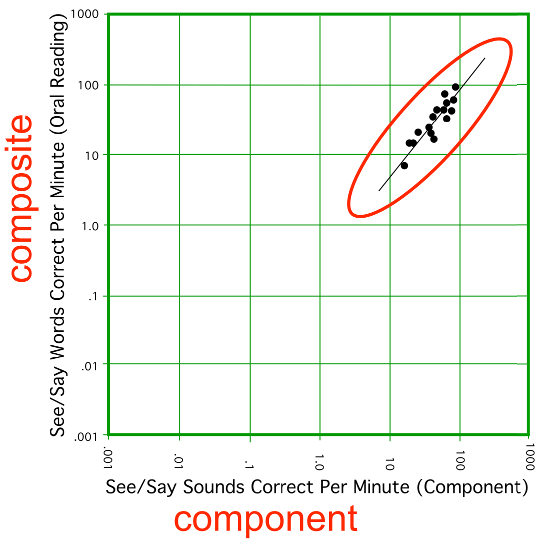
- Academic tool skills limit basic skills (e.g., see/say digits, free/write digits limit see/write sums).
- Motor elements limit self-care and vocational chains (e.g., “Big 6”: *reach, point, touch, grasp, place, release* limit dressing, writing, assembling, etc.).
- Oral motor components limit speech.
- *And so on…….*

Component-Composite analysis became
a central curriculum strategy in Precision Teaching.

Component-Composite Relationships
Non-fluent Components Limit Composite Fluency

- Links and Chains
- Discriminations and skilled movements
- Coordinated movements
- Elements of associations or equivalent terms
- Language used to describe these relationships:
  - Part / Whole
  - Tool Skill / Basic Skill
  - Element / Compound
  - Component / Composite

Fluent Components Enable Fluent Composites
("Application")



Component fluency supports composite fluency

This is true with all kinds of skills

Ray Charles on *Practicing Components*

ROBERT SIEGEL: You practice a lot?

RAY CHARLES: Whenever I can. I don't -- I don't practice as much as I would like to, because I'm not around a big piano all the time. But I try to, you know, I try to practice a little bit every day for the most part.

ROBERT SIEGEL: And when you practice, I mean, do you practice the tunes that you'll be playing at the next concerts......?

RAY CHARLES: Oh, no, no, no, no, no, no, no, no, no, no.....

ROBERT SIEGEL: I guess the answer is no, you're saying?

RAY CHARLES: No. No. I practice things like scales and chords and movement of my hands and things like that, because, I mean, I -- what I'm going to play on stage, I know. What I'm practicing for is to try to improve what I might play, you know. You gotta practice. I mean you gotta keep your fingers loose, you gotta keep your mind active, you know, because what your mind think of -- the question is: what your mind think of, can your fingers play it?

ROBERT SIEGEL: Right.

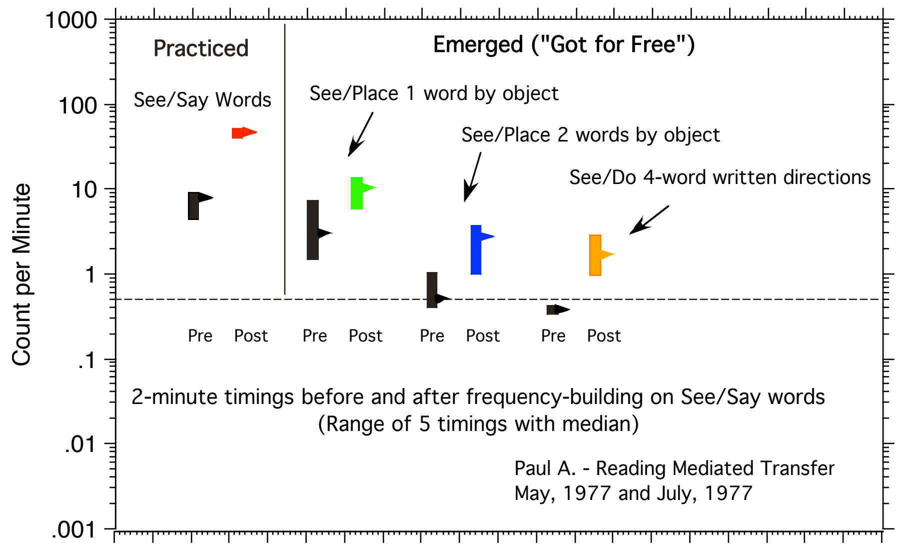
Interview on National Public Radio
Celebrating Ray Charles 50 years in recording
September 23, 1997

Practicing Components in Isolation
Dramatically Improving Application

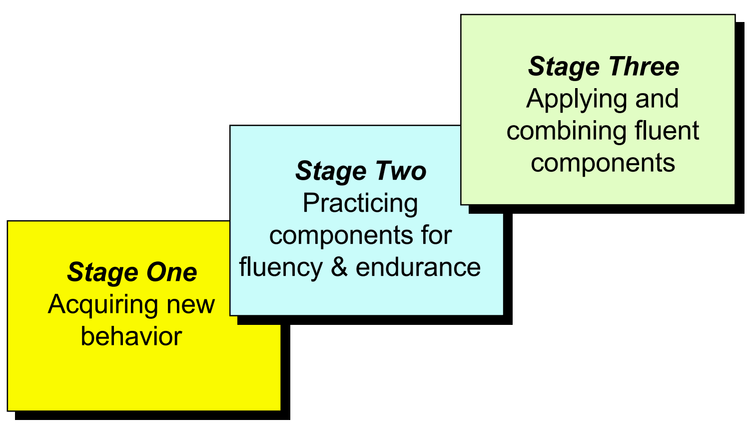
- Workshop assembly tasks – adolescents with autism
- Using toilet paper – severe DD adults
- Putting on a shirt – DD teenagers
- Grasp/Release with all kinds of objects & devices
- Big Six elements and Body Control Movements
- Terry Harris – overcoming severe CP

Frequency-building in a Mediated Transfer Paradigm ("Generativity")

1. Baseline assessment:
   - See/Say objects and actions – "naming" (yes)
   - See/Say follow spoken instructions (yes)
   - See/Say printed words – "reading" (no)
   - See/Say place printed word(s) by object – "matching" (no)
   - See/Do printed instructions – "following directions" (no)
2. Teach See/Say printed words
3. Test same as before ("pre-test")
   - Untaught behavior **emerged** – *matching and following directions*
4. Build frequency ("probability") of See/Say printed words
5. Test same as before ("post-test")
   - More untaught behavior emerged – *following directions*
   - All previously emergent behavior increased in frequency



Stages of Learning



Each requires different procedures and materials.

Handicap-defined Ceilings

Measure and Keep Trying!

- We still found skills whose frequencies we could not bring into normal/competent ranges, e.g., speech sounds, fine motor movements.
- We continued to measure and try.
- We shifted to other types of behavior for achieving the same outcomes if possible.
- *AND we remained aware of the challenges rather than being blinded by measurement-defined ceilings.*

Since then some of our colleagues have discovered and accelerated components that had imposed the handicaps.

Another Big One - *Endurance*

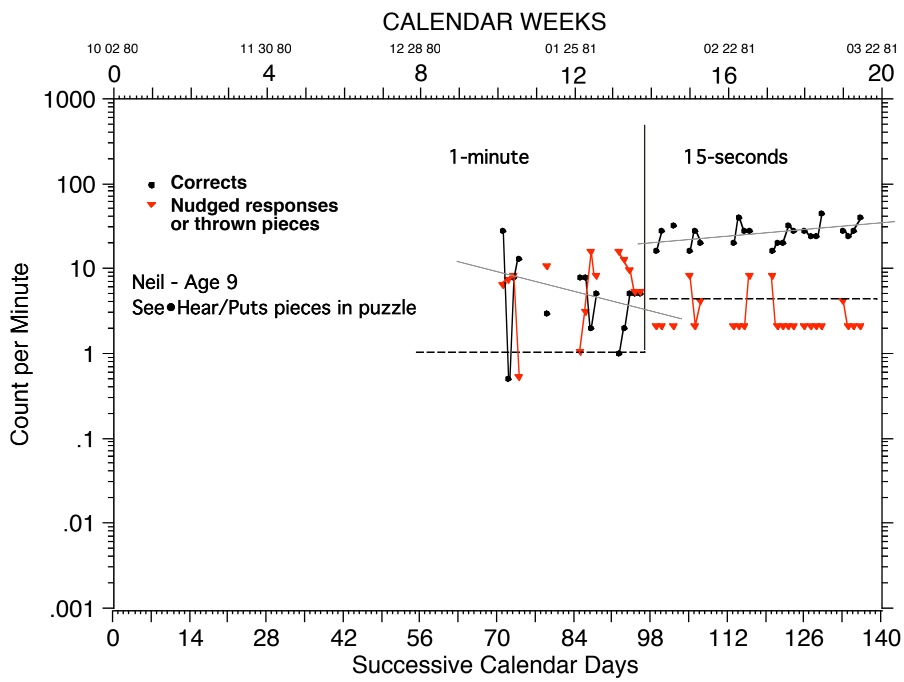
Metaphor of the Long-Distance Runner

We had seen that high levels of count per minute performance seem to optimize **retention** and **application**. Now we began to see that prior to achieving high levels, performers had **endurance** problems:

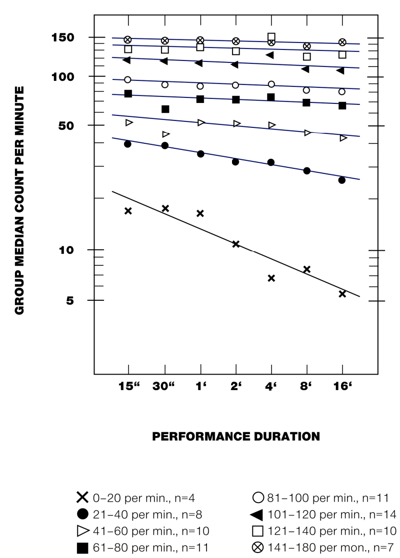
– Extended performance led to easy disruption or interference.

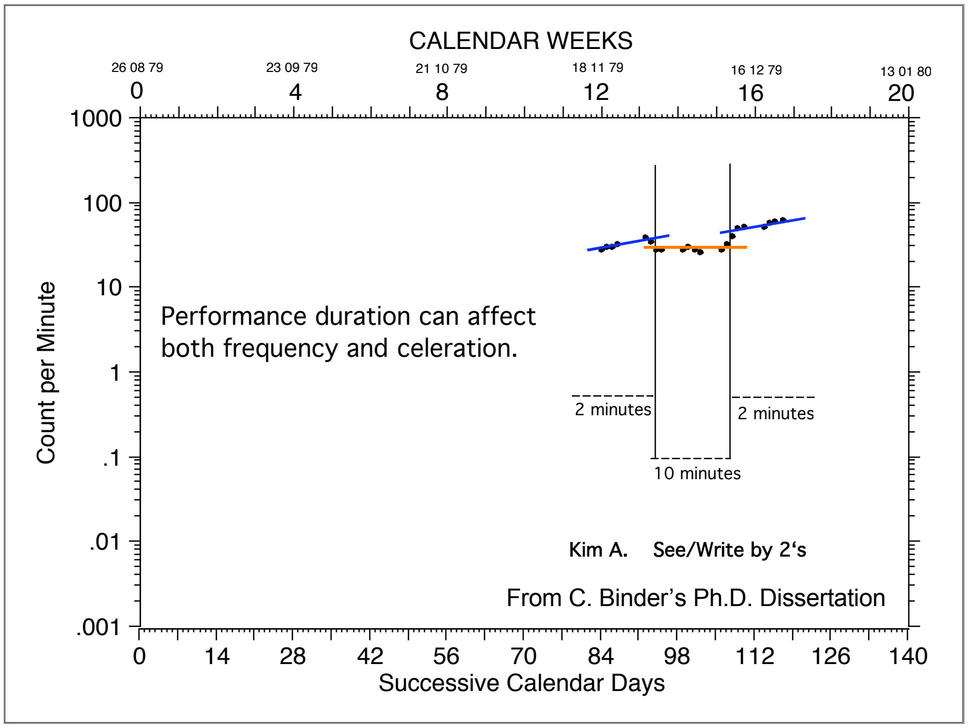
– Increased errors and variability.

– Rapid performance decline over long durations.



Fluency Supports Endurance





An Early Observation of Endurance

"I've been putting some of my kids on 10 second timings. They've spent weeks on 1 minute timings and haven't made it. But within a few sessions at 10 seconds some of them attained REAPS. Now we are increasing the timings and so far they haven't dropped out of the range. I'll let you know what happens. It may be a quicker way of getting to REAPS. The endurance is the part they don't have."

Anne Desjardins
Reported in *Data-Sharing Newsletter*
April, 1981, #34 page 3

Fluency Blockers with Fluency Builders
A More Recent Terminology

- **Measurement** of performance and learning
- **Procedures** for learning and practice
- **Materials** for learning and reference *(ergonomics)*
- **Skill** elements *(behavior components)*
- **Knowledge** elements *(behavior components)*

Features of Learning and Performance Systems that Either Prevent or Ensure Fluency.

Boiling It Down About Practice…

- **Reasons traditional "drill & practice" fails:**
  - lacks explicit fluency criterion as goal
  - long durations stretch endurance and attention
  - often the "chunks" are too big
- **Reasons well engineered practice succeeds**:
  - explicit time-based goal for practice
  - brief durations allow peak performance
  - builds fluent elements before application

Summary and Implications…

One cannot distinguish between expert and non-expert performance without *measuring the time dimension*.

It is essential to design materials, procedures, user interfaces, and other elements of performers' environments to encourage rather than obstruct the development of fluent performance.

If we do *not* measure the time dimension, we will likely fail to build environments that support fluency.

Achieving fluent performance often, if not always, involves the development of *fluent component behavior* prior to or at the same time as development of composite behavior.

Often the greatest obstruction to fluency development is simply *a lack of opportunity* to achieve fluency on critical components before being expected to perform composite applications.

It is helpful to view learning as occurring in three stages: 1) *initial learning* for accuracy or quality; 2) *practice of components* for fluency and endurance; and 3) *application or combination of components* into composite behavior.

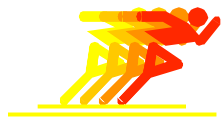
Many programs fail to produce mastery because they skip or minimize the 2nd stage and prematurely plunge learners into the 3rd stage before they can fluently perform key components.

Perhaps the single greatest potential for improving the ROI of any program is to *allocate more time to practice on critical components* prior to requiring application or transfer.

This can usually be offset by *trimming scope with careful front end analysis*, *allocating less time to initial learning*, and *reducing time needed for application* by first building fluent components.

The revised program is almost always *significantly more cost-effective.*

Everybody Needs Fluency!



Discussion?

Thank You.

Doesn't Everybody Need Fluency?

by Carl Binder, PhD

What does it mean to be good at something? How, in other words, do we define competence or mastery? This article and the ISPI Master's Series presentation that it previews summarize a career-long investigation of this issue, and 30 years of ever-expanding applications of what we have discovered in that investigation.

Everyday Life Outside the Percentage-Correct Box

We all grew up in a percentage correct world. In most elementary, middle, and high schools (at least in America), tests and grades are based on percent-correct calculations. Similarly, universities, graduate schools, and most professional training programs use some form of percent-correct calculation to evaluate learning success and, by implication, to define mastery. Consequently, most of us assume without question that percent correct, an accuracy-only basis for evaluation, is the scale on which to define mastery or competence. With rare exceptions in education and training (for example, typing or specific job tasks with time-based performance criteria) we define mastery as a specified level of accuracy while we ignore the time dimension.

This is not true in most fields outside of education and training, or in everyday life. In athletics, music, dance, auto mechanics, commercial cooking, heart surgery, and most other fields of human endeavor, there is either an implicit or explicit time dimension included in the definition of mastery. For example, did you know that surgeons often practice making sutures to be sure they can sew up their patients quickly without error on the operating table?

According to John Wooden, the famous UCLA basketball coach, "Skill, as it pertains to basketball, is the knowledge and the ability, quickly and properly, to execute the fundamentals. Being able to do them is not enough. They must be done quickly. And being able to do them quickly isn't enough, either. They must be done quickly and precisely at the same time. You must learn to react properly, almost instinctively" (1988, p. 87).

This is also true in most other athletic activities. Merely making the right move or being able to execute a play correctly is not sufficient for success. There is always a need for quickness, smoothness, and a lack of hesitation—passing the ball, making the throw on time, ducking and turning simultaneously, twisting in the air while flipping, and so on. Likewise in dance or music, the appropriate pace of a performance is obvious in the expert and painfully absent in the nonexpert. In verbal or cognitive tasks such as entering numbers at a cash register, composing newspaper articles on deadline, or engaging in effective conversations with customers, achieving the appropriate pace of performance is also a necessary criterion for competence.

As the late Dr. Eric Haughton once remarked, "You can take behavior out of time, but you can't take the time out of behavior" (personal communication, 1976). In other words, all behavior occurs in time and has a temporal dimension which is an essential part of a complete description of the behavior itself. A description of behavior without its temporal dimension is incomplete and ultimately false. Laypeople recognize competence, in part, when they see behavior occurring in time with smoothness and snappiness, or grace and rhythm. Strangely, however, in education and training, we've come to ignore the pace or speed of performance with the mostly unquestioned or unconscious assumption that it's not relevant except in special cases. From the perspective of everyday life, this is utterly absurd!

This time-based understanding of competence has implications for how we learn and teach, implications that coaches and performing artists have understood for centuries. Musicians, like athletic coaches, know that mastery of an overall performance often requires one to achieve quick, smooth execution of smaller segments and components (for example, riffs, scales, chord changes) in preparation for playing entire compositions at an appropriate unbroken rhythm and pace. In a 1997 interview on National Public Radio, the interviewer asked Ray Charles, "When you practice… do you practice the tunes that you'll be playing at the next concert?" Mr. Charles answered, "Oh, no, no, no, no….I practice things like scales and chords and movement of my hands and things like that, because…what I'm going to play on stage, I know. What I'm practicing for is…to improve what I might play... I mean you gotta keep your fingers loose, you gotta keep your mind active, because …the question is, what your mind think of, can your fingers play it?"

Bruce Lee, the legendary martial arts and film star, created a system of training based on elementary components of a complete fighting capability (Lee & Uyehara, 1977). He and his students practiced these elements, both in isolation and in combination, to achieve correct form with lightning speed. Athletes and musicians understand the necessity of practicing both behavior components and composites or combinations in order to achieve smooth, quick, and accurate execution. They also recognize that improvisation, whether in athletic activities or in music, depends on the ability to quickly and effortlessly execute components in novel combinations, virtually without thinking. The same can be said of creative performance in more cognitive domains such as negotiating a deal, solving a complex algebra problem, or deciding how best to solve a technical engineering challenge.

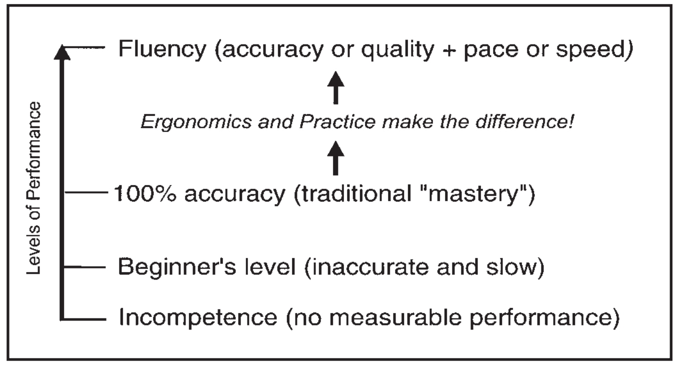


Figure 1. Achieving True Mastery Adds Speed to Accuracy.

Again, training and educational professionals seem to ignore these obvious facts of behavior, facts that any child or adult who has taken time to truly master a skill or body of knowledge understands intuitively and without question. We are trapped in a percentage correct box, blinded by our years of exposure to grading systems based solely on accuracy. The fact is, however, that competence or mastery virtually always involves a temporal dimension, and until we recognize that, we'll be unlikely to design optimally effective or efficient learning or performance development programs.

A Summary of Research and Development

Over the last 30 years, I have come to understand *fluency* as the true definition of mastery (see Figure 1), based on research and development that I and a small community of my colleagues have conducted with a very wide array of populations and performance domains (Binder, 1996). This section summarizes a series of discoveries that we made during the 1970s while I was a graduate student in Experimental Psychology at Harvard and Associate Director of the Behavior Prosthesis Laboratory. Primary input to that work came from B.F. Skinner (1938), Beatrice Barrett (2002), Eric Haughton (1972), and Ogden Lindsley (1964). The stages in this evolution yielded a series of principles that now comprise what is called fluency-based instruction, or fluency-based performance improvement.

Removing Measurement-Defined Ceilings

At the Behavior Prosthesis Lab during the early 1970s we were developing programmed instruction for a number of populations, including developmentally disabled children and adults. Instructional procedures followed sequences of steps in which teachers or machines presented requests, questions, or other prompts to students who then responded. We scored accuracy based on counts of correct, incorrect, and skipped responses and summarized performance with percent-correct calculations. While we paid attention to the duration of teaching sequences for scheduling

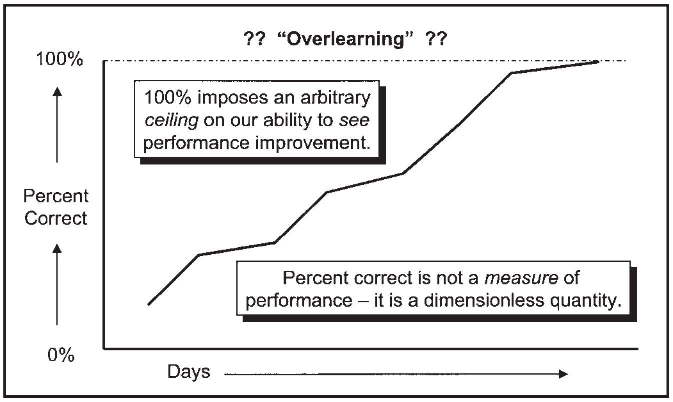


Figure 2. Percent Correct Imposes a Ceiling on Measurement.

purposes, we did not take the time dimension into account when describing student performance. This continues to be the typical form of evaluation in the field of instructional technology.

An interesting technical point is that researchers and educators who use percent-correct evaluation use the term "overlearning" to describe practice beyond the point where learners hit the 100% ceiling. They know from measures taken hours, days, or weeks after instruction that so-called "overlearning trials" improve retention and transfer of training. But without the time dimension, their percent-correct evaluations during and immediately after instruction cannot detect increases in response probability that result in these important learning outcomes (see Figure 2).

Because our lab studies had evolved from those of Skinner (1938) and Lindsley (1964), who used rate of response (for example, count per minute) as their basic measure, Beatrice Barrett recommended we introduce the time dimension into our instructional measurement procedures. We timed teaching sequences and summarized performance as count per minute of correct and incorrect responses. We used Lindsley's (1999) standard celeration chart to graph performance and learning across instructional sessions.

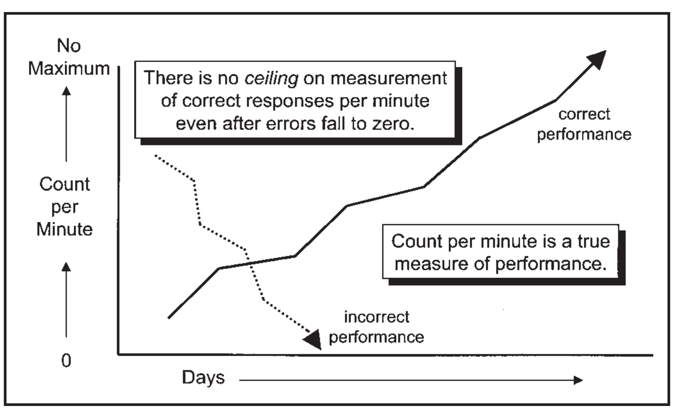


Figure 3. Including the Time Dimension Removes the Measurement Ceiling.

This change in measurement methodology had a profound effect on our understanding and subsequent research. We immediately saw that instructional trials or opportunities to respond were generally occurring at no more than 12 per minute. After we began to time performance, we saw that it is possible to reduce errors to zero while continuing to accelerate the pace of correct responding—to produce accurate responding that is also quick and nonhesitant (see Figure 3). In other words, we saw that our previous way of evaluating performance, where 100% correct formed the "ceiling" of the measurement system, prevented us from seeing the great potential for improving performance that is available for most skills and knowledge beyond the attainment of 100% accuracy.

It was as though blinders had been removed from our eyes when we recognized that percentage correct calculations are utterly insensitive to differences between accurate but hesitant performance and accurate but smooth, masterful performance. It's hard to describe the career-changing impact this had on us personally and as performance scientists! It was as though we had been driving without headlights, navigating without a compass, or attempting to design airplanes without being able to measure wind velocity.

We sampled dozens of different skills and types of knowledge in many populations to better understand how count per minute measures sensitively distinguish among levels of competence. We saw countless instances in which percentage-correct scores could not distinguish between levels of performance that were obviously quite different. For example, while teaching basic components of math, reading, and writing to a class of institutionalized developmentally disabled adolescents and adults, we decided to collect brief timed samples of performance on these skills from a group of our colleagues (normal adults) and in a classroom of young elementary school children (see Figure 4). These data show dramatically how percent correct (they all scored 100%) cannot distinguish between the skill levels of people with graduate degrees, young children, and students with severe developmental disabilities due to brain damage and genetic defects. Yet percent correct is the almost universally applied form of educational evaluation!

After removing what we eventually called "measurement-defined ceilings"—later termed "measurement-defined fluency blockers" (Binder, 1990; 1996)—we came to understand that unless we include the time dimension in our measurement procedures, we cannot detect the difference between beginner's level and mastery, and therefore will almost certainly fail to develop procedures that produce genuine competence.

Removing Teacher-Imposed Ceilings

Our time-based measurement procedures revealed the severe restrictions that our teaching methods and materials had

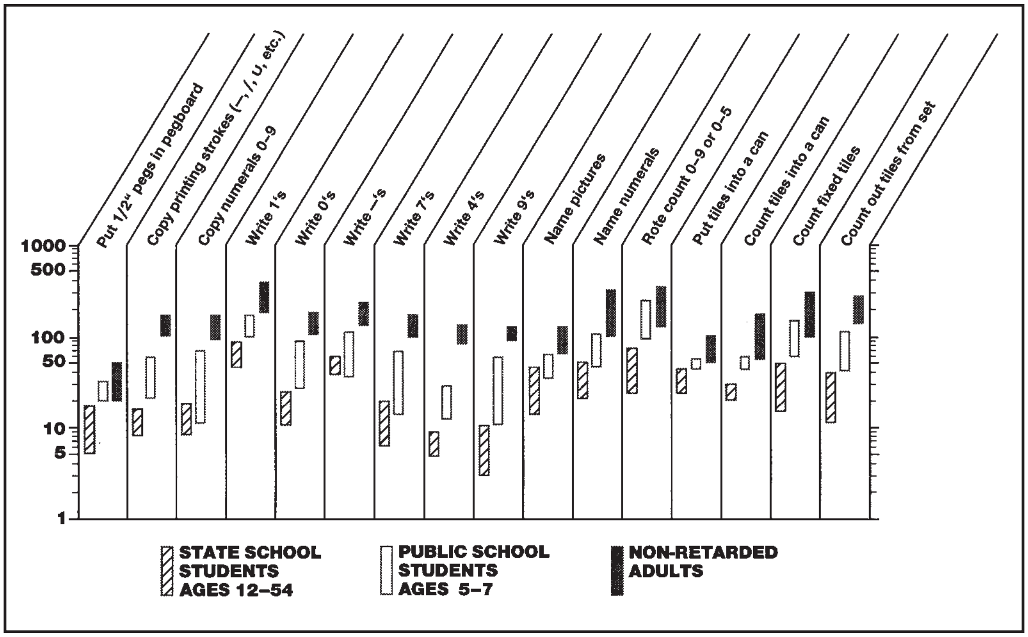


Figure 4. Count per Minute Ranges of Correct Performance on Basic Component Skills in 30-Second Timings. Note: There were no errors, so all scores were 100% correct (Reprinted with permission of B.H. Barrett).

imposed on learners, which prevented them from moving quickly at their own pace. For example, we were teaching sight vocabulary with programmed instruction that allowed students to respond no faster than 12 words per minute, despite the fact that competent oral reading occurs at 200 words per minute or faster. We were teaching vocational skill sequences and only measuring whether trainees could perform steps in the sequences accurately, despite the fact that in the workshop these assemblies need to occur rapidly to be productive. We were preventing students in lecture courses from asking questions or giving answers at their own pace by using procedures that allowed those with 10 or 15 questions the same number of opportunities to respond as those with only one or two. We taught math skills to children, for example, basic written addition or subtraction, using procedures that measured accuracy only and provided too few problems to perform much more rapidly than 20 problems per minute, while you or I can perform such skills at between 80 and 100 correct answers per minute.

This was analogous to teaching people to dribble a basketball by having them perform one bounce at a time, or teaching the violin by having students only perform isolated notes. Only after beginning to pay attention to the clock, and to real-time performance requirements, did we see that such procedures are ridiculous, that they actually handicap learners (Barrett, 1979). Our measurement and teaching methods were *preventing* students from achieving useful, functional levels of performance.

We spent more than two years focused on designing procedures and materials that enabled teachers to get out of the way of students. We came up with teaching routines that allowed and encouraged learners to accelerate to levels of accuracy plus speed that would ensure retention and easeful application to more complex skills (Binder, 1996). We figured out ways for students to practice critical skill and knowledge components at high rates before requiring them to combine the components into more complex performances, much as golfers practice with buckets of balls on a driving range to improve critical features of their swing. It was all about freeing students to learn, practice, and perform. In fact, Barrett summarized our thinking of that period in a framework that she called "parameters of pupil freedom" (1979).

The results were breathtaking. We enabled severely retarded learners to master complex academic, vocational, and self-care skills that they had previously never been able to learn. Our regular education colleagues enabled elementary school students to leap 20–40 percentile points in national test scores by adding just 20 to 30 minutes per day of timed measurement, practice, and instructional decisionmaking (Beck, 1979; Binder & Watkins, 1990). Removing teacher-imposed ceilings or fluency blockers helped us to understand from a more technical or scientific perspective features of learning and teaching that good trainers in athletics and the performing arts have known for centuries.

Removing Deficit-Imposed Ceilings

The final part of this three-stage journey began almost simultaneously with the removal of teacher-imposed ceilings, and it continues today in our many training and education applications that expand fluency-based instruction. Once we had removed our blinders by adding the time dimension to instructional measurement, enabling us to see how our procedures and materials were limiting performance, we began to identify performance gaps that nothing we had previously understood could explain. This step forced us to discard the traditional model of learning hierarchies in which mastering each step at an accuracy-only criterion is deemed a sufficient criterion for advancing up the hierarchy.

Our new understanding came when students were performing accurately, but at count-per-minute levels that were far below what we knew they would need to be successful in application. For example, in regular classrooms we learned that students need to be able to write answers to between 70 and 90 simple addition problems per minute in order to be able to successfully and smoothly master arithmetic story problems. However, some students seemed to level off at around 20 or 30 problems per minute, and no amount of reward or encouragement seemed to help. Some of our colleagues (Starlin, 1971; Haughton, 1972) decided to check how many digits those students could read and write per minute—critical components of writing answers to problems. As you might guess, they were very slow, which held down their composite performance. With practice of the components on their own to the point of rapid accurate performance (for example, reading and writing digits at 100 per minute or more), students were able to progress smoothly toward competence on solving the written math problems.

We replicated this result with vocational skills, self-care skills, all kinds of academic and intellectual skills, fine and gross motor movements with handicapped people, and later in such areas as customer service and sales training. The general finding is that until skill and knowledge components achieve criterion levels of both accuracy *and* speed, it is difficult and sometimes impossible to achieve fluent performance on combinations of those skills or knowledge. But if we provide explicit practice to fluency on the components, acquisition and development of fluent composite skills will occur with relative ease and often in far shorter time.

As with the other insights, this one brought forth an "Aha!" experience when we looked beyond the confines of our classrooms. In music, dance, martial arts, sports, and so many other areas of endeavor, good trainers already know this principle. Yet in traditional academic classrooms, without the measurement and procedural methods to detect and support fluency, and without the identification and isolated practice of critical components, learners often falter, achieving little or no progress beyond a certain point. In fact, most of us have experienced this faltering in mathematics at some point along the path from basic counting to advanced calculus. By pursuing systematic investigation we had in some sense rediscovered, while adding quantitative precision to, teaching wisdom that had existed outside of education for centuries.

Corroboration From Other Fields

After nearly a decade of day-to-day immersion in this research and development with an expanding network of classrooms and training centers, we began to scan the learning research literature in other fields to see what corroborating evidence we could find. Our own findings suggested that by increasing the speed or pace of performance well beyond mere 100% accuracy it was possible to increase retention and maintenance of skills, improve endurance and attention span, and enable application or combination of skills into more complex behavior (Binder, 1996). These findings were consistent with observations in everyday life, but we wanted to see if other researchers and scientists had uncovered similar effects.

Sure enough, a number of unrelated studies in other fields yielded consistent findings about the importance of quickness and its effects on critical learning outcomes (Binder, 1996). More recently, studies of fluency in reading have shown compatible outcomes (Wolf, 2001), and research in precision teaching master's and doctoral studies have continued to refine our scientific understanding of these effects (Kubina & Morrison, 2000; Bucklin, Dickinson, & Brethower, 2000).

Implications and Applications

While a complete description of what we've learned and applied is beyond the scope of this article, we can summarize important implications of fluency research and development with a number of key points:

- One cannot distinguish between expert and nonexpert performance without measuring the time dimension.
- It is essential to design materials, procedures, user interfaces, and other elements of performers' ergonomic environments to encourage rather than obstruct the development of fluent performance. If we do not measure the time dimension, we will likely fail to build environments that support fluency.
- Achieving fluent performance often, if not always, involves the development of fluent component behavior prior to or at the same time as development of composite behavior. Often the most challenging obstruction to fluency development is simply a lack of opportunity to achieve fluency on critical components before being expected to perform well on composite applications.
- It is helpful to view learning as occurring in three stages: initial learning for accuracy or quality; practice for fluency and endurance; and application or combination of components into composite behavior. Many learning programs fail to produce true mastery because they skip or minimize the second stage and prematurely plunge learners into the third stage before learners are able to perform one or more critical components fluently. The common dissatisfaction with and relative ineffectiveness of role plays in corporate training is a good example of this failure.
- Perhaps the single greatest potential for improving the return on investment of any learning or performance development program is to allocate more time to practice on fundamentals or critical components prior to requiring application or transfer to new or more complex performance requirements. This can usually be offset by trimming the scope of programs based on careful front-end analysis, allocating less time to initial learning, and minimizing the time required for application by ensuring fluency in critical components as a prerequisite. The revised program is almost always significantly more cost effective.

Most of my professional career has been devoted to working with colleagues to expand the range of examples in which fluency-based methods have been shown to produce dramatic results. In the 1970s we demonstrated with handicapped and regular students, both children and adults, that achieving fluent performance through systematic, timed, and charted daily practice on behavior components could produce huge gains in achievement test scores as well as in practical, everyday applications (Haughton, 1972; Beck, 1979; Binder & Watkins, 1990).

During the 1980s and 1990s, we added adult literacy education (Johnson & Layng, 1992) and professional sales knowledge training (Binder & Bloom, 1989), producing unprecedented gains in personal and professional performance. In recent years we've shown that new hire development in call centers and software application training using fluency-based learning and coaching methods can accelerate performance ramp-up and produce levels of productivity far beyond those yielded by conventional training approaches, sometimes in less time (Binder, 1987; Binder & Sweeney, 2002).

After years of using the term fluency to refer to that combination of accuracy plus speed that characterizes competent performance, I've found that most people readily understand and adopt the term based on a prior familiarity with fluency in foreign language speaking. They recognize that being good at something nearly always includes both quality (accuracy) and pace (speed). This intuitive acceptance is a primary reason that we have continued to use our particular "f word" for so many years.

While there are many more populations and performance objectives to be addressed with fluency-based methods, our general conclusions seem clear from research, from practical application, and perhaps most importantly from everyday experience outside education and training environments. It seems clear that everybody needs fluency, no matter what their personal or professional endeavor, because fluency is the true definition of mastery or competence. We've seen that programs that do not measure and explicitly aim to produce fluent performance fall far short of optimal learning success and often fail to produce lasting, useful outcomes.

As we continue to demonstrate effectiveness and to communicate about fluency in plain language to an ever-wider audience, it is our intention to make available the unprecedented gains that are possible with fluency-based methods to an increasing number of children, families, and groups of productive adults throughout the world.

NOTE: This article is a preview of the book *Everybody Needs Fluency.*

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Masters Statement

What defines your mastery?

Two things define my mastery. First, I was fortunate to have world-class teachers and mentors, including B.F. Skinner, Beatrice Barrett, Eric Haughton, Ogden Lindsley, and Tom Gilbert. Second, I've followed the data, often in surprising directions. Because my mentors gave me powerful and sensitive tools for measuring behavior and its outputs, I've been able to collect and make data-based decisions that guide my research and application. If you seek out great teachers and pay attention to the data, you will inevitably be able to make important and satisfying contributions.

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Dr. **Carl Binder** is a Partner in Binder Riha Associates, a performance consulting firm in Santa Rosa, California. He is best known for research in behavioral fluency and development of the FluencyBuilding™ performance improvement methodology, and for contributions in knowledge management for sales and marketing organizations, performance measurement, and promotion of effective instructional methods for children. Since 1972 he has consulted with scores of Global 2000 and fast growth companies as well as educational and human service agencies. A long-time contributor to the International Society for Performance Improvement (ISPI), he has authored several dozen articles and chapters in scientific, educational, professional, and business publications, served on numerous ISPI committees, and delivered seven ISPI Encore Presentations and one previous ISPI Master's Series session.

Carl is passionate about the practical and cultural implications of shifting our understanding of mastery from accuracy-only to fluency, and he believes that this paradigm shift offers enormous potential for reversing our growing educational crisis. Carl has devoted most of his professional career to developing and communicating about fluency-based instruction and is currently working on a plain-English book called *Everybody Needs Fluency,* to be published by Sopris West Educational Services in mid-2003. He may be reached at carlbinder@aol.com, and you can download many of the sources referenced in this article at www.Binder-Riha.com/publications.htm.