

Behavioral Systems Analysis: Fundamental concepts and cutting edge applications

Part III The Total Performance System

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Part I of this series of articles:

- describes behavioral systems analysis as an approach that draws from two disciplines, behavior analysis and general systems theory
- asserts that knowledge from both disciplines is important for practical work because
 - behavioral knowledge about how each person will act within a specific environment and
 - general systems knowledge about how organizations and other living systems functionis essential in today's complex world
- describes $B = f(O, E)$ as the fundamental concept of the biological, social, and physical sciences, psychology, and general systems theory.

Part II provides a way to analyze any activity into 3 essential components, using the 3 term contingency. The 3 term contingency is the smallest meaningful unit for analyzing individual performance. Part II then describes three different service models used by successful consulting firms. Each firm, in a different way, helps managers apply the 3 term contingency and associated principles within business environments.

Part III will describe the unit of analysis for behavioral systems analysis, the adaptive system. It will also show that proper use of the adaptive system concept helps identify what performance (behavior plus what the behavior accomplishes) to improve.

Introduction

Early in my career I was responsible for operating the Reading Improvement Service at the University of Michigan. When I accepted the task, I asked Donald E. P. Smith, who had the job before me, what I was responsible for in the new role. Don's answer was very simple, totally accurate, and very frightening: "Everything!" What if, I wondered, one of the practicum students did a bad job of working with one of the children? "You are responsible for that," said Don. What if the Freshman Engineering Advisors stop referring their students and enrollment drops in the college service? What if the University administration cuts the budget in half? What if ... Don responded to every question in the same way: "You are responsible for that!"

I am grateful to Don to this day. His clarity and insight enabled me to see that I had better learn really fast. Otherwise, I would not fulfill my responsibilities. Knowledge of the 3 term contingency had enabled me to do the things I did to qualify for the job of Chief of the Reading Improvement Service. But I had to learn a lot more to do the job. I had to learn more ways to use the concept. I was afraid, correctly, that I would have to

get out of my comfort zone. It was time to really master some of the general systems theory concepts I had read about.

The always-present practical problem for any O (me or the Reading Improvement Service or business leaders) is “What should I do now?” Acting appropriately in the here and now occurs occasionally by good luck but knowledge of E, the environment that supports and threatens and challenges us can help enormously. Knowledge of E helps predict which actions will be effective. Knowledge of E helps avoid mistakes and do the right things.

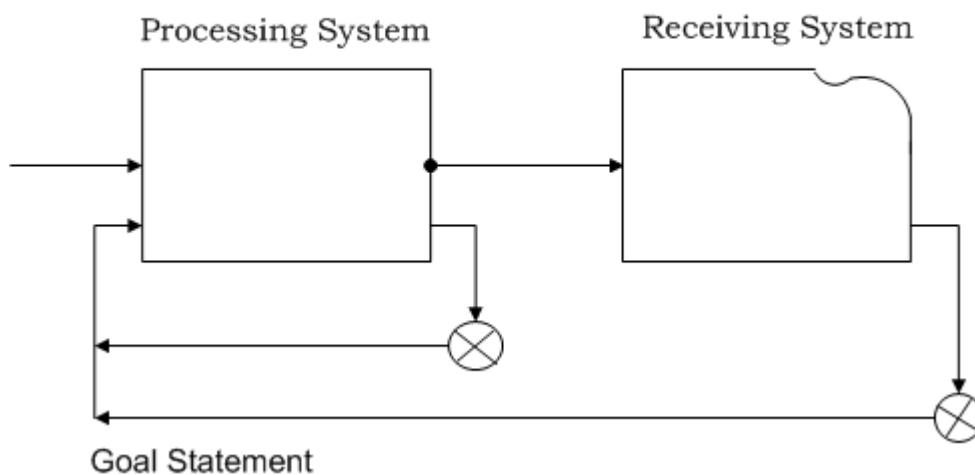
Helping ourselves and others behave intelligently is much easier if we know the fundamental concepts of behavior analysis and of general systems theory. Dwight Harshbarger and Richard Mallott created the term “behavioral systems analysis” almost 30 years ago to label this combined knowledge.

Fundamental Concept Three The Adaptive System

The unit of analysis for behavioral systems analysis is the adaptive system. The concept of the adaptive system does for behavioral systems analysis what the concept of the 3 term contingency does for behavior analysis: it gives us the “atom” or smallest unit we can use to understand what we must. Like the atom and the 3 term contingency, the adaptive system has parts and is a unitary whole. The diagram below shows the 7 parts, each necessary for intelligent performance. Several examples follow to illustrate how

- the parts fit together to function as a whole (called the Total Performance System),
- we can use the concept to manage an enterprise intelligently, and
- the adaptive system concept and the 3 term contingency relate to one another.

Total Performance System

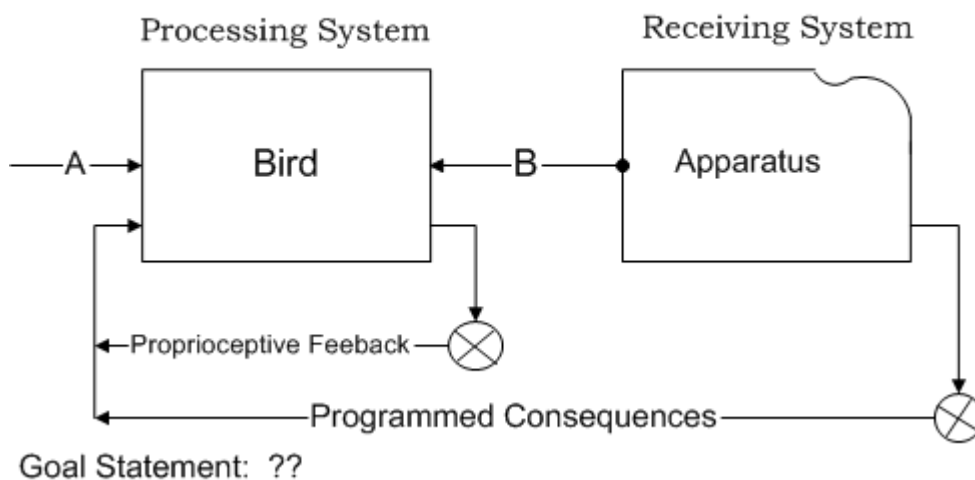


The Processing System box represents the (O), the Receiving System box represents the (E). The arrow from Processing to Receiving System represents (B). The arrows coming

out of the boxes and going down to the circles represent data; the circles signify interpretation of the data, thereby converting it to feedback. (The examples that follow illustrate the importance/necessity of having both feedback loops to support intelligent or adaptive behavior.) The arrow into the Processing System, the input arrow, represents the inputs of material, information, and energy that enable the Processing System to function. The Goal Statement represents the purpose, mission, or reason-for-being of the system.

The diagram below uses the same diagram to describe an experiment set up to study behavior. It is the set-up I first encountered when I was a graduate student doing research with pigeons. Imagine a pigeon (Bird) inside the Processing System box. The input arrow represents the A or antecedents (all the conditions and stimuli we had arranged); the output arrow represents the behavior (B) of the pigeon. The Processing System feedback loop represents proprioceptive feedback, that is, feedback the bird receives directly from the bird's behavior. (It is like the proprioceptive feedback you and I receive as we walk or talk or type.) The control Apparatus is inside the Receiving System box. The apparatus records the pigeon's responses and provides the consequences (C), such as a new stimulus or a reward/reinforcer. The presentation of consequences and stimulus changes is represented by the feedback loop from the apparatus to the pigeon. The Goal Statement is about the bird's goal. Since birds do not ordinarily write their goal statements, we infer the goals from the bird's behavior. I count the 7 parts of the adaptive system, beginning with 1) the Goal Statement, 2) the Receiving System, 3) the Receiving System Feedback, 4) the output arrow, 5) the Processing System, 6) the Processing System Feedback, and 7) the input arrow. They can be counted in any order but I do it that way to emphasize the importance of the goal, receiving system, and receiving system feedback in an adaptive system.

An Experiment as an Adaptive System



The diagram below uses the adaptive system/total performance system diagram to depict a learner as an adaptive system. The learner is in a speed reading class at a major

university. The learner's goal is simply to read faster. The learner's Receiving System includes the class instructor, other students in the class, and students and instructors in other classes the student takes at the university. (The Receiving System also includes much more: e.g., the student's workplace, friends, family, academic advisor, the Dean of the college the student attends, and much more; we don't show everything in the diagram—which is both a strength and a weakness of the diagram.)

Relevant Receiving System feedback includes immediate feedback from the instructor, feedback from reading tests taken in the class, and feedback from tests taken in other classes. The student's outputs are her notes, completed reading assignments, and the like. Processing System Feedback is labeled "Self-talk" in the diagram because students talk to themselves ("This is a stupid assignment!" "I like this!" "I hate this!" "I'll never be able to do this!" "I've almost got it!") and represents not only what they think but what they feel. Inputs are the assignments given by instructors.

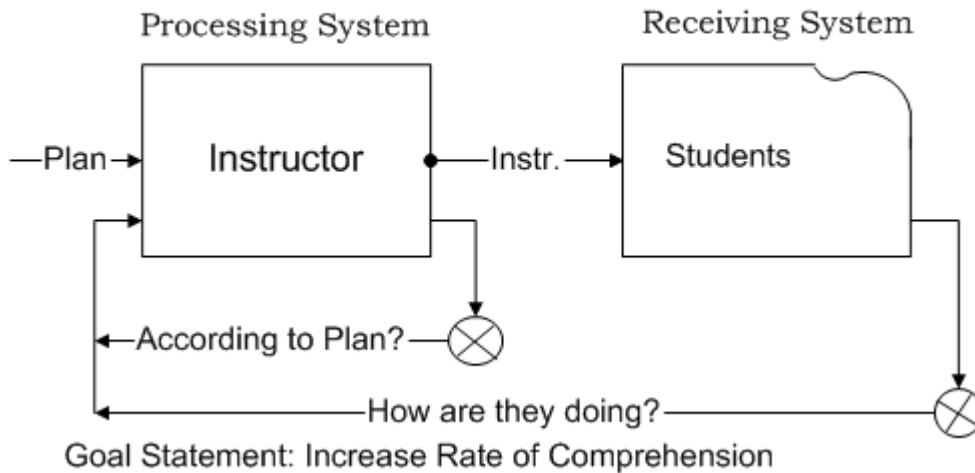
The next diagram depicts the instructor of the reading class. The instructor's immediate goal is to enable the learners to comprehend material faster—faster reading with equal or better understanding. Students are the Receiving System and feedback about their performance is Receiving System Feedback. The instructor's outputs are simply labeled instructions and include assignments as well as confirming and corrective feedback. (The confirming and corrective feedback are part of the feedback loop to the learner on the diagram above.) The instructor for this class has a plan to follow and monitors his own performance regarding how well he follows the plan. If Receiving System Feedback shows that the plan isn't working, he might modify it as he goes and will certainly modify it before teaching the class again.

Like the experimenter, the instructor considers the O, the "stuff" the student brings. The student's stated goal is to read faster. Not just for the fun of it but to learn more in less time, i.e., increase learning rate. If the instructor helps the student increase reading rate and not learning rate, the student will thank the instructor but not be truly satisfied: the instructor has not "served" the student. That is why instructors of these reading classes have students do "homework" with real material and do so out in the receiving system. Doing so enables the student to get receiving system feedback from an important source, instructors in other courses. The instructor gets that feedback, too, by talking with the students and coaching them in their efforts to apply what was learned in the clinic.

The receiving system feedback is delayed feedback and not very precise but it is necessary to necessary to sustain the value of the more immediate feedback. This form of feedback, from real attempts to use the skills, is the single most important difference between these classes and other speed reading classes: we consider both loops, (a well-known psychologist has even named it "dual loop learning".) It is a difference that makes a difference: it answers the relevance question for student and instructor. When several of my colleagues and I pioneered this method of instruction in the 1960s it was quite rare. It has become increasingly common in the years since then. Karolyn Smalley and I were able to write an entire book recently about applications of this form of

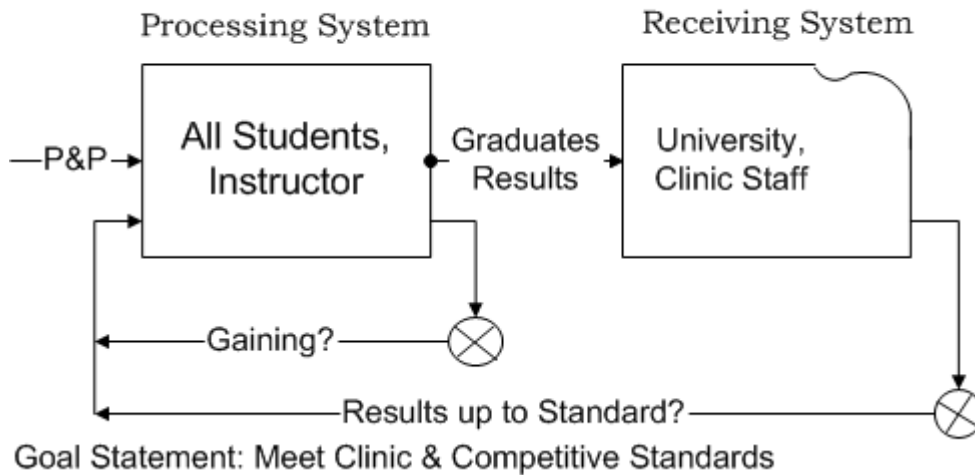
instruction in business and industry. We call it “Performance-Based Instruction” because it focuses on real performance outside the classroom in which it is taught.

Instructor as an Adaptive System



The next diagram shows the whole classroom as an adaptive system. The Goal is to meet Clinic and competitive standards. The Clinic offered subsidized services to students at the university but they could purchase the services elsewhere. The Goal was to compete on quality and price, i.e., beat commercial competitors on both quality and price. The Receiving System is shown as the University as a whole and the entire Clinic Staff. If key persons in the clinic and in the university were not satisfied with the results, students would be referred to the competition or staff assigned to other clinic programs or the budget cut. Two outputs are shown, both Graduates (the students themselves) and Results (statistical summaries of reading gains.) The Standards for end-of-class results were set at higher gains, faster and cheaper than the competition. Internal feedback monitored whether or not the class was moving at a pace necessary to achieve that goal. The P&P on the input arrow stands for Practices and Policies at the clinic. The practices and policies, goals and standards, and receiving system demands all contributed to each instructor as he or she planned lessons from semester to semester and from one class to the next.

A Class as an Adaptive System

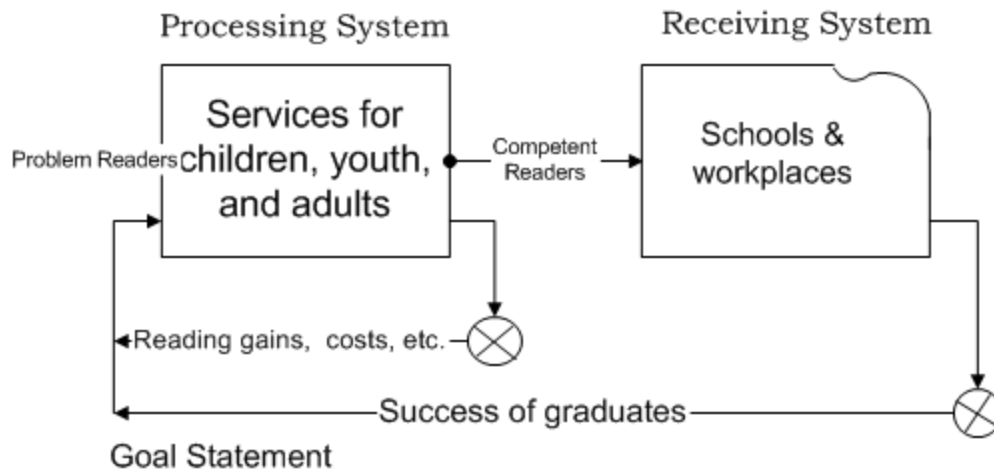


The views above of the learner, the instructor, and the classroom are based upon work I did for my doctoral dissertation many years ago. The dissertation was a validation of the adaptive system concept and the total performance system diagram I invented to represent an adaptive system in a practical and useful way. The title of the dissertation was *The Classroom as a Self-Modifying System*. Classrooms contributing data to the dissertation were located in the Clinic and in two elementary schools in the area.

The diagram below shows a larger system, viewing the entire clinic as an adaptive system. This is the perspective I used when I was Chief of the service. (My boss was ex-Navy and established his title as Chief of the Bureau of Psychological Services. Each service within the Bureau was headed by a Chief.)

The internal loop feedback was the basis of weekly staff meetings in which instructors in every program show/discuss the current data: how many students are gaining? How much? Are the students applying it and making real world progress? Notice that much of these data are anecdotal. We used the data and trusted it only because we had other sources of more objective data that we could use to confirm or disconfirm our interpretations of the anecdotal data. If I had presented those data to my boss, he would not have been impressed. But data on such things as grade point averages before and after the clinic services were more meaningful to him. The data answered these questions: Are students using what they have learned? Does using it do any good?

Reading Service as an Adaptive System



Goal Statement
The Reading Improvement Service enables readers to satisfy standards for reading achievement and to attain academic or workplace goals

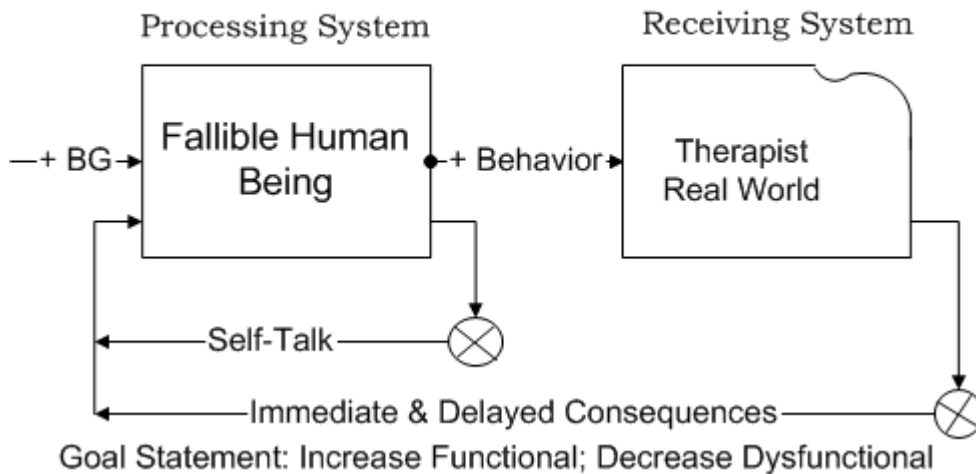
The Goal Statement is significant. We were committed to doing two things. First, we would do the job we were expected to do and “enable readers to satisfy standards for reading achievement.” But when we asked ourselves if we would be satisfied as professionals if that is the only thing we accomplished, the answer was no. We would be satisfied only if graduates attained “academic or workplace goals.” We would be satisfied with our:

- adult literacy program only if graduates could read well enough to do their work competently
- children’s service only if graduates could perform competently in mainstream school classrooms
- college service only if graduates performed well academically, i.e., if they graduated with higher than expected grades.

The decision to include academic and workplace goals in our goals is unusual for reading clinics but not unusual for behavior analysts. There is good evidence that far too little that is learned in a clinic setting will be applied outside the clinic unless we do specific things to assure transfer. We “teach for transfer” and provide follow-up support. It was unusual, 35 years ago, to have students practice with everyday material but it later became a “best practice” in adult literacy.

These 5 examples show that the adaptive system concept can be applied to laboratory experiments, individual learners, instructors, classrooms, and total not-for-profit agencies. The cutting edge applications that I will describe a bit later apply the concept to for-profit businesses. The next example applies it to a client in (psychological) therapy.

A Person In Therapy as an Adaptive System



The goal statement shown is a generic one, to increase functional and decrease dysfunctional behavior. The client and therapist might agree, for example, to work on increasing the number of healthy interpersonal relationships through learning new skills and decreasing specific bad habits, such as belittling others, avoiding social interaction, making unreasonable requests, and rarely listening to what another person says.

The client is listed as a Fallible Human Being, the only kind there are. The output arrow specifies desired behavior, i.e., the behavior necessary to achieve the therapeutic goals. The Receiving System includes the therapist and the client's world outside therapy. The Receiving System Feedback is about immediate consequences and delayed consequences of the client's behavior. The input arrow shows positive behavior guidelines that are provided by the therapist. During the session, the client might practice some of the new interpersonal behaviors and receive immediate coaching from the therapist. The client will typically have a homework assignment to use the new skills in the real world and to track the frequency of specific instances of the bad habits. The real world sometimes provides immediate consequences. The client might belittle others, who immediately get up and walk away; the client might practice active listening skills and learn more about the other person. The real world also provides delayed consequences such as terminating employment if the client persists in the bad habits or ending a probationary period if the client performs well.

Not all clinical psychologists do therapy in this way but it is common among behavior analysts. The clinical research literature shows that it is common among therapists who get good results, independently of the therapist's theoretical orientation.

Behavioral Systems Analysis Lessons Learned: Please allow me to point out 5 things these examples illustrate about using the adaptive system diagram and concept.

1. In all applied behavior analysis specialties the client's goals are attained by decreasing dysfunctional behavior and increasing functional behavior in the client's real world environment. $B = f(O,E)$ That is the meaning of "behavioral" in behavioral systems analysis.
2. In all our professional work, we engage in activities in which the pay-off is elsewhere. The pay-off comes in the Receiving System, not the Processing system. Success is determined by the Receiving System and is a resultant of interactions between the Receiving System and the Processing System.
3. The 3-term contingency operates within the adaptive system. The person or persons in the Processing System each functions within his or her moving window in time. Immediate consequences of each person's behavior, though often unnoticed, are extremely important in supporting functional and/or not supporting dysfunctional behavior.
4. It is important for the manager or teacher or researcher or therapist to understand the apparatus (the receiving system.)
5. If any of the 7 parts of the adaptive system are missing or defective, the system cannot function effectively.
 - The two feedback loops are necessary to support adaptive behavior. The processing system feedback helps people keep track of what they are doing; the receiving system feedback helps people know whether or not what they are doing is "working" properly.
 - The goals determine what outputs/behaviors are necessary and what feedback is necessary.
 - Feedback is often missing, delayed, inaccurate, conflicting or misinterpreted and misused.

I've given special attention to the units of analysis (the 3 term contingency and the adaptive system). The units of analysis leverage and organize many basic principles. Each of the remaining 4 fundamental concepts is important but requires less explanation.

As an introduction to Part III, I shared a personal experience, assuming the role of Chief of the Reading Improvement Service at the University of Michigan. I knew the 3 term contingency and faced my responsibilities with full confidence that I could do the job a sadly lacking in knowledge about exactly how. The lack of knowledge propelled me toward general systems theory. It also propelled me toward people who knew something about organizations, business, and management including professors in the College of Business. Among the many that I learned from, I learned the most from George Odiorne, an economist, entrepreneur, professor, and Director of the Bureau of Industrial Relations and Geary Rummel. George told me once, in speaking about business, "You know how to solve a very large number of business problems. The only obstacle is, you don't have the foggiest notion of what the problems are!"

The collaboration with Geary was essential because George was right. I knew behavior analysis but I did not know three things:

- the B, what behaviors were valuable in business,

- the O, the way organizations worked, and
- the E, the nature of the business environment.

The adaptive system concept and the total performance system diagram enabled me to figure out what I had to do to fulfill all my responsibilities. It helped me pinpoint the behaviors that would enable everyone to accomplish more, the behaviors that were part of valuable performances. But there was much more to learn.

Geary Rummler had already earned his Masters in Business Administration. His knowledge of business, coupled with good sense and practical experience from summers working with automotive engineers, complemented my knowledge perfectly. Between the two of us, we knew enough to be very effective in doing behavioral systems analysis! We worked together for several years and then worked separately to develop systematic procedures to enable us to be more effective and efficient in the work.

Conclusion—an invitation to think

You are invited to think about what you have just read. Doing so will help you understand where and how the material relates to topics or issues you are concerned about.

1. Think about your experiences as a student or as an employee. What Receiving System feedback did you get regularly, if any?
2. Think about what happens to an employee's performance if any of the parts of the total performance system/adaptive system are missing or weak. (I do that as a group exercise, assigning each of the 7 parts to different people. When they report back and discuss, they always conclude that if any part is weak, it makes it harder for an employee to perform well. They also conclude that, if Receiving System feedback is very weak or absent it would be impossible for the person to perform intelligently.)

Part IV introduces a concept from general systems theory that helps keep business concepts simple and in perspective. It then introduces 3 additional general systems concepts that are especially relevant understanding why long term success for an organization requires managing it as a whole, not as a collection of separate parts.

Reference

Brethower, D. M. (1970). *The Classroom as a Self-modifying System*. Ann Arbor, MI: Ph.D. Dissertation, University of Michigan.