Some Historic Roots of Education Reform

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INTRODUCTION

Those of us who are old enough can remember the big splashes that educational technology made in the 1960s and 1970s with involvement of the national media, the White House, Congress, state agencies, and corporate America, and international reverberations via UNESCO and the OECD. What follows is my attempt to weave the connecting threads of these achievements into a story that reveals them as precursors of current work in school reconfiguration and education reform.

THE COLUMBIA UNIVERSITY PSYCHOLOGY DEPARTMENT OF THE 1950s

That's where the story begins. It was a time of unabashed idealism, of graduate students giddily discussing the ways in which the emerging science of behavior would transform society. We were on fire with a sense of mission.

Each of us had reached it by a different path. My own featured a war-whipped childhood with multiple close calls in the Holocaust. Survivor's guilt? Maybe. What I know for sure is that I was left with a strong sense of obligation. Perhaps it was my Viennese upbringing that led me to assume that I would fulfill it as a painter or pianist, but at age 20, I discovered what seemed like a more impactful way—the science of behavior. In any case, I adopted a monastic existence in which personal comforts had no standing. I spent 14-hour days, 7-day weeks in the lab, feeling dedicated to the advancement of behavioral science and its application to human affairs.

The other zealots

There was Thom Verhave, the whimsical, intense Van Gogh lookalike with a Dutch accent and deep knowledge of the history of science and classical music; Donald A. Cook, the erudite conversational virtuoso known for an encyclopedic knowledge of literature, the arts, and the sciences, ready with an Auden or Yeats quotation for any occasion; Bob Thompson, leader of the

Red Onion Jazz Band; Robert Berryman, the gifted apparatus wizard and connoisseur of art, philosophy, and world cultures; Bill Stebbins, Jack Findley, and many other exceptional people. The legendary firebrands of the preceding generation—Murray Sidman, Don Bullock, Jim Dinsmoor, and Joe Antonitis—had just moved on, and Charles Ferster had left Columbia for Harvard to work with Skinner.

Some of the faculty members

The founder of the Columbia psychology department's behavioral orientation was the affable, modest, and beloved Professor Fred S. Keller. When he didn't approve of someone, the worst he would say is, "I don't know about him." Ever ready with the perfect quip, he used to call Don Cook "Silver Tongue" for reasons that became evident as soon as Don opened his mouth. Don was a spellbinding speaker, and when Keller could not give one of his Psych 1-2 lectures for any reason, he had Don give it in his place.

Professor William "Nat" Schoenfeld delivered his colorful metaphors with the dramatic inflections of a radio announcer, punctuated with backward and sideways head jerks as his eyebrows rose and fell and his eyes widened and squinted. He taught his graduate students that to pin down a phenomenon experimentally, it is valuable to define the entire function by using several (not just two) values of the independent variable, and when possible also varying one of the function's parameters.[1]

Professor Ralph Hefferline's calm demeanor exuded warmth and wisdom. His ideas were among those that had influenced me to replace my early passions for painting, piano, and chess with a commitment to behavioral science. Hefferline and I were usually the only people left in our labs on the

[1] The dissertation on avoidance behavior that Murray Sidman did under Schoenfeld has rightly been held up as a model of that methodology.

second floor of Schermerhorn Hall at three in the morning.

Professor Henry Garrett tended to side with Lionel Trilling of the English Department and Robert K. Merton of the Sociology Department in attacking the Skinner-Keller-Schoenfeld orientation as fatally narrow and misguided in its seeming tenet that the complexities of the human mind were reducible to bar pressing by rats. Keller made no secret of the unhappiness and battle weariness these attacks caused him.

How Schoenfeld challenged his students

"There is no real evidence for the theory of evolution." "The brain has nothing to do with behavior." "Genetic factors have no significance." The rantings of some kind of ideologue? No. Statements by Nat Schoenfeld in his seminars. Outrageous though these statements were, he pretended to believe them and would invite refutation. And when a brave soul did pick up the gauntlet, Schoenfeld would lunge at any soft spots with one of his stock jabs—"What do you mean by that?" "How do you know that?"—and with erudite ridicule reduce the protagonist to silence, fury, or even tears. When taken to task for bullying, Schoenfeld explained that his goal was to provoke scrutiny of unexamined beliefs. No one disputed that this worked, and worked well. I confess that my own tendency to question widely held beliefs resonated with this goal, though not necessarily with the method.[2]

Jobs I owe to Keller

Shortly after being accepted into the department, I asked Keller if he could suggest a way for me to earn some money. "Talk to Don," he said. Don Cook, who was heading up Keller's Air Force contract on Morse code learning, thereupon hired me, first as a test subject and then to collect and

[2] Few training systems are more effective than a culture-hopping childhood, such as mine, for instilling skepticism of strongly held beliefs.

analyze the data. Don became my mentor, and his scientific erudition inspired me to try to broaden my own scientific education.[3]

After the Morse code project, Keller hired me to work on his contract with the School of Aviation Medicine, to determine whether alpha-tocopherol could mitigate the behavioral effects of hypoxia. One of the behavioral measures I devised to assess such effects, the "counting schedule," [4] became my PhD thesis and in 1956, thanks to Keller's recommendation, got me hired by Schering Corporation to establish a behavioral pharmacology laboratory.[5]

In 1955 I was appointed Lecturer, with the assignment of redesigning and teaching a 5-point experimental psychology laboratory course. For the next five years I taught three sections of that course, each with a maximum enrollment of 22 students.

B.F. Skinner and programmed instruction

All of us in the psychology department shared the conviction that education was the field in which the behavioral sciences would make a big impact, and that Skinner was pointing the way to game-changing instructional techniques. His 1954 article "The Science of Learning and the Art of

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[3] Since Columbia allowed its graduate students to take courses in other departments for free, Don and I took courses together in differential equations, mathematical statistics with Herbert Robbins, symbolic logic, modern algebra, and Professor Lofti Zadeh's information theory course. I also took biochemistry, physiology, electronic circuit theory, genetics with Theodosius Dobzhansky, and anthropology with Margaret Mead.

[4] Once I realized that I could put a second bar into the response chamber (this rather obvious idea was new in 1953), the counting schedule was only one of many new procedures I was then able to devise. This procedure eventually led to the "revealed operant" concept.

[5] Description and photos of the laboratory: Mechner papers, Archives of the History of American Psychology, The Cummings Center for the History of Psychology, The University of Akron.

Teaching," together with his 1958 article "Teaching Machines," inspired me to start experimenting with programmed instruction. In 1959, while developing an instructional program for elementary algebra, it became clear to me that the effectiveness of instructional programs would depend on some applications of behavioral science.

Instructional program development

Accordingly, in 1960 I began to write up my program development process (Mechner, 1961, 1962).

I described the first step as "specification of the terminal behavior" to be achieved by the learner. I thought of it as an extension of Peter Drucker's influential "management by objectives" concept to "*learning* by objectives." This key initial step received further attention from others in following years (e.g., Mager, 1962; Markle, 1964; Vargas, 1972).

The second step, which I called behavioral analysis,[6] consisted of identifying the important concepts and skills of which the specified terminal behavior was composed, for the particular target population. The concepts would then be analyzed in terms of discriminations between classes and generalizations within classes—instances and non-instances—and sequences of concepts or actions, such as certain skills, would be analyzed as behavior chains (Keller & Schoenfeld, 1950; Mechner, 1962, 1965a, 1967; 1981b). Behavioral analysis also reveals whether the target performance and the response formats should be written, spoken, or other, and what type of instructional medium would best simulate the situations in which the target performance is to occur. Only after the behavioral analysis step had been completed would it be productive to start creating instructional materials.

I described the "developmental testing" step as repeated cycles of testing and

[6] Not to be confused with "behavior analysis," the term that Skinner applied to the field as a whole, many years later.

revision—a standard technique of product development. The programmer observes members of the intended target population working their way through the program and uses the data to identify and fix the inevitable flaws and gaps in the materials. I estimated that three or four such testing and revision cycles would usually be sufficient.

BASIC SYSTEMS, INC.—A CRAZY PLUNGE

Though I was strongly committed to my basic research work,[7] I was beginning to wonder whether the standard academic route of publishing and grant seeking would ever enable me to deliver tangible benefits to society. At the same time, I thought that my new instructional technology was crying out for application and that it was up to me to bring it to life.

I had become convinced that for any science to garner support, it must deliver benefits to the society whose support it seeks, and that in our society, the corporate vehicle is the best way to go.[8] So, in September of 1960, I founded my "Institute of Behavior Technology," [9] and immediately thereafter, Basic Systems, Inc. in partnership with David Padwa, a lawyer friend of Don Cook's and mine. We agreed to be 50-50 partners and that 10 percent of Basic Systems' profits would go to fund my research institute.

I become a renegade

Friends and colleagues assured me that starting a business was foolhardy. They were right, of course. I had zero business knowledge, zero capital, and worse, zero understanding that this could be a problem. But I had become

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[7] I was working on a formal language for codifying behavioral contingencies and developing techniques for studying the internal structure of multi-response operant units with my two-bar procedures. I continued to develop these techniques in my psychopharmacology work at Schering.

[8] I later elaborated this thesis in Mechner, 1966.

[9] The predecessor of today's Mechner Foundation

convinced that if I wanted to follow unfashionable paths, I could not continue to depend on the sponsorship and approval of the traditional institutional patrons. I would need financial independence.

Keller was dismayed by what he interpreted as my repudiation of academia and all that he had done for me, in favor of a plunge into what he described as "commerce." Schoenfeld was even less happy with my decision.[10] I knew that by taking the self-funding route, I was renouncing the venerable imprimatur of academia—a brazen act of defiance.

The launching of Basic Systems

I immediately recruited and began to train Basic Systems' staff of young programmers, mostly Columbia undergraduates and graduate students. My daily sessions with them required 100-hour work weeks in a little office above a Chinese restaurant at 112th Street and Broadway, an unsustainable schedule that I knew would eventually require me to give up my Schering lab and my Columbia Lecturer position along with the great pleasure that teaching my experimental psychology course had been giving me.

I wrote the first industrial training program over the 1960 Christmas holidays. It was designed to teach Schering sales representatives the medical background of oral antifungal agents. Schering promptly ran a controlled test of the program's effectiveness on their own sales reps. They published the spectacular result (Hain & Holder, 1962), and gave Basic Systems contracts for several more programs. One of these, "Reading the Electrocardiogram," designed for doctors, won an award two years later as the best program yet written. Basic Systems was launched.

Basic Systems' debt to Skinner

It wasn't just intellectual. Early one Saturday morning in January of 1961, I received a phone call from Charles Walther, Editor of Appleton Century

[10] Decades later, all was forgiven.

Crofts, Skinner's publisher. He explained to me that he had asked Skinner where they might find programmed instruction courses to publish, and Skinner had referred him to me (the only game in town at that time). The result: In April of 1961, Appleton Century Crofts invested $360,000 [11] in Basic Systems for an 18 percent equity interest and the right to publish our school programs.[12]

And it didn't end there. In February of 1961 Skinner came to Columbia University's Teachers College to "debate" Professor James McClellan on the viability of programmed instruction. My role as the third speaker on the program was to show that programmed instruction was viable and would not eliminate teachers. Two days later a student of Skinner's who had been in the audience, Charles D. Atkinson III, made a substantial investment in Basic Systems.[13]

The Ph.D.s from Columbia and Harvard

Once Basic Systems had money for salaries, I recruited its full-time senior staff of outstanding PhDs, most from Columbia and Harvard: Charles D. Atkinson, Donald Bullock, Donald A. Cook, Irving Goldberg, William Laidlaw, Stuart Margulies,[14] Lauren Resnick, Kathleen Speeth, and Alva Bazemore (whose PhD was in biochemistry). They were motivated by equity participation and a work environment that gave them a shared sense of mission, with freedom to innovate and take intellectual ownership of their achievements.

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[11] Multiply by 8 to convert to 2014 dollars.

[12] This quick and rather lucky financial success, and those that followed, did not endear me to some of my colleagues: my hubris in forsaking academia was being rewarded instead of punished.

[13] He subsequently joined Basic Systems and over the following four years met all of our capital needs through investments by his family and money management firms with which they had relationships.

[14] The main author of *Bobby Fischer Teaches Chess* and *Effective Listening.*

Xerox buys Basic Systems

Fast-forward four years to May 1965: Xerox Corporation acquires Basic Systems for $6 million dollars ($45 million in 2014 dollars). Why did Xerox pay so much money for this little company? In the words of Joseph C. Wilson, Xerox's visionary President and CEO, to his shareholders:

> [Basic Systems] is a cluster of very, very unusual people. They have done some of the most extraordinary work ever done in the United States in relation to new methods of teaching, programmed learning, and industrial training. After a very careful survey we made among academic people and people in the U.S. Office of Education, we decided that we wanted to be associated with these people…BSI-designed instructional courses have been among the most successful in the nation…(Xerox Corporation, 1965a)

Wilson could also have mentioned that Xerox had been using Basic Systems as the supplier of their training systems.

"The decade's most talked about acquisition"

The industry publication *Edubusiness* later wrote as follows regarding Xerox's acquisition of Basic Systems in "A report to management on the education and training market":

> Basic Systems became one of the decade's most talked about acquisitions…the value of the company, most people agree, was the people who were in it... the greatest assembly of bright people under one roof…Francis Mechner, described as "the towering technical person and inventor of behavioral design," left in 1966. (A Report to Management, 1970)

To convey the full import of the story I am relating, I find myself needing to make occasional reference to financial facts. For instance, Xerox's decision to buy Basic Systems was richly rewarded when it resold the company for

$117 million (close to half a billion in 2014 dollars), in 1985, to the Los Angeles Times Mirror, which renamed it Learning International.

Basic Systems' flagship program, PSS

Why was Xerox able to sell Basic Systems (which it had renamed Xerox Learning Systems) for that much money? Because Basic Systems' main product at the time, "Professional Selling Skills" (PSS), had achieved sales of approximately $50 million per year for many years,[15] and had become by far the most widely used (and copied) training system of all time (see also *History in the Making* (1985)), which describes the program's origins. Unprecedented, too, was the type of competency PSS addressed—the complex interpersonal skills of consultative selling: probing and listening so as to diagnose a client's needs, formulating features of the product as benefits to the client, and the process of persuading.

To clarify what Joseph Wilson meant when he said "extraordinary work," I will retrace some of the most important trails Basic Systems blazed before they disappear entirely, as unmarked trails usually do.

Penetrating the bastion of medical education

One of the things Wilson must have had in mind was Basic Systems' large-scale penetration of the impregnable bastion of medical education. In September 1962, Pfizer's magazine *Spectrum* polled its readership of 250,000 doctors as to whether they would want to use programmed courses for their own continuing medical education. To illustrate this new method of learning, the article included a short program I had provided.[16]

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[15] The reported figure of $50 million per year is in line with the $117 million price Xerox received for the PSS business. As for the total number of trainees trained with PSS, it can be estimated by assuming that clients paid $100 per trainee and dividing that figure into the total PSS sales since 1965.

[16] It was a modified version of the electrocardiography program I had written for Schering the year before.

The response was unprecedented in *Spectrum*'s experience. More than 60,000 doctors responded, many with long, enthusiastic letters. Concerned that this response could have been due to the sample program's subject matter sample rather than to its instructional technique, Pfizer repeated the test with another program sample I gave them, on a different subject. This time the response was even greater.

So, Pfizer awarded Basic Systems a series of large contracts to develop programmed instruction courses for physician education. The first one was *Allergy and Hypersensitivity*.[17] When the first print run of 100,000 was gone, they did a second run, and then a third.

An editorial in the *Journal of the American Medical Association*

A January 1964 editorial in the prestigious *Journal of the American Medical Association* noted:

> A pharmaceutical firm has scooped the field in continuing medical education, and has had more than 100,000 requests for its first program. It is evident that education has come upon a new day in which solid theory is being translated into new instructional concepts and methods. Medicine may not be in the vanguard, but let it not be laggard in exploiting what is sound in this new science (Summit, 1966a).

Leon Summit, *Spectrum*'s editor, then reported:

> JAMA [*Journal of the American Medical Association*] lauded programmed instruction and said it promised to introduce new ease, effectiveness, and efficiency into the initial and continuing education of physicians…To date, there have been 250,000 requests for *Allergy and Hypersensitivity*, and most of the medical schools in America are using it, as well as the course that followed, *Current Concepts in*

[17] Mechner papers, Archives of the History of American Psychology, The Cummings Center for the History of Psychology, The University of Akron.

Thyroid Disease. The allergy course is believed to be the most widely used self-instructional program in the world up to now, and it may well be that the thyroid course is the second most widely used in the world. The courses continue to elicit high praise from educators as well as practicing physicians (Summit, 1966a).

Today, all three courses are being used to teach in virtually all of the 91 medical schools and the 1,100 teaching hospitals in the country. Many schools and hospitals have incorporated the courses into their required study materials … Medical educators request the courses in hundreds at a time, and renew their requests each year for new classes (Summit, 1966b).

The significance of these achievements

For Basic Systems, they represented a huge business success, as several other major firms sponsored additional Basic Systems medical education programs. The topics were electrocardiography, primary arterial hypertension, rheumatoid arthritis, renal function and electrolyte balance, and endocrinology. Several of these had print runs in the six-figure range, like Pfizer's first three programs. We also developed widely used instructional programs for nurses, technicians, and other paramedical personnel (Mechner, 1965b).

These results also demonstrated what can be achieved when behavioral technology is brought to bear—competent behavioral analysis of subject matter and the developmental testing and revision process, as described earlier. But for me personally, it was a vindication of my thesis that in our contemporary American society the corporation is the natural vehicle for bringing the fruits of a science to the benefits of society. No governmental or academic funding agency would ever have provided the hundreds of thousands of 1963 dollars required to fund the development of these high quality programs.

Job Corps Training Centers and school design

In 1964, Basic Systems received a contract from the office of Governor Endicott Peabody of Massachusetts to design a residential training center for disadvantaged youths. The center's objectives were specified in terms of the competencies to be achieved by the target population after a training stint in the center. The center's behavioral design featured a sophisticated behavior management system, and contingencies designed to simulate the work and family environments for which the trainees were to be prepared. Here we have the first glimpse of behavioral technology's applicability to the design of educational institutions, such as schools.

Though the Massachusetts center was never built, its design led to a $4 million contract award to Basic Systems from the U.S. Office of Economic Opportunity (OEO) in 1965, to build and operate a Job Corps training center in Huntington, West Virginia. Again in the insightful words of Joseph C. Wilson, President of Xerox, in Xerox's 1965 Annual Report:

> Operation of the Huntington Center not only provides BSI [Basic Systems, Inc.] with an unusual opportunity to assist in solving an important national problem, but also creates a curriculum laboratory where the instructional process can be observed and newly developed teaching techniques applied… [*to create*] school materials designed for many different levels of achievement in such areas as science and language arts. (Xerox Corporation, 1965b)

Behavioral design applied to school configuration

The 100+ Job Corps Training Centers established by the OEO in subsequent years incorporated many of the design features of the Huntington Center and the Massachusetts Center. The underlying approach, now often referred to as Organizational Behavior Management (OBM), demonstrated how behavioral science could be applied to the design of an entire institution, with the performance outcome specified in terms of the competencies of its

graduates.

The centrality of the institutional design issue in education reform is generally ignored. Most educational innovators have tended to approach school reform from the standpoint of instructional design, curriculum reform, or best practices, while ignoring the organizational and management features of the learning environment. Basic Systems' attention to these features and the prevailing behavioral contingencies in the design of the Job Corps Training Centers was a conceptual antecedent of the Paideia Individualized Education approach to school configuration described later.

The management system for Job Corps training centers

Concurrently with its work on the Huntington Job Corps center, Basic Systems' technical personnel developed the behavior management system and training programs for most of the OEO's Job Corps training centers. As of 2013, there were still 125 Job Corps centers throughout the country, with nearly 2 million youths having been trained in them as of that date.

The behavior management system sought to address most of the important issues in educational technology.[18] The training programs covered interpersonal competencies like communication and collaboration, maintaining a living space, personal health, grooming, self-management heuristics for handling problem situations, money management, vocational competencies, and job interview skills. Though these Job Corps systems and programs have undergone gradual change over the past decades, the total

[18] Issues addressed were the use of intrinsic versus extrinsic reinforcers, assessment methods, motivational techniques involving point award or token systems, when it is and isn't appropriate to display or reveal awards publicly; in what circumstances it is permissible to penalize by subtracting points, when ad hoc awards can be beneficial, relative numbers of points awarded for the various types of achievement, redemption rules, issues of fairness perception, frequency and length of tests, discipline policies, and other behavior management issues that are still being studied today.

societal impact of Basic Systems' contributions through the Job Corps program may well dwarf that of all its other contributions combined.[19]

Breadth and diversity of applications

The broad range of competencies, behaviors, and target populations Basic Systems was able to address successfully speaks to the versatility of its technology. Prominent examples: selling skills, medical education, Job Corps Training Centers; Effective Listening; *Bobby Fischer Teaches Chess* (close to 1.5 million copies sold to date); computer languages, programming and systems analysis for UNIVAC and IBM; and Xerography.[20]

The true significance of PSS, beyond its dissemination of consultative selling and persuasion skills, resides in its demonstration of the episode-based simulation methodology. Both the target performance and the types of situations in which it is to occur are simulated in episodes that require the trainees to respond during training in the ways they are being trained to respond in the target situations. Simulation had long been used for pilot and

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[19] Clara Slavin's 2009 "Brief History of the Job Corps" summarizes its social contributions. Some excerpts: In 2007, the Job Corps was found to increase children's basic reading and math skills by 60%, and 60% found employment and went on for further education. Job Corps graduates have an average hourly wage of $1.50 more than before and stay employed for longer periods of time (Performance and Accountability report, 2007). Criminal activity was reduced, with a reduction in criminal justice system costs, personal property damage, personal injury damage, and stolen property costs (Glazer, 1988,p.82). Lower crime and arrest rates contributed to higher employability, improved educational attainment and increased annual earnings of 28% (Blau and Abramovitz, 2004, p.334). For every dollar invested, the Job Corps returns $2.02 through students working more hours, paying taxes, engaging in fewer crimes, and relying less on public assistance (Schell, 2002). Only 10% of youths keep gang-related ties after completing the program (Spergel, 1995, p.275).

[20] More examples: training of Nautilus submarine personnel; supervisory skill training; PERT (Program Evaluation and Review Technique); various engineering-related skills; nursing education; and diverse programs for the Air Force, Army, and Navy.

combat training, but PSS demonstrated how it can also be used for the training of complex interpersonal skills. Examples: supervisory training, leadership training, management training, and teacher training (e.g., Mechner 1978, 1981a).

The applicability of simulation also extends far beyond skill training—e.g., to the simulation of real-world work and family situations for which young students must be prepared. This application has important implications for the design of educational institutions, as reflected in the PIE technology described later.

Awareness of Basic Systems' accomplishments

In the 1960s, behavioral science was generally viewed as irrelevant to education or other societal issues. Claims regarding its applicability beyond animal training[21] might have been met with some combination of condescension and derision. That is why my Basic Systems colleagues and I thought that we had finally generated some of the long-sought demonstrations of our science's wide reach—convincing evidence of its broad applicability to human affairs: the PSS story because of the unprecedented number of trainees that were trained with it and the complexity of the behavior learned; the adoption of our medical education programs in virtually all of the nation's medical schools and teaching hospitals; and the vast scope and societal impact of our Job Corps Center work. The evidence for the significance of these achievements may just have gelled too gradually to generate notable reportable events.[22]

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[21] The spectacular achievements of behavioral science in the field of animal training were widely recognized.

[22] In retrospect, I regard these reporting failures as having been mainly mine. I didn't publish or promote, and snubbed recognition and awards. It may have looked like arrogance, but it was actually a desire to avoid the appearance that those were the things I was after.

Sputnik shakes up American education

The 1957 launching of Sputnik galvanized the education reform movement to an extent nothing else ever had. The Soviet Union seemed to have surpassed the U.S. in the areas considered key to our technological superiority—science and technology. President Eisenhower signed the National Defense Education Act, and from that point forward the direction of education reform was driven by his science advisors, whose contributions to winning World War II had earned them great respect and credibility. Prominent curriculum reform projects, amply funded by the National Science Foundation, were MIT physicist Jerrold Zacharias's Physical Sciences Study Committee (PSSC), the School Mathematics Study Groups at Yale and the University of Illinois, the Biological Sciences Curriculum Study group, and Larry Strong's Chemical Bond project.

Harvard psychologist Jerome Bruner, in his influential book *The Process of Education* on the proceedings of the 1959 Woods Hole Conference on education reform (Bruner, 1960), called for greater attention to "the process of inquiry" and critical thinking (Bruner, 1966). But curriculum reform continued to be driven by the scientists. It is surprising that despite their systems analysis orientation, which stresses consideration of all of a system's relevant elements, they never identified *the configuration of the school itself* as needing reform.

Basic Systems and curriculum reform

While the education reformers maintained their focus on curriculum—the *what* of education, Skinner had been calling attention to the *how*—the learning process. I argued that *both* had to be targets of behavioral technology, with their goals defined in terms of behavioral outcomes—the competencies to be acquired. Appleton Century agreed, and Basic Systems' programs for schools reflected it. Applied Electricity was a hands-on program with a lab kit; Dimensional Analysis, Vectors, Binary Arithmetic,

the Language of Sets, and Mitosis all used innovative curriculum approaches. Prof. Charles Dawson, my erstwhile Columbia chemistry professor, was our consultant on Chemistry 1: Atomic Structure and Bonding.

Basic Systems' international legacy—the UNESCO project

Basic Systems' technology received a flattering endorsement from UNESCO in 1963, when the physicist and educator Albert V. Baez,[23] head of UNESCO's science division and colleague of Jerrold Zacharias (of PSSC fame), hired us to help reform science teaching in South America and Asia. He first invited me to Paris to present our technology to the UNESCO education division, and then assigned a full-time member of his staff, Le Xuan, to spend a residency at Basic Systems to learn our development process. He then sent us to São Paulo, Brazil, to train 30 physics teachers, two from each of 15 South American countries, to incorporate programmed instruction, laboratory work, and film into their teaching methods.

In 1965 UNESCO sent me and Professor Larry Strong (of Chemical Bond Approach fame) to Bangkok, Thailand, to train 30 chemistry teachers, again two from each of 15 Asian countries. According to subsequent UNESCO reports, both projects resulted in widespread modernization of science teaching methods on those continents.

Europe's OECD gets involved

Basic Systems' technology was also recognized by the European Organization for Economic Cooperation and Development (OECD). In 1963 they visited us and commissioned us to write the report "Behavioral Technology and Manpower Development" (Mechner & Cook, 1964).

Educators from several of their member states then came to visit us. A three-

[23] Yes, he was Joan's father, and his voice resembled hers.

man team came from Israel,[24] Japan sent a 12-man "study mission," and a Venezuelan government agency invited us to provide training in Caracas. The *Getulio Vargas* Foundation expressed interest in bringing our technology to Brazil. The *Fundação Cenafor* later invited me to perform a "*transferencia de technologia"* by establishing a "Brazilian Basic Systems" (to be named EDUTEC) and training cadres of educational technologists to staff it. The Federal University of Rio de Janeiro engaged me to lead their federally funded NUTES project for the training of executives. From 1973 to 1978, I made 40 visits averaging nine days each to Rio and São Paulo to build EDUTEC and to help develop dozens of large-scale training systems for Brazilian corporations and governmental agencies.[25]

What happened to programmed instruction?

Many authors with good credentials in their fields but little understanding of behavioral technology created "programmed instruction" materials by simply inserting blanks into text and displaying the answers on the next page, without behavioral analysis of the material. In the 1960s the market was flooded with such programs. Though almost all were soon rejected as boring or ineffective, it is to these that the terms "programmed instruction" became attached. Their poor quality confirmed for many the alleged sterility of *all* programmed instruction.[26]

In the words of *Spectrum*'s editor Leon Summit,

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[24] They then used Basic Systems' process to develop training systems for Yemenite Jewish immigrants. I had a follow-up session with a twelve-person programming team in Jerusalem in 1965.

[25] We developed training systems for water treatment engineers, flight attendants, gas meter readers, computer operators, metro conductors, first line supervisors, business executives, and dozens of other competencies.

[26] The quality of a program, like that of a soup, is difficult to ascertain by visual inspection. But the discerning eye can detect omission of the behavioral analysis

> In 1963, many people thought programmed instruction was headed for the graveyard of educational fads, because of the predominance of immature and shoddy programmed materials…it has been said that the excellence of some of the Basic Systems medical programs rehabilitated programmed instruction and may have saved this valuable educational technique from an undeserved scrapheap (Summit, 1966a).

The underlying instructional technology

The reputation of programmed instruction never did recover. But what ultimately matters is the survival of the underlying instructional technology (e.g., Mechner, 1962, 1967, 1977a, 1981b). The reason for the quality of Basic Systems' programs was a development process that included behavioral analysis of the subject matter, developmental testing, and the systematic focus on the achievement of *outcomes.* Particular instructional techniques were secondary.[27]

Donald Bullock and I trained close to 120 of our programmers in behavioral analysis. [28] But no matter how competently the behavioral analysis is performed, without systematic developmental testing and revision cycles no

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step, as when the program teaches trivial or obvious material. The behavior analyst makes judgments as to which skills and concepts will be challenging to the members of the intended target population. Indicators of competent behavioral analysis are concept formation sequences that present instances and non-instances of non-trivial concepts; items that require behavior that is closely related to the target behavior; sequences that build target skills; and features designed to simulate target situations.

[27] Tom Gilbert, the acclaimed philosopher of performance technology, elaborated the point that what ultimately matters is the value and worth of the result achieved (Gilbert, 1978; Dean, 1992).

[28] Outside of Basic Systems, even sophisticated developers usually omitted the critically important step of behavioral analysis in favor of attention to the less demanding issue of "frame construction" (Mechner, 1961; Margulies, 1962; Markle, 1964). Frame construction is important but does not replace behavioral analysis of the subject matter.

instructional program can be very effective. Because developmental testing is demanding, inconvenient, and time-consuming, others rarely if ever marshalled the discipline and grit to perform it.[29]

Xerox and early childhood education

After Xerox's acquisition of Basic Systems, I wrote a paper describing some new industries to which behavioral technology is likely to give rise (Mechner, 1966).[30] I urged Xerox to enter some of these industries, starting with preschool and elementary school education. I cited the growing understanding that the most cost-effective way for a society to educate its next generation is to start during children's formative years.[31]

Xerox agreed, and funded the project generously until 1968. But then, when they understandably decided to concentrate on Basic Systems' lucrative PSS and the Huntington Job Corps Center, they gave me permission to proceed with the childhood education work on my own.

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[29] Over the years, we learned to parse the issues involved in the developmental testing of programs in terms of type of material being tested, type of target population involved, diversity of the target population, and type of behavior being learned, and had refined the developmental testing technology to a high degree. Basic Systems did not publish this know-how formally, it just applied it.

[30] In a talk I gave at a conference of the American Management Association, which was published by them as an article titled "Behavior Technology and Social Change," I described some of these industries—pre-school and early childhood education, patient education in medicine, a reconfigured type of school, credit cards and the checkless society, Wikipedia-like functionalities, community design, and other areas. This paper can be downloaded from the Mechner Foundation website, and is also available at Mechner papers, Archives of the History of American Psychology, The Cummings Center for the History of Psychology, The University of Akron.

[31] When my first child, Jordan, was born in 1964, I became intensely interested in early childhood development, and came to appreciate the significance of John Dewey's and Jerome Bruner's teachings.

UEC, INC.—A HUGE UNDERTAKING

So I founded UEC, Inc. and raised $11 million[32] to fund it.[33] I recruited a distinguished Board of Directors and Advisors[34] and a talented creative team of over 100 designers, artists, puppeteers, educators, and engineers. Over a 3-year period, UEC invested over $4 million of its capital, on top of the $600,000 that Xerox Learning Systems had previously provided, to create an early childhood curriculum unlike any that had ever existed.

This curriculum used behaviorally designed educational films and videos, video-taped puppet shows, educational toys and games, novel types of electronic presentation devices, computer-mediated games, an educationally enriched crib for infants, and parent education materials and resources. The curriculum covered basic literacy and math skills, several dozen relational concepts such as before/after, larger/smaller, through/around/into, part/whole, and concepts that contribute to thinking competency like possible/likely/sure, true/false, believe/suspect/know, same/similar/different, opposites, deduction, causality, conditionality, heuristics like self-queries to categorize situations that are encountered, and inquiry skills that included

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[32] Approximately $75 million in 2014 dollars.

[33] What convinced banks, insurance companies, investment banking firms, and venture capitalists to invest such a large amount of money in this start-up company? It was partly my 1966 "Behavior Technology and Social Change" paper, along with Basic Systems' widely publicized success.

[34] It included Prof. Martin Deutsch of New York University, Wilbur J. Cohen (former Secretary of the U.S. Department of Health, Education, and Welfare and "father of Medicare"); Norman Cousins, the author and Editor of the *Saturday Review;* Prof. Robert L. Glaser of the University of Pittsburgh; Dr. Amos Johnson, past president of the American Academy of General Practice; Prof. Myrtle McGraw of Briarcliff College; Edward Gudeman, past president of Marcor, Inc. and Partner of Lehman Brothers; Lee Tagliaferri, Vice President of United States Trust Company; Dr. Palmer Weber of Troster & Singer; Bayard Rustin, President of the A. Philp Randolph Institute; Prof. Urie Bronfenbrenner of Cornell University and planner of Project Head Start; and Theodore Kheel, the prominent labor arbitrator.

the asking of questions.

Most of these ideas were not completely original with me. The novel and unique ingredients that brought them to life were UEC's organizational structure, the collection of creative talent, and the capital required for their development.

Preschool education goes live

We installed this curriculum in our nine preschool "Discovery Centers" located in New York, New Jersey, and Connecticut. These provided educational assessment and enrichment for preschool children and assistance to their parents regarding their children's education.

We also installed the curriculum in the educational daycare programs we operated under state contracts. The largest of these was a five-year contract with Pennsylvania, budgeted at $4 million in the first year and $6 million per year for each of the following four years, a total of approximately $140 million in 2014 dollars. We also operated smaller educational daycare contracts with Georgia, Alabama, and Nebraska.[35]

Aspects of UEC's preschool curriculum also found their way into the *Sesame Street* and *Electric Company* television programs.[36] The television journalist Barbara Walters gave early childhood development a big publicity boost when she interviewed me on the *Today Show* (Walters, 1970). There were feature articles about UEC's Discovery Centers and educational day care centers in the New York Times, Business Week, the National Observer, the Christian Science Monitor, and many smaller papers, as well as

[35] Brochures, photos, and articles available at Mechner papers, Archives of the History of American Psychology, The Cummings Center for the History of Psychology, The University of Akron.

[36] I participated in the original planning of their design under the Carnegie Corporation's Children's Television Workshop project, with Joan Ganz Cooney, Lloyd Morriset, Edward Palmer, and Gerald Lesser of Harvard.

numerous radio interviews. Public figures like Governor Cahill of New Jersey came to visit us for photo ops (See photo below). This level of

Governor Cahill of New Jersey (right) and Francis Mechner at the opening of a New Jersey Discovery Center in 1970. The children are playing with the closed circuit video device. UEC opened nine such centers throughout the northeast.

publicity, though it made me uncomfortable personally, certainly raised public awareness of the educational importance of the early years of a child's development, and stimulated the level of understanding that contributed to the attention early childhood education then received at the federal policy level, as described below.

Impact at the federal level

In 1969 President Nixon announced "the establishment within the White House of a National Goals Research Staff" under Leonard Garment and Dr. Daniel Patrick Moynihan. It was gratifying to me to see that our work seemed to be getting some recognition when they invited me and five others to the White House to contribute our ideas in our respective specialty areas.[37] The position paper I wrote in response prompted the invitation I received in September of 1971, from Congressman John Brademas, who was also an educator, to testify before the Senate Finance Committee on behalf of the epochal Mondale-Brademas Comprehensive Child Development Act of 1971 (see Senate Finance Committee, 1971). The bill was passed by both houses of Congress.

An unusual endorsement

Later that year, in December, the U.S. Department of Health, Education, and Welfare (HEW) appointed a team of five prominent experts, led by Jule Sugarman (father of Project Head Start), to conduct a one-year study of UEC's program. These are some quotes from the resulting report that HEW issued to state agencies involved in day care:

> …the most sophisticated and complete set of plans for development of day care…a remarkably thoughtful total or near-total package…it is, in fact unique…very sensitive in the social and management senses… Administrative, curriculum, and staff training procedures

[37] Their letter, dated October 26, 1969, asked me for "a statement regarding the application of behavioral principles of reinforcement to marketing procedures and how business can be a vehicle for furthering and advancing social goals…We would welcome your observations and comments about education today and what it might become tomorrow." Original at Mechner papers, Archives of the History of American Psychology, The Cummings Center for the History of Psychology, The University of Akron.

> have been more fully detailed than in any other day-care program we know (Sugarman & McCandless, 1971).

Georgia's Governor Jimmy Carter took a personal interest in Georgia's educational daycare contract with UEC, as did his wife Rosalynn. When Carter became President, in 1976, one of his first acts was a significant increase in Head Start's funding level.

President Nixon's Veto

Unfortunately, in 1972, President Nixon, under pressure from certain lobbies, vetoed the Comprehensive Child Development Act—a great tragedy for the country and depressing to those of us who had worked hard for it. Had he signed it, its national impact would have been transformative, and UEC would have been well positioned to help implement it.

In 1972-73, the same forces that had forced Nixon's veto were also generating irresistible political headwinds for the execution of UEC's large state contracts. These headwinds, combined with my own inexperience regarding political matters, prevented UEC from becoming a great financial success.[38] Nonetheless, UEC had accomplished an important mission: to increase national awareness of the importance of early learning and to create valuable technology for subsequent state programs and preschool undertakings.

SCHOOL RECONFIGURATION: WE CREATE A NEW TYPE OF SCHOOL

We didn't want to limit ourselves to preschool education. We felt that we had the technology to create a K-12 school able to deliver a complete education, one that places equal emphasis on academic achievement and the non-academic aspects of development. Up to this point, most educational technology endeavors had focused on the achievement of academic

[38] At the time I was still largely tone-deaf regarding politics and didn't anticipate the predictable reaction in some parts of the country to the idea of New Yorkers and African-Americans coming into their domains to educate their young children.

competencies only. We wanted to include emphasis on competencies in thinking, interpersonal behavior, self-management, and executive function.

All of the individual components of such a school had already been described by others, and in some cases demonstrated separately. We saw the challenge as the design and creation of an educational environment in which the desired competencies and goals are actually achieved, not merely espoused and advocated. We believed that this would require a reconfigured and non-traditional school, and wanted to demonstrate how a systems approach, based on behavioral technology, could address this challenge by considering *all* of the system's elements.

The components to be integrated included more effective instructional resources; updated curricula; modern organizational management theory; and the teachings of John Dewey, Jerome Bruner, Howard Gardner, and their successors (Dewey, 1900, 1902, 1938). Key, of course, was Keller's "Personalized System of Instruction" (PSI) (Keller, 1968). His stroke of genius had been to transcend ingrained assumptions regarding teachers' roles by recasting them as "learning managers," a pioneering step that addressed the configuration of the instructional setting itself.

The Paideia Individualized Education technology

So, in 1968, UEC created the Armonk Paideia School.[39] The innovative Paideia Individualized Education (PIE) technology on which the school was based has since been taken further by its present-day successor, Queens Paideia School (Mechner, Fiallo, Fredrick, & Jenkins, 2014a), described in more detail later.

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[39] An original brochure and a photo of the New York State Charter are available at Mechner papers, Archives of the History of American Psychology, The Cummings Center for the History of Psychology, The University of Akron. I had previously sketched out the design of the school in the 1966 "Behavior Technology and Social Change" paper. Okay, I admit it: I also wanted to provide the best possible education for my own children and nieces.

Key features of this technology are personalized instruction achieved by team teaching with a very low student-teacher ratio (usually 6:1), and LearningCloud—a computer-accessible database of learning objectives and learning resources that makes effective individualization practical (Mechner, Jones, & Fiallo, 2014b). Many of LearningCloud's features had their roots in the "Storage, Transfer, Acquisition and Consolidation of Knowledge System" (STACKS), initially described in Mechner (1966), and later in Mechner (1976).[40] LearningCloud is one of the technologies the Mechner Foundation has been furthering at its Queens Paideia School. The Cambridge Center for Behavioral Studies has agreed to participate in the recruitment of contributors and curators through its own distinguished board of trustees and advisors.[41]

New instructional resources

Since the days of Basic Systems and UEC, research in the application of behavioral technology to the design of instructional resources has continued apace. Examples are Ogden Lindsley's "precision teaching" methods for fluency enhancement (e.g., Binder, 1988; Lindsley, 1990); continuing improvement in the instructional design of workbooks and textbooks; and the Headsprout reading program created by Joe Layng's and Janet Twyman's

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[40] Digital technology was not yet up to storing vast volumes of data, but the STACKS design implemented in Brazil in the 1970s did describe key-word searches, the searchable ever-expanding database, ways to motivate contributors, feedback from users, and quality control of contributions.

[41] The Cambridge Center for Behavioral Studies was founded in the early 1980s with many prominent behavioral scientists among its trustees and executive directors. At its third annual meeting, Fred S. Keller commented thus on CCBS's significance:

> The experimental analysis of behavior is clearly here to stay, and its application to practical affairs has already met with more success than any effort of its kind in the past (Keller, 1984).

development team.[42] But even the best instructional resources are difficult to utilize fully in traditional school situations. Online instructional resources and TV programs like *Sesame Street* and *Electric Company* have offered an alternative in situations where individualization is not feasible.

Instructional settings and teacher roles

There is now wide agreement that school reform requires reconfiguration of both schools and teacher roles (e.g., Ravitch, 2010; Mehta, Schwartz, & Hess, 2012), and that a complete education requires attention to both academic and non-academic educational objectives. But most proposals for reform had been limited to statements of goals and calls for change, without designs for their practical achievement. Notwithstanding Keller's PSI work or UEC's PIE initiatives of the 1960s and '70s, most of the published education reform proposals continued to ignore school configuration and teacher roles, perhaps because these have traditionally been regarded as immutable.

Non-academic competencies, too, were largely ignored, perhaps because they cannot easily be addressed with student-teacher ratios higher than 6:1, and are difficult to define and track. In 1977 an entire issue of the journal *Educational Technology*, ostensibly devoted to school reform, had only one article out of 15 that addressed school reconfiguration (Mechner, 1977b).[43]

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[42] Headsprout, Inc. was founded in 1999 by Greg Stikeleather, Joe Layng, Kent Johnson, and Edward L. Anderson.

[43] This pattern of emphasis continued for decades. The year 1983, for instance, saw the publication of dozens of studies that called for the overhaul of American education. The Education Commission of the States issued an influential report titled "Action for Excellence: A Comprehensive Plan to Improve Our Nation's Schools." But its call for excellence focused on science and math achievement while ignoring ways in which the schools themselves and the roles of teachers might need to be reconfigured. The entire July 1988 issue of the journal *Youth Policy* was dedicated to a set of articles on instructional methodology (Donald A. Cook, Julie S. Vargas, Carl Binder, Ernest A.

Efforts to redefine the instructional setting and teacher roles finally received a boost in the1980s from the burgeoning work on the education of students with developmental disabilities, with its use of one-on-one formats. The successes that behavior analysis techniques achieved in the treatment of autism spectrum disorders (e.g., Baer, Wolf, & Risley, 1968; Bondy, 2012; Lovaas, 1987; Mayer, Sulzer-Azaroff & Wallace, 2014; Thompson & Iwata, 2007) are now widely acknowledged, as evidenced by the nearly nation-wide mandated coverage of the treatment costs—due mainly to the work of Unumb &Unumb (2011). In 1980, Kent Johnson founded Morningside Academy in Seattle to provide behaviorally designed academic and social programs (Johnson & Layng, 1994; Johnson & Street, 2004), and in 1986 Douglas Greer of Columbia University founded the Keller School and developed his "Comprehensive Application of Behavior Analysis to Schooling" (CABAS) system (Greer, 1989; 1998).

The PIE technology and Queens Paideia School

Educators agree easily on the attributes and competencies that a complete education should foster in addition to academic achievement: a love of learning, self-motivation, curiosity; competencies in inquiry and critical thinking, communication, social skills, executive function and self-management; and ability to form and maintain relationships. But the real challenge is to create a working model of a school that actually fosters these attributes. The Mechner Foundation founded Queens Paideia School in 2009 to pick up where the Armonk Paideia School left off.

These are the main features of the PIE technology (Mechner et al., 2014a):

- A 6:1 student-teacher ratio, the highest ratio at which the PIE technology retains its full benefits

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Vargas, and Francis Mechner, all 1988). The only article from that era that gave school reconfiguration a weak nod was Barrett et al., 1991.

- Team teaching by learning managers who have complementary proficiencies in the basic academic content areas
- Personalization of learning objectives and learning plans [44]
- Every student working at his/her individual level of achievement and progressing as rapidly as possible in every subject area
- Equal emphasis on academic and non-academic learning objectives
- Continuous monitoring and quantitative assessment of achievement in all areas, academic and non-academic [45]
- Long-term student-teacher relationships based on daily personal contact
- Preparing students to function in adult work and family situations by simulating essential features of these situations in the school environment
- Emphasis on critical thinking and inquiry skills (Mechner, Fredrick, & Jenkins, 2013)
- Mixed-age groupings
- Inclusion of many kinds of special needs students

These are the key features of the PIE technology that make genuine individualized education possible. They reflect application of the behavioral sciences and modern management concepts like those of Peter Drucker and OBM (e.g., Daniels & Bailey, 2012).

The scaling up process and cost savings

Although the small PIE school is not, in and of itself, a prototype for a reconfigured public school, it can serve as the prototype of a *modular building block unit* of a larger school. If 18 PIE modules are aggregated to form a 610-student school, the per-pupil cost is calculated to be

[44] Aided by the use of the LearningCloud database

[45] Valid quantitative measurement and tracking of the non-academic as well as the academic components of a complete education, for every student, is clearly one of the frontier challenges, not only for PIE technology but for all education.

approximately 22% lower than current public school expenditures.

The savings are achieved by:

- Inclusion of many students normally classified as "special needs"
- Complete elimination of the need for remedial programs
- Greatly reduced discipline problems with their many hidden costs: teacher demoralization, absences, turnover.
- Reduction of costs associated with periodic mass movements of students between classrooms—discipline issues, time loss, etc.
- The greater efficiency of decentralized management (e.g., hiring, training, and supervising school personnel at their work locations.)

These sources of savings illustrate the principle that it is less expensive to do things right in the first place than to fix problems later, and to operate a smoothly functioning system rather than a defective one, even when the system is a school. The fact that the PIE model's benefits flow to all educational stakeholders should help its political feasibility.

Innovative technology requires prototypes

Any technological endeavor to create a novel product must begin with the creation of a prototype whose performance can be observed and improved. For school reform this means creating working models of schools designed entirely from scratch, to generate the desired competencies at an affordable cost per student by applying the best current knowledge.[46] I am hopeful that such prototypes will be created, tested, and perfected, in parallel with the search for successive approximation paths toward the goal of comprehensive school reform.

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[46] A study performed by the Mechner Foundation suggests that a school prototype consisting of an aggregation of 18 PIE schools may take approximately five years to create, at a cost of $6-8 million.

Summary and Conclusions

This article recounts some seminal applications of behavioral science in education, some dating back to the 1960s and 1970s, and traces back to them various current ideas for school reconfiguration and reform. Highlights:

- Basic Systems' Huntington Job Corps Training Center for disadvantaged youths informed the design of many of the OEO's future Job Corps Centers and demonstrated the applicability of behavioral technology to the design of educational institutions, including schools;
- Basic Systems' team developed the management systems and many of the training programs for the nationwide network of Job Corps training centers, in which almost 2 million youths have been trained, with an immeasurable societal impact;
- The sales training program "PSS" developed by Basic Systems, Inc. became by far the most widely used training program of all time, and spawned today's sales training industry;
- Programmed instruction courses developed by Basic Systems had a major impact on medical education in the 1960s and 1970s, with a total of over 700,000 copies distributed and used in virtually all of the country's medical schools and teaching hospitals, as well as by many practicing physicians for their own continuing education;
- UEC, Inc.'s behavioral science-based early childhood development programs had a far-ranging impact on federal legislation and the funding of such programs.
- The most recent, most widely recognized, and ongoing accomplishment of behavior analysts is the management and treatment of autism spectrum disorders. Other recent accomplishments, like OBM, are described in other chapters of the present volume.

The article seeks to show how these technological achievements were antecedents of current work in education and school reconfiguration. I tried to draw the distinction between (a) instructional resources and curriculum

reform, and (b) the reconfiguration of schools and teacher roles, with the PIE technology a case in point.

A personal note

I was lucky that my many strokes of good luck, bad luck, and mistakes netted out favorably. It could just as easily have gone the other way.

In retrospect, I now see that over the years, my business entrepreneurship activities took a larger bite than I had bargained for, out of the time I was able to devote to my research work. That is the price I paid. Yet the eleven business enterprises I founded and built between 1960 and 2014 have funded and are still funding my continuing work in the behavioral sciences and educational technology. They also provided me with the experience that enabled me to develop the PIE technology, because the 54-year training program I completed taught me far more than I thought there was to know about building and managing innovation. Without that experience I would not have understood why school reform must be addressed as a technological undertaking rather than as a purely educational or political one.

But the story I related is not just about me. I was only one of many agents who demonstrated the power of the behavioral sciences to address some of the challenges we must meet to make our world more livable.

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