

# The Legacy of B.F. Skinner to Education

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# The Legacy of B.F. Skinner to the Field of Education

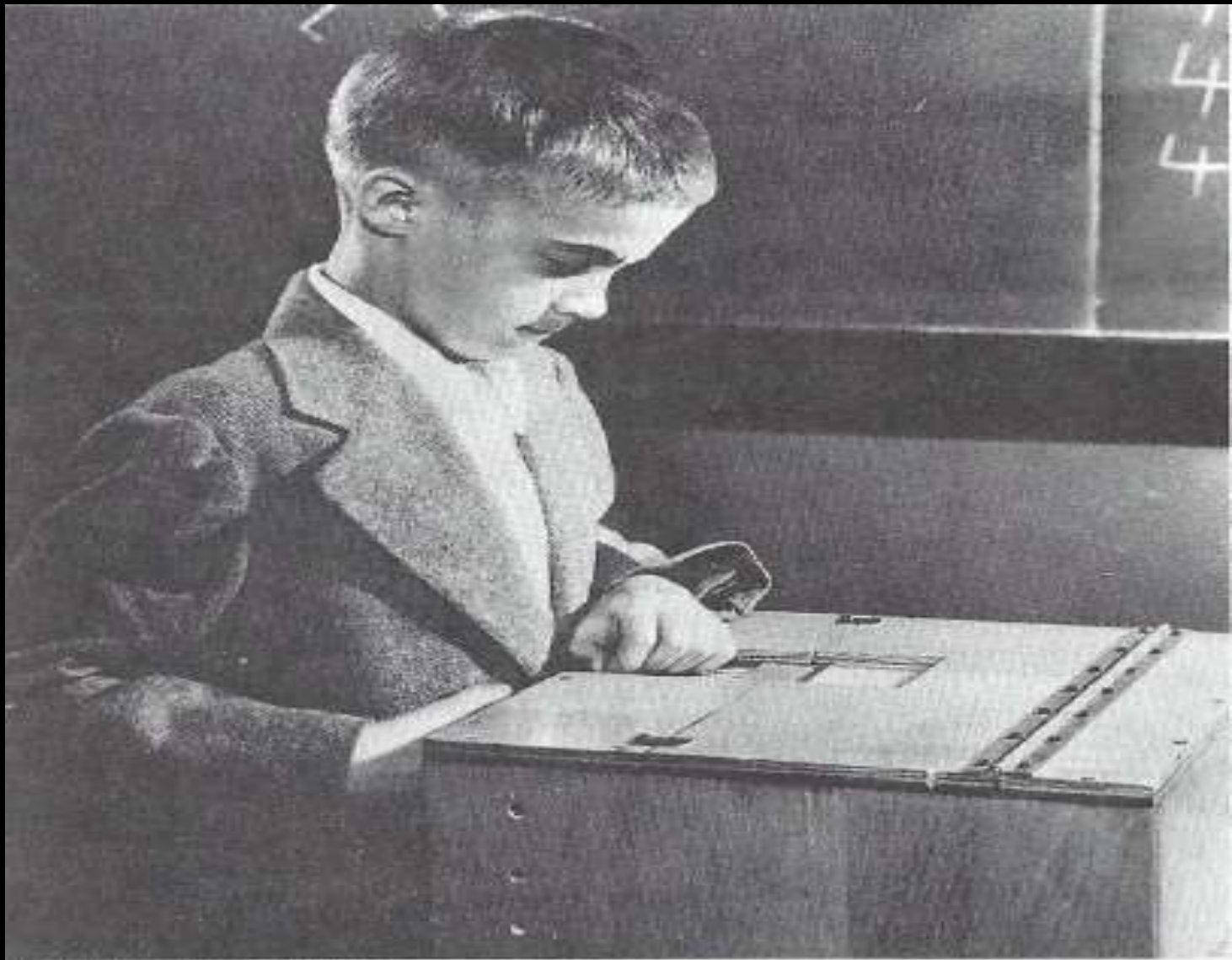
“On November 11, 1953, during Father’s Day at Shady Hill School in Cambridge, Massachusetts, Fred observed daughter Debbie’s fourth grade arithmetic class and then wrote:

- ‘I suddenly realized something had to be done’”. (Barrett, 2002, p.19)
- Skinner’s frustration resulted from what he considered the teacher’s violations of at least two important principles of effective instruction:
  1. the students were not told if their work was correct or not and,
  2. every student was moving at the same pace within the curriculum without regarding for their skill levels.

- Skinner knew he had solved similar problems in the laboratory but the field of education was making no use of discoveries coming from the experimental analysis of behavior
- Skinner's experience in his daughter's classroom sent him on a mission to improve education through application of the principles he was discovering in the laboratory.
- "Some promising advances have recently been made in the field of learning. Special techniques have been designed to arrange what are called contingencies of reinforcement..."  
(Skinner, 1954)

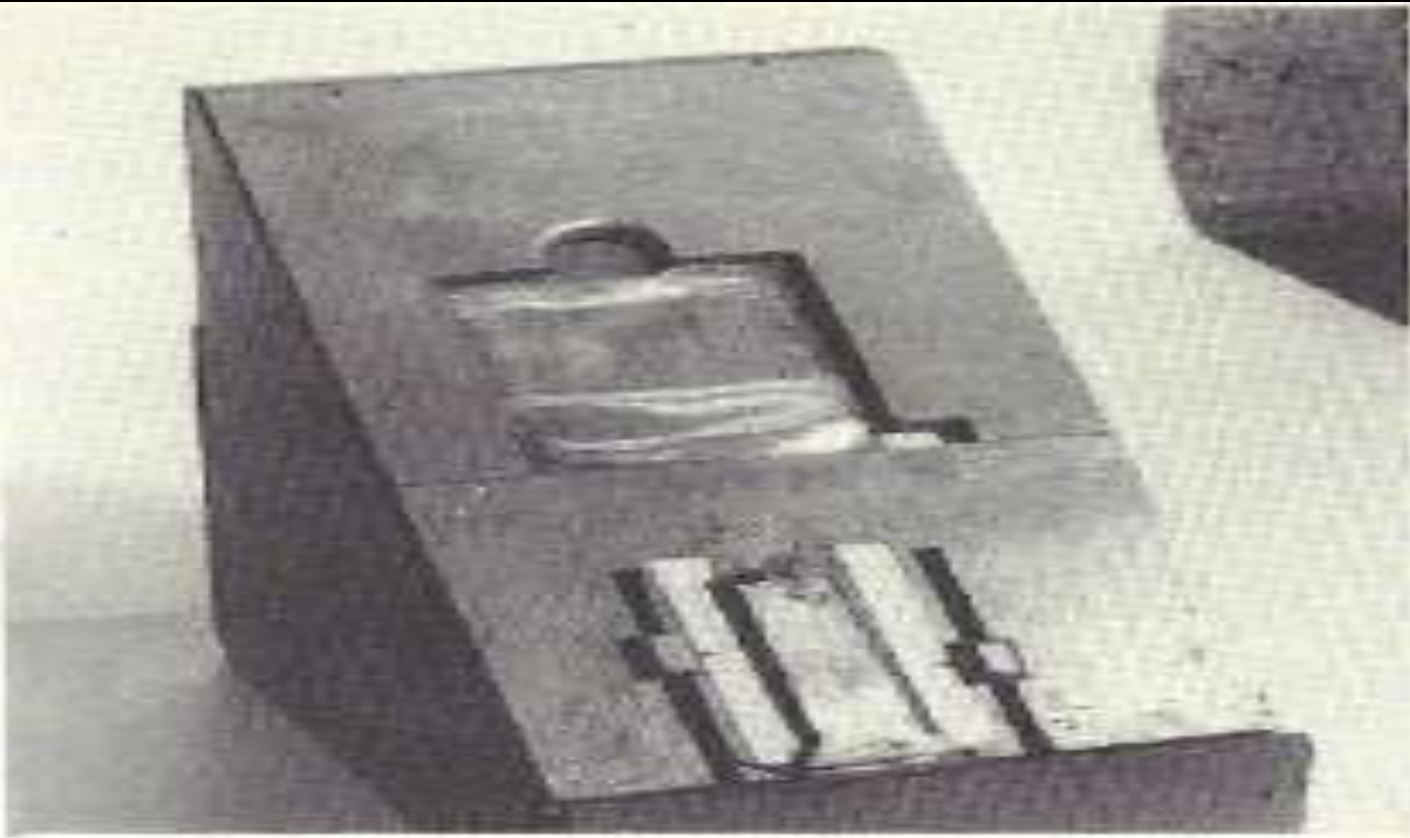
- “Much of what we know has come from studying the behavior of lower organisms, but the results hold surprisingly well for human subjects” (Skinner, 1958,p.970).
- Skinner was now motivated to take specific action to improve the teaching of children every where. He knew that teacher enthusiasm and knowledge of the subject were not enough. “A third essential is knowing how to teach” (Skinner, 1963, p172.)
- “From this exciting prospect of an advancing science of learning, it is a great shock to turn to that branch of technology which is most directly concerned with the learning process-education” (Skinner, 1954, Republished 1968, p.14)

- While he was convinced that the experimental analysis of behavior had provided the methods to improve pedagogy he was equally convinced from his experience in Deborah's class and the laboratory that instrumentation was also needed.
- He was seen a few days after his classroom visit, and before a lecture at MIT, cutting manilla folders to build a prototype of his first "teaching machine". (Barrett, 2002).
- With some of the first prototypes of his machine in hand Skinner presented his first major talk at the University of Pittsburgh in 1954, titled "The Science of Learning and the Art of Teaching".



One of the first teaching machines;  
demonstrated in Pittsburgh in 1954  
(Skinner, 1968,p.23)

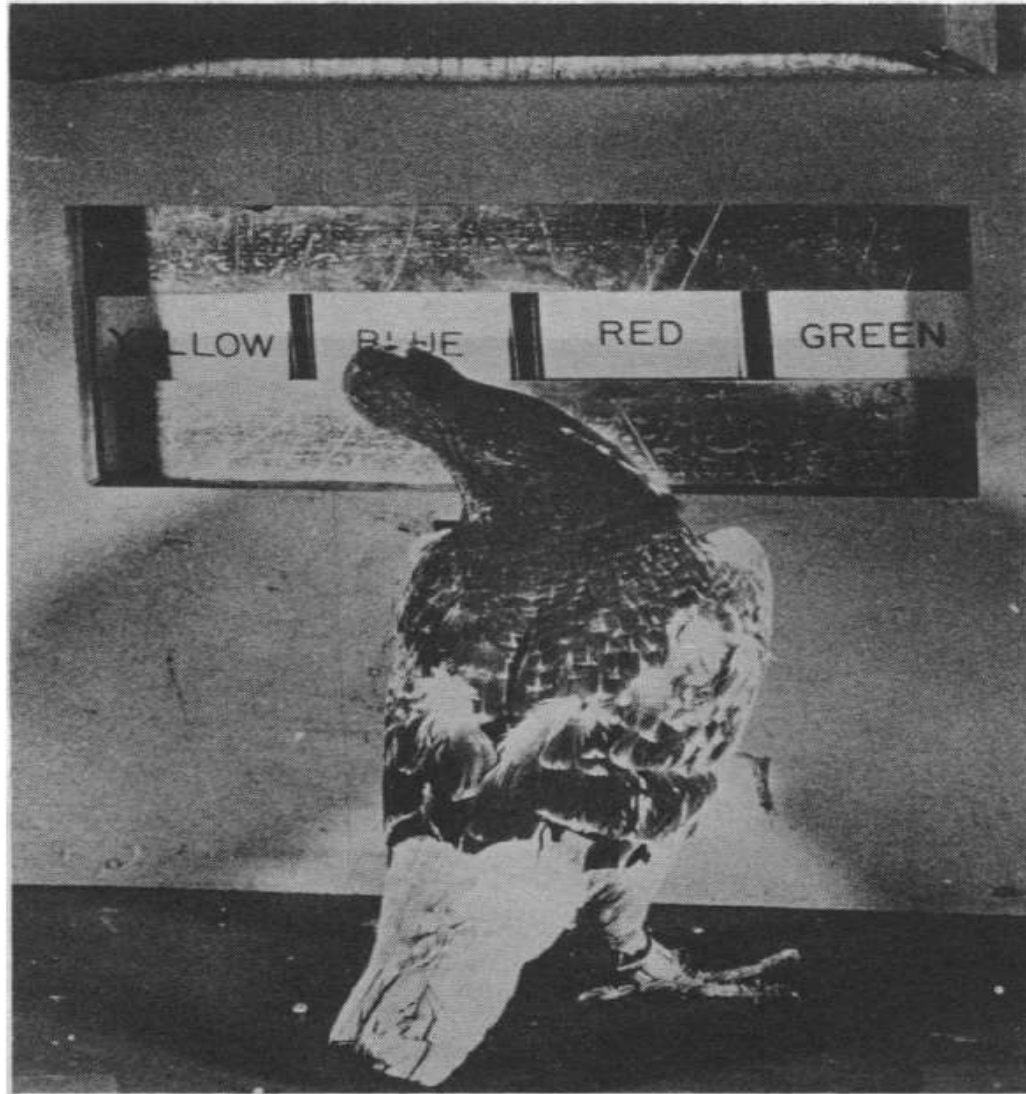




Vargas & Vargas, 1992,p.37

**A** Skinner's first machine (1953) had two sliders containing the numbers 0 through 9 with which the student composed the answer to simple arithmetic problems on cards inserted one at a time.

# THE “REAL” FIRST TEACHING MACHINE



Holland, 1960 p.278

**Figure 3. A pigeon “naming colors.” The pigeon pecks the color name corresponding to the color of the light projected above him.**





Teaching Machines Programmed to Teach Rhythm and Piano Playing



Skinner, 1968, p.70



Teaching Machine Requires the Student to Compose the  
Response Not Merely Select

Skinner, 1968, p.38



Teaching Machine Programmed to Teach Matching Skills to Young Children  
Holland, 1968, p.277





## Teaching Machined Programmed to Teach Math and Spelling

Skinner, 1968, p.25



Teaching Machine Programmed to Teach Form Discrimination to a  
Man with a Developmental Disability





*Testing the handwriting program with a student.*



- That same year, 1954, Skinner's paper "The Science of Learning and the Art of Teaching" was published in the *Harvard Educational Review*.
- In that paper he estimated that it would take about 50,000 contingencies to acquire math skills at the 4<sup>th</sup> grade level.
- "Now the human organism is, if anything, more sensitive to precise contingencies than the other organisms we have studied. We have every reason to expect, therefore, that the most effective control of human behavior will require instrumental aid". (Skinner, 1954)
- Skinner continued his call for teaching machines in 1958, with the publication of his paper "Teaching Machines" in the prestigious journal *Science*.

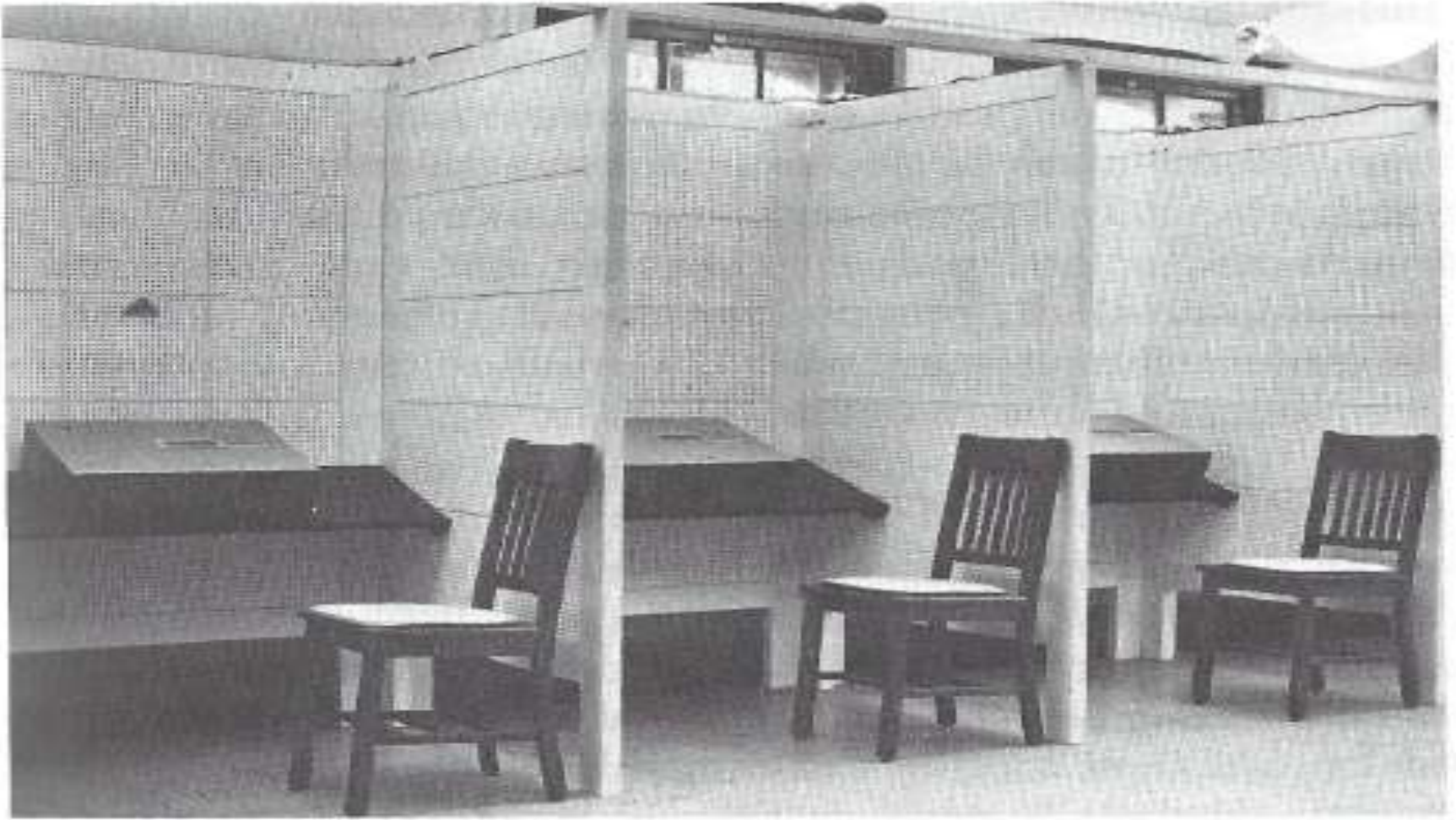
- Skinner was now gathering a group of talented graduate students at Harvard to work in earnest on this important project. This group included Jim Holland, Sue Markle, Matt Israel, Nate Azrin Lloyd Homme and others.
- It was Jim Holland who pointed out that the use of “...machines are not the essential or defining aspect of this technology...”. (Holland, 1960, p.275)
- “This new technology of education is the application of behavioral laws in modifying and controlling behavior”. (Holland, 1960, p.275)
- “Such a technology became possible with the realization that we are actually referring to a verbal repertoire (Skinner, 1957) controlled by the same laws as other behavior”. (Holland 1960, p.275)

- In fact, in 1955, as Skinner was completing the book *Verbal Behavior* (1957) he suddenly became aware of the fact that much of what he had written about the development of verbal repertoires was relevant to this new technology of teaching.
- He now realized that his discovery of the different sources of control for verbal operants and the antecedent methods such as prompting, fading, priming and vanishing were crucial to shaping and developing new behavior and not just practicing what was already known.
- “Behavior could be shaped using the techniques outlined in *Verbal Behavior*” (Vargas & Vargas, 1992, p.40).

- It was at this point Skinner uncovered the basic elements of this new technology of instructional design, and he called it “programmed instruction”. He defined programmed instruction as the “ ... the construction of carefully arranged sequences of contingencies leading to the terminal performances which are the object of education” (Skinner, 1963,p.169) This involved teaching new behaviors through small errorless response steps toward a terminal behavioral outcome.
- During the decade between the late 1950s to 1960s Skinner and his students perfected the programming of instruction through grants from major corporations and the government.
- Jim Holland programmed Skinner’s Natural Sciences 114 course for machine delivery and hundreds of Harvard and Radcliffe students took the course. (Vargas & Vargas, 1992)

Items from the Psychology Program (11). These Items Illustrate  
the Gradual Development of a New Concept.

Item	Correct Answer	Percentage of Students Giving the Answer
1. Performing animals are sometimes trained with "rewards." The behavior of a hungry animal can be "rewarded" with _____.	Food	96
2. A technical term for "reward" is reinforcement. To "reward" an organism with food is to _____ it with food.	Reinforce	100
3. <i>Technically</i> speaking, a thirsty organism can be _____ with water.	Reinforced	100



Stations with Teaching Machines Where Skinner's Course on Human Behavior with Harvard and Radcliffe Students Served as the First Large Scale Evaluation of Teaching Machines.

The Course Later was Presented in Text Format as "The Analysis of Behavior" by Holland and Skinner (1960) Skinner, 1968, p.52



- The data from this course were used to improve the programming and the subsequent version was ultimately published in 1961 in the form of a book “The Analysis of Behavior”, by Holland and Skinner.
- Commercial tests of teaching machines occurred in several public school districts throughout the US beginning in 1960.
- The most famous of which was the Roanoke, Virginia project.
- In one experiment, 34 high school students who were not slated to take classroom algebra completed a year long course in one semester without any assistance from a teacher

- These results were replicated with 900 students the following school year.
- This time student instruction was through programmed textbooks without teaching machines.
- The groups which using the printed programmed materials completed the year long course by December and the group without any teacher support performed best.
- “The experiment vindicated many of the key precepts in Skinner’s theory regarding programmed instruction” (Ferster, 2014, p. 84)
- The success of this project attracted commercial attention from Encyclopedia Britannica and others.



Figure 3.13. Students at work during the Roanoke, Virginia, programmed instruction experiment. (Ferster, 2014)

- Student satisfaction was good and one student commented about the self pacing component “The eggheads don’t get slowed up, and the clods don’t get showed up” (Ferster, 2014, p.84)

- Unfortunately, Skinner's technical and commercial development of teaching machines never led to wholesale adoption. There were many reasons for this but mainly rejection by the educational establishment and teachers were the strongest.
- In the early 1960s there was some interest within the field of public education but most of the interest eventually was in training in business and the military.
- Also around this time Fred Keller's Personalized System of Instruction (PSI) for teaching college courses was developed and contained some of the elements of programmed instruction.
- Even in the 1980s with the advent of computer technology, and "the ultimate teaching machine" (Skinner, 1989, p.94) the developers of computer assisted instruction ignored the basic principles of behavior that are essential for shaping a new repertoire. (Vargas & Vargas, 1992)

- Consequently, in 1968, almost 14 years after his visit to Debbie's classroom Skinner wrote "Yesterday I finished the *Technology of Teaching*. I felt numb. It had dominated me for years, with increasing ferocity." ( Skinner, 1983, p.296)
- Just before his death Skinner told an interviewer that "...his failure to convince educators of the importance of instructional programming was one of his greatest disappointments". (Sparzo,1992,p.225)
- Despite Skinner's clear sense of exasperation, his work and the work of his student's and colleagues during those 13 plus years gave us a rich legacy of instructional practices.
- During this period the the principles derived from the experimental analysis of behavior, as fairly recently discovered in the laboratory, were for the first time applied to the practices of educators and important discoveries followed.



- Despite his disappointment, his work on programmed instruction has had an important impact on education and special education practices of today.
- Skinner was clearly on a mission to change pedagogy. As stated by Holland (1960) they were interested in a new technology. "...a behavioral engineering of teaching procedures". (p..275)
- "Before the programmed instruction movement of the 1960s, most approaches to pedagogy dealt primarily with presentation or 'transmission' of 'information'... (Vargas and Vargas, 1991)



Here is a list of the contributions that his efforts have given us:

1. OPERANT CONDITIONING “The law of effect has been taken seriously...”. Once we have arranged the specific type of consequence called reinforcement, our techniques permit us to shape the behavior of an organism almost at will” (Skinner, 1968, p. 10).

The discovery of operant conditioning by Skinner (1938) made it possible to develop the technology of teaching that followed. We now know that learning can be measured by changes in behavior and behavior change is a function of environmental variables. “...his experiments on laboratory animals would lend insight into how people learned, and his view was ‘teaching is a matter of arranging contingencies of reinforcement under which students learn’”. (Ferster, 2014, p.72)

2. VERBAL BEHAVIOR “In education the behavior to be shaped and maintained is usually verbal, and it is to be brought under the control of both verbal and nonverbal stimuli. Fortunately, the special problems raised by verbal behavior can be submitted to a similar analysis” (Skinner, 1968,p.33).

Skinner’s text *Verbal Behavior* (1957) provides a thorough analysis of the repertoire to be shaped in most educational settings. Explanatory concepts such as knowledge, meaning and symbolic concepts were discarded as adequate units of learning because only behavior showed a lawful relationship to the environmental events.(Holland, 1960). “Skinner argued that anything that could be verbalized could be taught by a teaching machine” (Benjamin,1988, p.709).

3. BEHAVIORAL OBJECTIVES “The first step in instruction is to define the terminal behavior. What is the student to do as the result of having been taught”? (Skinner, 1968, p.199-200)

This use of behavioral objectives to measure instructional outcomes has become a well accepted practice in general and special education. Prior to Skinner’s work the education establishment had no way to measure student outcomes. The special education law 94-142 in the 1970s mandated performance measures and monitoring. Emphasis upon competency based training and mastery learning are the result of Skinner’s work in the field of education and programmed instruction.

4 . ACTIVE STUDENT RESPONDING “It is important to emphasize that a student does not passively absorb knowledge from the world around him but must play an active role...”.(Skinner, 1968, p.5) “The student must ‘compose’ his response rather than select it from a set of alternatives as in a multiple choice self-rater”. (Skinner, 1958, p. 970.)

Skinner’s work in the laboratory showed that high rates of responding were an important measure of learning and that it was behavior that was changed not mental processes when learning occurred. “Behavior is learned only when it is emitted and reinforced”. (Holland, 1960, p.278) “But in the classroom, the student performs very little, verbally” Holland, 1960, p.2780 It is now well recognized that active student responding must be present for learning to occur. The precision teaching research which emphasizes rate of responding has shown the benefit of active student responding and high rates of active responding.

5. IMMEDIATE REINFORCEMENT “When terminal behavior has been specified, arrangements must be made to strengthen through reinforcement” (Skinner, 1968, p.206). “It is characteristic of the human species that successful action is automatically reinforced” (Skinner, 1986, p.20). “...using this immediate feedback not only to shape behavior most efficiently but to maintain it in strength in a manner which the layman would describe as ‘holding the student’s interest”. (Skinner, 1958, p.971)

The notion that immediate reinforcement must be delivered for students responses in educational settings is now well established and understood. That does not mean that it occurs as often as necessary. “But the fact that mainstream teachers use the term at all shows the lasting influence of features coming from programmed instruction”. (Vargas & Vargas, 1992, p.52)

6. SHAPING “The teacher begins with whatever behavior the student brings to the instructional situation; by selective reinforcement, he changes that behavior so that a given terminal performance is more and more closely approximated. Even with lower organisms quite complex behaviors can be ‘shaped’...” (Skinner, 1963, p.169).

The gradual progression toward the terminal behavior Skinner described within programmed instruction was an extension of the process of shaping that began in the laboratory with lower organisms. He defined programmed instruction as “... the construction of carefully arranged sequences of contingencies leading to the terminal performances which are the object of education” (Skinner, 1963,p.169) “The behavior developed in many experiments is like that developed in the classroom. Both are complex operants” (Holland, 1960, p.279. “Each opportunity for student’s to respond provides an occasion for shaping behavior” (Vargas & Vargas, 1991,p.243)



7. *ERRORLESS PERFORMANCE* “Errors are minimized- and the number of responses which are automatically reinforced are maximized” (Skinner, 1968, p.157) “A good program of instruction guarantees a great deal of success” (Skinner, 1986, p.20)

Skinner’s recommendation to teach with very few errors was drawn from the early work of Terrace (1963) with pigeons in the laboratory. “We may wish to avoid extinction,...the organism is to acquire the discrimination without any errors” (Skinner, 1968, p.71)

Teaching methods that produce near errorless performance is now a hallmark of the work with persons with autism and developmental disabilities. It is well understood that decreasing errors in some children increases acquisition and reduces resistance to instruction. The early research on programmed instruction by Holland demonstrated that errors reduced the motivation of students and led to withdrawing from the instructional environment.

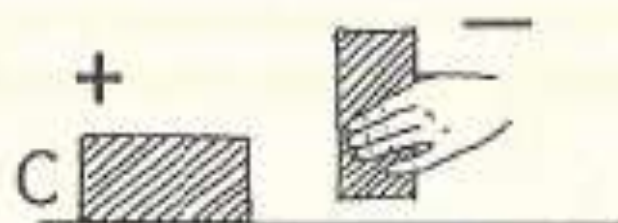
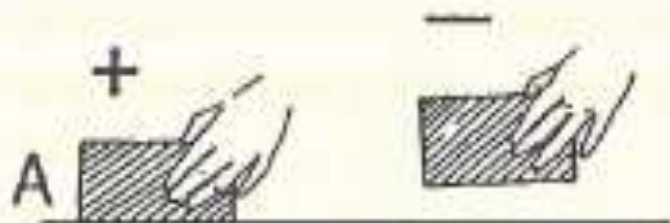
8. STIMULUS CONTROL – Discrimination Training “Another kind of programming is concerned with bringing behavior under the control of stimuli” (Skinner, 1968, p.71). The discriminative capacities of lower organisms have been investigated with methods which require very skillful programming” (Skinner, 196, p.72).

Skinner was clear about the fact that the outcome of an effective education was not to merely produce many responses but many responses under the proper sources of control. “To impart knowledge is to bring behavior of a given topography under the control of given variables”(Skinner, 1968,p.203)

Mechner suggested that most of the behaviors that usually are of interest within education and training can be analyzed in terms of discriminations, generalizations and chains” (Lockee, Morre & Burton, 2004, p.550)

Programming is the “art of teaching” How to arrange antecedent events to bring the student’s response under the appropriate sources of control. Holland developed a “black out” procedure that altered the presentation of the programmed material over many presentations to determine the relevant components of the stimuli controlling correct responses. This is a large part of what we now call instructional design.

## Teaching "On"

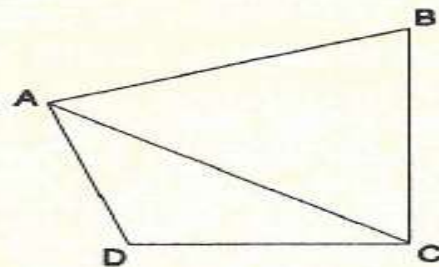


## A Comparison of Frames with Appropriate and Inappropriate Stimulus Control (from Cook, 1984)

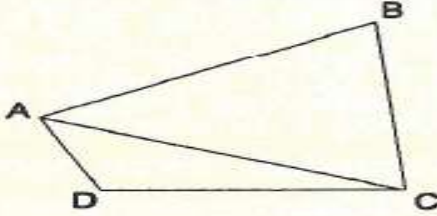
A straight line connecting opposite corners of a quadrilateral is called a diagonal.

In the figure at the right, which is the diagonal?

AB, CD, BD, AC, BC, DA



**A** To complete this frame, a student must respond to the figure and to the definition of a diagonal.

A quadrilateral with vertices labeled A, B, C, and D. Vertex A is at the top left, B is at the top right, C is at the bottom right, and D is at the bottom left. A straight line segment connects vertex A to vertex C, representing a diagonal.

A straight line connecting opposite corners of a quadrilateral is called a diagonal.

In the figure at the left, line AC is a \_\_\_\_\_?

**B** This frame, which looks similar, will not teach as effectively as Frame A. Here, the student needs only to copy the word in capitals. He or she does not need to attend to either the definition of diagonals or to the figure.



9. STIMULUS CONTROL TRANSFER PROCEDURES “Simply waiting for behavior to occur so that it can be reinforced is inefficient-indeed, for many parts of a terminal repertoire, are quite useless. Shaping behavior by progressive approximations can be tedious. There are better ways of solving the ‘problem of first instance’”. Skinner, 1968, p.207)

As Skinner was finishing the book Verbal Behavior (1957) he realized that the stimulus control procedures he was describing in the section “Practical Control” were relevant to his on-going development of instructional practices. “Our fourth principle is,...-one which involves the gradual withdrawal of stimulus support” p.279. Priming is how he solved the problem of the first response and then prompting, prompt fading, vanishing and probing were used to bring the verbal response under the proper source of control. These were some of the first steps in the development of the field of instructional design. The outstanding instructional design work of Sue Markle, Janet Twyman, Joe Layng and examples found in programs such as Headsprout had their beginnings in Skinner’s early programmed instruction efforts.

10. INDIVIDUALIZED INSTRUCTION “Stop making all students advance at essentially the same rate.” (Skinner, 1986, p.16)

Skinner had more in mind than just “individualizing instruction”. He was clear that it is not possible to effectively teach 30-40 students by presenting the same material without regard for the differing skill levels. His notion was that “we must turn to individual instruments...”

He was eventually convinced that similar positive outcomes could be achieved with “instruments” in the form of programmed texts and not just machines.

His emphasis upon individually designed programs of instruction certainly had an impact on educators and the regulations that govern the development of IEPs for children with disabilities.



**11. DATA BASED DECISION-MAKING** “Whether good programming is to remain an art or to become a scientific technology, it is reassuring to know that there is a final authority-the student” (Skinner,1958 p. 974). “Just as students must not only learn but know that they are learning, so teachers must not only teach but know they are teaching” (Skinner, 1984,p.952)

A well accepted practice in the field of special education includes the modification of instructional methods based upon student performance data. The proponents of precision teaching have guided the field of education on how to make precise data-based decisions (See Kubina & Yurich, 2012,Chapter 4). “The Student is always right”. Holland (1960) in his description of the early attempts to program educational material suggested that frequent errors are the result of poor programming not poor students. He suggested “The student can write the program-he can not write the textbook” (Holland, 1960 p.286)



*"Boy, do we have this guy conditioned. Every time I  
press the bar down he drops a pellet in."*

Columbia Jester  
@ 1956

# More of the Legacy

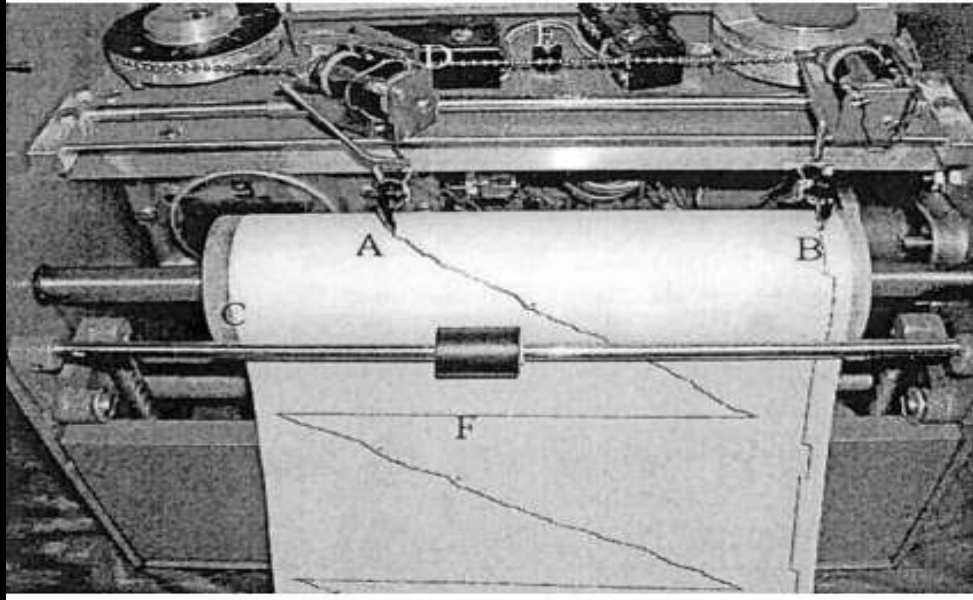
- Precision Teaching
- Direct Instruction
- Morningside Model of Generative Education
- Comprehensive Application of Behavior Analysis to Schooling (CABAS)
- Headsprout Reading

# PRECISION TEACHING

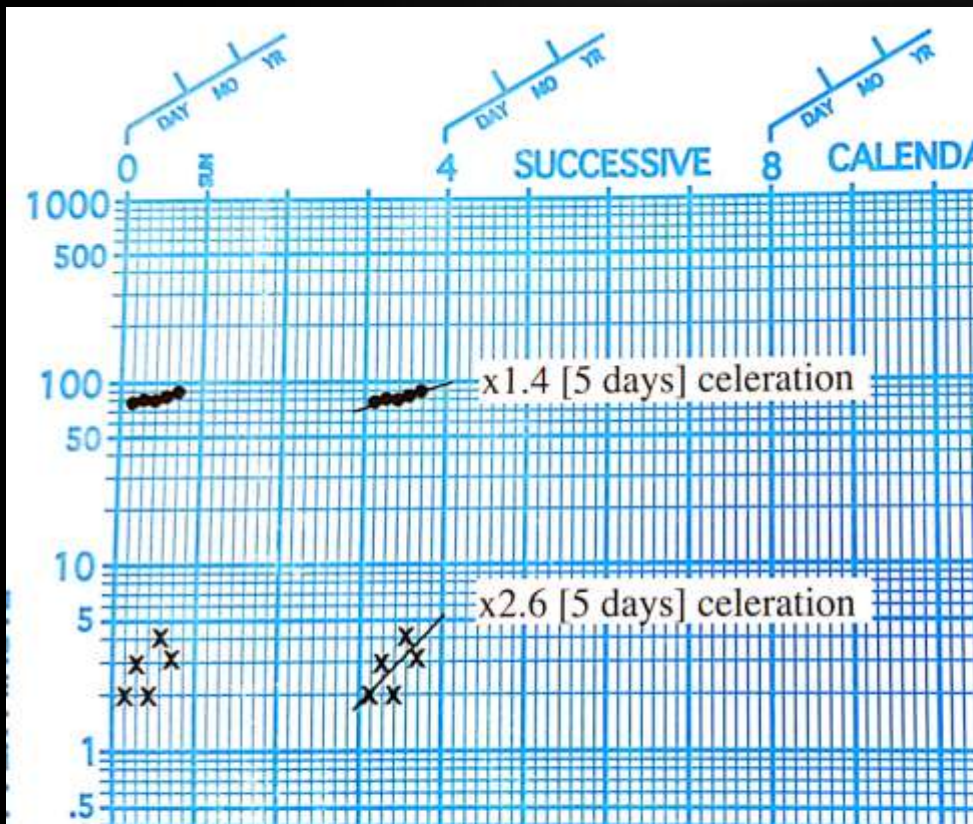
- “Precision teaching inherited rate of response and cumulative response recording from B.F.Skinner. This legacy is unique since Precision Teaching is the only instructional system derived from Skinner’s work to use his monitoring method exclusively” (Lindsley, 1991, p253.).
- This surprised Lindsley since Skinner declared these two of his most important contributions in a paper, “Farewell, My Lovely” (Skinner,1976).
- “Precision teaching has developed a measurement approach that embraces Skinner’s powerful laboratory discoveries (e.g. cumulative response recorder) and makes the scientific method available to teachers” (Kubina, Morrision & Lee 2002, p.235)

- It was Ogden Lindsley, a student of Skinner's, who saw the value in standard measurement of behavior.
- It was the cumulative recorder that allowed Skinner to see the orderliness of response curves in his laboratory that led to his discovery of the basic principles of behavior.
- In turn, Lindsley devoted his career to improving the education of children in schools by standardizing measurement through his discovery of the Standard Celeration Chart (SCC) and disseminating his findings to teachers through his students, publications and lectures.
- On the next slide are the Cumulative Recorder used by Skinner and the SCC developed by Lindsley.



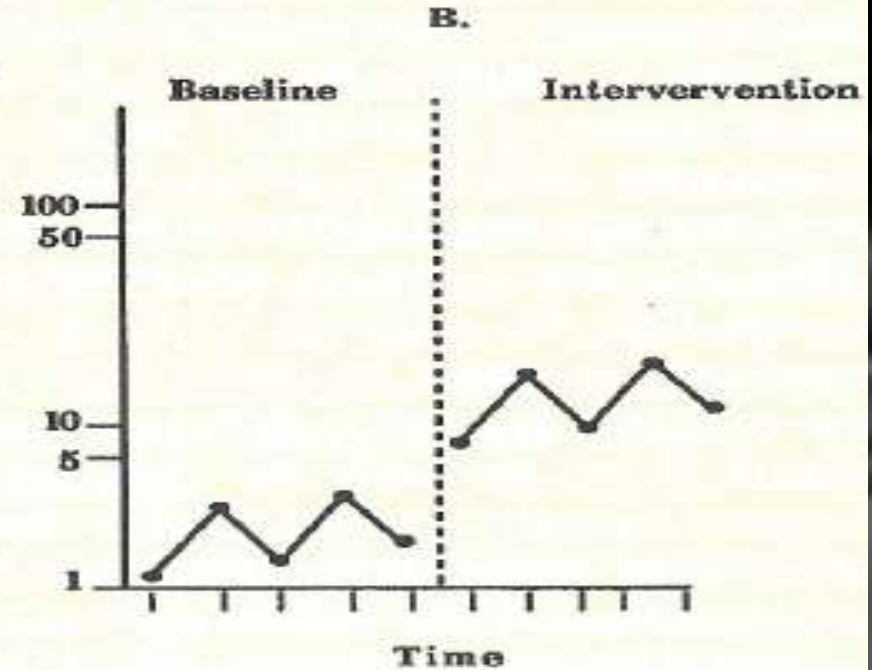
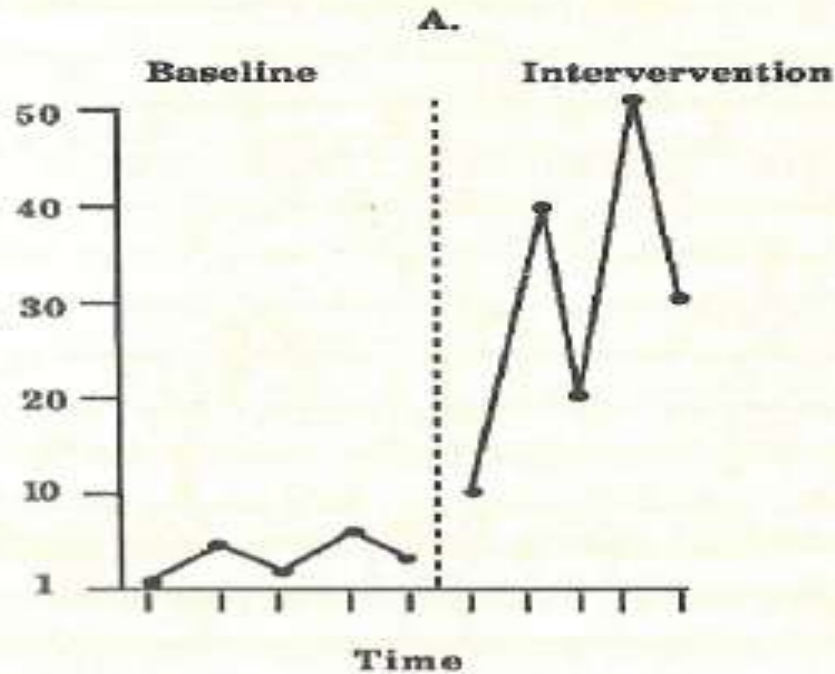


CUMULATIVE  
RECORDER



STANDARD  
CELERATION CHART  
(Kubina & Yurich, 2012)

- Both methods provide a standard measure of behavior.
- As Explained by Kubina & Yurich (2012), the cumulative recorder provides a graphic display of changes in behavior from moment to moment.
- The SCC provides a graphic display of changes in frequency of behavior from the first day of instruction to the end of the week (frequency to frequency) thereby yielding a quantified measure of the “celeration”, fluency of responding and learning.
- It appears that skills learned to fluency are more beneficial to the student than simply mastered skills.
- “The chart helps teachers and students discover measurably effective instructional procedures” Potts, Eshleman & Cooper, p.182)



Arithmetic Chart (Stretch to Fit)

Ratio Chart (SCC)

- As Skinner and Lindsley suggested, a standard chart allows you to make precise judgments about the effects of your independent variables.

- Those who make use of precision teaching use guidelines that come directly from Skinner's work on programmed instruction;
  1. Focus on observable behavior
  2. Measure using frequency
  3. Graph performance data on a SCC
  4. Use the performance data to guide instructional methods.  
(Kubina & Yurich, 2012)
- An early paper by Kubina, Morrison & Lee (2002) outlined the benefits of Precision Teaching for children with autism.
- One of the best resources on the topic is provided by Patrick McGreevy (1981) "Teaching and Learning in Plain English".
- 
- For a review of the impact of Precision Teaching on the education of children with developmental disabilities and autism see Ramey, Lydon, Healy, McCoy, Holloway & Mulhern (2016)

- Videos

- When precision teaching is part of the instructional curriculum for children with autism daily fluency timings of student frequency of responding is typically implemented across instructional domains .
- Here are some videos of this in educational settings with children with autism.
  - [Student Timing](#)
  - [James Timing](#)
- Finally, for those of you who have failed to make use of Precision Teaching because you found the chart “too complicated”, the contents of the next slide might change your mind.



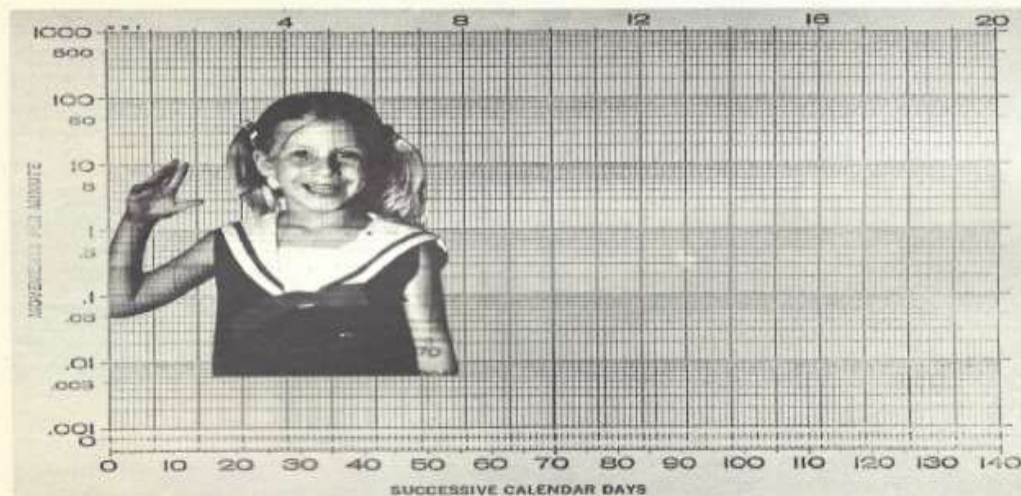
# “...and a child shall lead them”: Stephanie’s Chart Story

STEPHANIE BATES  
DOUGLAS F. BATES

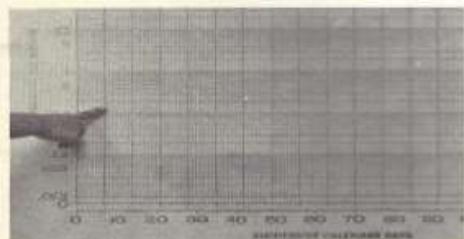
Stephanie Bates is a 6 year old, first grade pupil. She was 5 years old when she dictated the tape presentation to her father, Douglas F. Bates is presently completing his doctoral work at the University of Kansas, Kansas City.

■ In the Book of Isaiah, we find “. . . and a little child shall lead them.” The counterpart of this in precision teaching is the principle, “The Child Knows Best.” After encountering a great deal of difficulty in teaching people to use the Standard Daily Behavior Chart, we decided to practice what we had been teaching and turned to a child to learn how best to teach charting. The result was an 18 minute color slide presentation written and narrated by Stephanie Bates, a 5 year old kindergarten pupil (Bates, 1970). We hope this adapted version of Stephanie’s slide-tape presentation will help you learn about charting.

■ Hello! My name is Stephanie Bates. I am 5. I go to kindergarten. I would like to show you how to use a chart.



■ This is a chart. You use it to write down how many times in a



day you help your mother, how many words you can read in a minute, and how many times the teacher has to tell the boys to stop running and making noise.

The chart has heavy, thick lines and light, skinny lines. The lines that go up and down are day lines. See this Sunday line going up and down and the Monday line right next to it. Do you see another Sunday line? The big heavy lines are

Sunday lines. They are day lines.

Do you see all the Monday, Tuesday, and Wednesday lines, and Thursday lines, and Friday and Saturday lines? They all go up and down like Sunday lines but are skinny. They are day lines too. All up and down lines are day lines.

■ These lines go across the chart. They tell you how many times you



do something. They tell you how often you can do something. I would like to teach you a new word. The new word is frequency. Frequency is how many times you do something in one minute. We use frequency on this chart to say how many times we do something in one minute, ten minutes, one hundred minutes, or a whole day. These lines that go across the chart are frequency lines.

■ See where the one line is that goes across. Dot number 1 is on the 1 line. The line that goes up and down through dot number 1 is the

## DIRECT INSTRUCTION

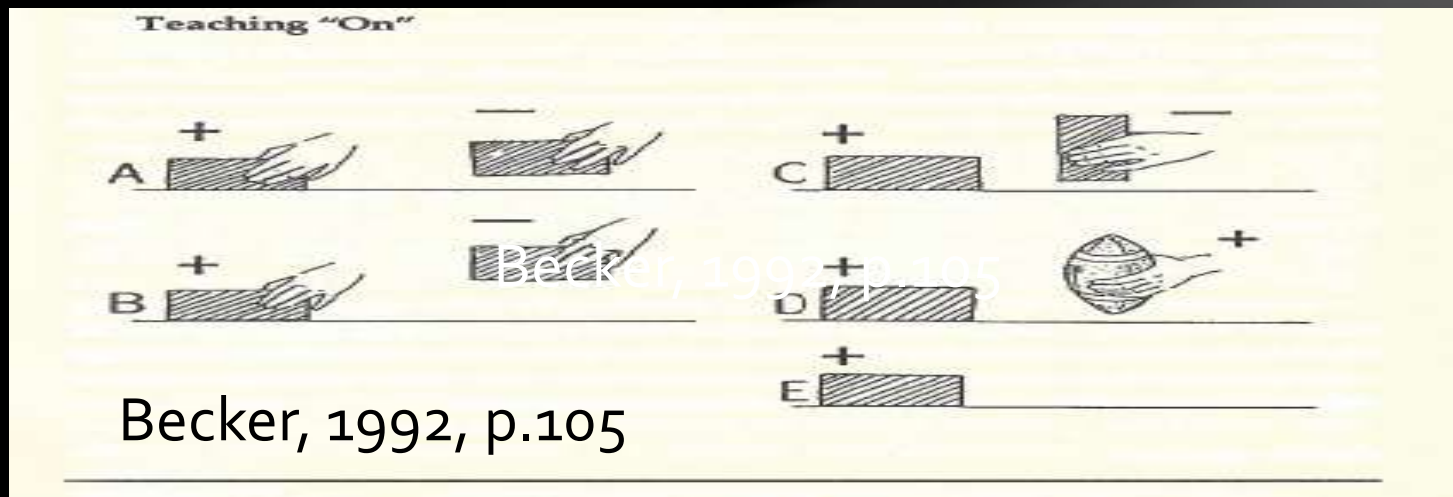
- The person most closely associated with the instructional method and materials referred to as Direct Instruction (DI) once said “...there is nothing wrong with behaviorism as far as it goes” (Becker, 1992)
- However, when Wes Becker and Doug Carnine joined Engelmann in the development of DI instructional methods the influence of Skinner and behavior analysis became obvious.
- Engelmann preferred a more logical approach than empirical approach to instruction. (Becker, 1992)
- In their text “The Theory of Instruction: Principles and Applications” (1982). Engelmann and Carnine explain the principles that guide Direct Instruction without a single behavior analytic term.

- All the principles and methods were not derived from previous research but instead were discovered day by day through field-testing with children.
- Becker (1992) notes that Engelmann adopted Skinner's position of letting the behavior of your subject teach you what works. It was the children that taught Engelmann.
- Much like Skinner his field testing taught him that reinforcement was important, observable outcomes should be measured, the teacher should be considered a behavioral engineer and learning requires programming one step at a time. (Becker, 1992).
- The Direct Instruction presentation of stimuli demonstrates precise antecedent or stimulus control to teach concepts.



# Teaching Concepts

- In the presentation below, examples (+) and non-examples (-) of the concept of “on” are presented along with adherence to “sameness principle” and “minimum difference” principle.
- It would be easy to translate this example into presentation of discriminative stimuli and S-Deltas necessary to bring the tact “on” under the control of the relevant stimuli.



- In the largest evaluation of instruction in the history of education, Project Follow Through (1968-1976), the DI methods show the greatest student gains compared to eight other methods of instruction. (See Watkins, 1995, Follow Through; Why We Didn't)
- Since that time there have been successful attempts to use DI methods and materials to instruction children with autism (Flores & Ganz, 2007; Ganz & Flores, 2009; Schillingsburg, Bowen, Peterman, & Gayman, 2015)

## DI Videos



# Comprehensive Models

- Skinner's work on technology of teaching have produced at least two comprehensive models of schooling that operate currently.
- **Morningside Model of Generative Education;** For over 35 years this approach to education developed by Kent Johnson and his colleagues have made use of Skinner's basic laboratory concepts and principles.
- As a level 3 research organization (Johnston, 1996) they have adopted educational practices derived from Skinner's laboratory (DI and Precision Teaching) and expanded their application to successfully serve individuals whose educational experience has been disadvantaged.

- For a thorough review of this behavior analytic approach to education see Johnson & Street- From the Laboratory to the Field and Back Again: Morningside's Academy's 32 Years of Improving Student's Academic Performance (2012)
- **Comprehensive Application of Behavior Analysis to Schooling (CABAS)**: this model developed by R. Douglas Greer at Columbia University is an operant systems approach to education.
- Greer and his colleagues have provided a behavioral analysis of a behavior analytic approach to education.
- Drawing on the technology of teaching presented by Skinner and his analysis of verbal behavior the inter-locking contingences that manage the behavior of students, teachers, supervisors, administrators and parents are targeted to produce the best possible student outcomes.

- Teachers learn to be “strategic scientists” in which teaching becomes a specialization within behavior analysis.
- With decades of data and publications of specific methods and program outcomes, CABAS serves as a model of the type of educational practices Skinner had attempted to produce through his educational reform period.
- See Greer, (1992) The Teacher as a Strategic Scientist: A solution to Our Educational Crisis?

# The Future

- While Skinner's unsuccessful attempt to overhaul the educational system was one of his greatest disappointments he nevertheless left an enormous legacy that teachers and children with disabilities and autism are benefitting from every day throughout the world.
- But, despite the setbacks Skinner never abandoned his commitment to improve the educational system.
- In 1984 he wrote "On a morning in October 1957 Americans were awakened by the beeping of a satellite. It was a Russian Satellite, Sputnik. Why was it not American? Was something wrong with American education?"
- This was the first lines of his scathing report, "The Shame of American Education" more than 30 years after his visit to his daughter's classroom

- In this paper he reflected on the fact that instructional practices have moved no further toward adopting a technology of teaching he developed in the 1950s and 60s.
- The calls for improvement in education that occurred in the 1980s almost never included any talk of improving teaching.
- He said, “There is a conspiracy of silence about teaching as a skill” (Skinner, 1984,p.2) “Pedagogy is a dirty word”
- ( Skinner,1984, p.2)
- He once again lamented the reasons for the failure of the educational establishment to adopt a technology of teaching.
- In general he asserted that colleges of education and the culture must accept and teach the principles derived from the experimental analysis and his analysis of verbal behavior if education is ever to be improved.



- Once that is accomplished the focus of education will be upon how to improve educational practices through effective pedagogy instead of the distractions of longer school years, coercion of teachers, more homework, student testing and calls for excellence.
- “A culture that is not willing to accept scientific advances in the understanding of human behavior, together with the technology that emerges from it, will eventually be replaced by a culture that is. If that is our culture that will be replaced, it would be a tragic end because there are many good things about it that might be lost”. (Skinner, 1984)
- “... When it finds its most effective methods education will be almost uniquely relevant to the task of setting up and maintaining a better way of life” (Skinner, 1973, p.6).

# THE END

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