Everybody Needs Fluency!
Carl Binder, Ph.D.  New York Academy of Medicine  April 2, 2004
“Working Together” Conference on Autism

My Background

- Early 1970’s: graduate study with B.F. Skinner - *Rate of Response*
  
- 1973-82: Behavior Prosthesis Lab & Classroom
  - Beatrice Barrett, Ogden Lindsley, Eric & Elizabeth Haughton
  - Precision Teaching, curriculum design, teacher-training
  - Research and application with multiple-diagnosis populations
  - Applications with all regular and typical school populations

- 1982-present: writing, teaching, consulting - *Fluency*
  - Regular and special education
  - Corporate training and performance improvement
  - Replication of effects across broad range of learners
  - Writing and speaking about fluency-based instruction

* A lot has changed since 1999... *


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The Challenge of Competence

- Students not remembering what they learned?
- Problems paying attention or staying on task?
- Working so hard on the mechanics of reading, math, or writing that it’s “hard to think” when applying them?
- Self-care, vocational, and academic skills really hard to teach? Chained skills falling apart?
- School getting harder rather than easier over time?
- Skills don’t seem “functional” in real world application?

Why?

While we know that there are many explanations for educational failure...

At the heart of the problem is a misunderstanding about what it means to be “good at” something...

...and how we measure it.

The largely unconscious assumption that mastery = 100% correct.

Champions in the Making!
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What is Fluency?

- You will have exactly 1 minute.
- Write (abbreviate) as many words or phrases as you can think of in association with this term.

Kindly don’t start……

….until I say….

“Please begin!”

Others’ Free Associations about “Fluency”

- quick, smooth, fluid
- confident, automatic
- never forget it, retention
- without thinking, natural
- competent, capable
- no hesitation
- proficient, masterful
- accuracy and speed
- can apply it, transfer
- expert, really knows it

- fun, likes to do it
- practice, repetition
- Carnegie Hall
- know it by heart
- creativity, improvisation
- foreign language
- don’t have to worry
- faster than thought
- good as it gets
- …and more….
**Fluency: The True Definition of Mastery**

Fluency = Accuracy + Speed

= Quality + Pace

= Doing the Right Thing without Hesitation

= Automatic or “Second Nature” Response

= True Mastery

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**Levels of Performance**

Fluency (True Mastery: accuracy + *speed*)

*Practice & Materials Design Make the Difference!*

100% accuracy (traditional "mastery")

Beginner’s level (inaccurate and slow)

Incompetence (no measurable performance)
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**B. F. Skinner’s Most Important Contributions**

“My most important contributions were rate of response and the cumulative response recorder.”


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**Likelihood = Rate of Response**

“Teaching is not only producing new behavior, it is also changing the likelihood that a student will respond in a certain way. Since we cannot see a likelihood, we look instead at how frequently a student does something. We see how fast he can add. The student who does problems correctly at a higher rate is said to know addition facts better than one who does them at a lower rate.”

— Dr. Julie Skinner Vargas, 1977, p. 62
“Children are not retarded. Only their behavior in average environments is sometimes retarded. In fact, it is modern science’s ability to design suitable environments for these children that is retarded…..The purpose of this paper is to suggest techniques…. for maximizing the behavioral efficiency of exceptional children who show deficits when forced to behave in average environments. These suggestions evolved from the methods and discoveries of free-operant conditioning.”

Ogden R. Lindsley, 1964
Direct Measurement and Prosthesis of Retarded Behavior, Journal of Education
Barrett on Time and Behavior

“…. behavior occurs in time, it takes time to occur, and it occurs through time. Time is, therefore, a fundamental parameter of behavior.”

Beatrice H. Barrett
The Technology of Teaching Revisited
Cambridge Center for Beh. Studies, 2002
www.Behavior.org

“You can take behavior out of time…. but ….you can’t take the time out of behavior.”

- Dr. Eric Haughton
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**Trapped in the 100% Box!**

We’ve All Grown Up in A Percent Correct World

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**NO Ceiling on Time-based Measures!**

The only upper limits are physiological or environmental.

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The difference between beginners and competent performers is ...

But we can’t tell the difference with percent correct!
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Percent Correct Handicaps our Students!

“When only a percentage correct scale is used to measure skill performance…. it is impossible to distinguish among various levels of skill proficiency.

When we fail to measure along the time dimension, we impose a serious constraint on our expectations for handicapped students, as well as on the likelihood that we will work to “normalize” their skill proficiencies.”

Carl Binder
Data-Sharing Newsletter, Sept, 1978
Behavior Prosthesis Laboratory

Reading with Discrete Trials Procedures

Time-based Measurement Shows that Our Procedures Handicap Children!
Everybody Needs Fluency!

Coaches Know about Fluency

“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.”

John Wooden, 1988
They Call Me Coach, page 87 Chicago: Contemporary Books
**Surgeons Practice to Achieve Fluency**

“Having good hands is a primary determinant of a surgeon’s success in the operating room.”

*Dr. Tim Deer*

*Center for Pain Relief*

*Charleston, WV*

Some surgeons-in-training practice making stitches on pigs feet and tomatoes.

**Michael Jordan on Practice**

“If you want to get better at anything, you have to practice. There’s no other way to do it. For me practicing is fun. I enjoy improving myself, and I enjoy developing new skills.”

*Michael Jordan, 1991*

*Television Spot*

But with percent correct measures we can’t see the results of practice!
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More Practice = More Rapid Learning

Typical Outcomes of Building Fluent Behavior

- Severely disabled students acquire and maintain vocational and self-help skills after years of failure (*Amego School, Boston, 1976*)

- 1-2 grade levels gained in 6-week summer school (*Morningside Academy, Seattle, for over 18 years*)

- Newly trained customer service reps surpass productivity benchmarks within weeks (AT&T Wireless Services, Anaheim, CA)
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Unprecedented Cost-effectiveness!
Adding 20-30 minutes of timed practice per day

Iowa Test of Basic Skills Percentile Rank

Top 10% in the country!

Reading Scores

4th Grade
Great Falls, Montana
Precision Teaching Project

Scientific/Technical Contributions to Fluency Development Methods

Perceptual Motor Learning Research
Human Information Processing Research
Human Factors Engineering
Endurance Research
Fluency Building R&D

Operant Conditioning
Precision Teaching
Aims
REAPS

Verbal Learning Research
Programmed Instruction
Mediated Transfer Research
Element-Compound Research
Expert Performer Research

High Tech Innovations
Generativity Research

Examples of Fluent Behavior

- Tapping a surface: 250-350 per minute
- Writing Digits: 140 to 160 characters per minute
- Arithmetic: 70 to 110 computations per minute
- Keyboarding: 60 to 90 words per minute
- Brainstorming: 20 to 30+ ideas per minute
- 3-point basketball shots: 15-25 hits per minute

Let’s measure ourselves.

Outcomes Associated with Fluency

**Improved:**

- Retention and maintenance of skills and knowledge
- Endurance, attention span, resistance to distraction
- Application or transfer of training to more complex tasks and subsequent learning (generativity, creativity)

**Valuable Learning Outcomes!**
And....Fluency is Fun!

“You know, when you learn how to do something and to do it well, you begin to enjoy it.”

Mamie “Peanut” Johnson
American Negro League Pitcher

Defining Fluency Standards:
REAPS – An Empirical Challenge

Retention – Endurance – Application
Performance Standards

We must identify Performance Standards that optimally support Retention, Endurance, and Application.
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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
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Shortening Practice Duration Can Reduce Bounce and Errors

Fluency Supports Endurance
Using What We Know about Endurance

In the beginning, many brief practices may be more productive than a few long ones.

10 or 15-second “sprints” are best to start with many cases.

Let’s experience it….
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Application
When Fluent Components Support Fluent Composites

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, 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]
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**Application**

*Combining Components into Composites*

- 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

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**Examples of Components**

<table>
<thead>
<tr>
<th>Composite / Whole Skill</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Putting on clothes</td>
<td>Reach, point, touch, grasp, place, release (“The Big Six”)</td>
</tr>
<tr>
<td>Writing your name</td>
<td>Make tallies, circles, loops, diagonals, crosses, etc.</td>
</tr>
<tr>
<td>Getting in and out of bed</td>
<td>Head, trunk, hip, leg, arm movements</td>
</tr>
<tr>
<td>Reading aloud</td>
<td>Break words into sounds, combine sounds, say sounds for letters, blend sounds, etc.</td>
</tr>
<tr>
<td>Using flashcards to learn picture names</td>
<td>Grasp cards, flip cards, “deal” cards, say words, etc.</td>
</tr>
</tbody>
</table>
The Terry Harris Story

Stage One
Acquiring new behavior

Stage Two
Practicing components for fluency & endurance

Stage Three
Applying and combining fluent components

Each requires different procedures and materials.
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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

Tactics for Building Fluent Behavior

- Get out of the student’s way.
- Accentuate amount of work completed and passage of time; reinforce higher completion rates.
- Use maxi-guiding – fast physical guidance - “feel what it’s like to be fast.” With motor components.
- Move from discrete to continuous imitation.
- Focus on behavior components that students practice repeatedly using many more sets of materials
- Use sprints, encourage bursts of behavior.
More Tactics for Building Fluent Behavior

- Fade procedures and materials from one-at-a-time, to arrays or clusters of items to allow more continuous performance.
- Leave materials in left-to-right arrays, then use pointing cues to move students along.
- Prompt and reinforce “keep going” to build continuous behavior in students with histories of heavy consequences.
- “Coaching and Cheerleading” combines paced prompting (“hustles”, nudges, etc.) and non-interrupting reinforcers.
- Ask the student what would make her faster.

And keep inventing materials and procedures that expand the parameters of pupil freedom!

About the Discrete Trials vs. Free Operant “Debate”

- **GOAL**: multiply response opportunities to achieve FLUENT behavior.
- FREE students from unnecessary constraints as quickly as possible.
- THEN accelerate performance toward fluency using continuous measurement to guide you.
- ALWAYS monitor behavior frequencies – even during discrete trials.
- ADJUST correction procedures, feedback, etc. based on correct and error frequencies and trends.
- CHANGE procedures, materials, and instructional sequences to find opportunity multipliers and accelerate behavior toward fluency.
Some Summary Statements

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

It is essential to design materials and procedures 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.*
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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.
Some Additional Resources on Fluency and Autism

- Helpful Resources page at our web site: www.Binder-Riha.com/publications.htm
- Precision Teaching web sites -- links from www.Celeration.org
- Dr. Rick Kubina, Penn State University -- speaking later at this conference
- Michael Fabrizio and Alison Moors, Fabrizio/Moors Consulting, Seattle 206-324-3805