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ABSTRACT

The booklet describes studies undertaken by the Washington Research Organization (UWRO) to examine generalization processes with severely handicapped students. Section one provides background information on the UWRO, including UWRO's advisory committee, communication with other institutes for research in education of the severely handicapped, and administration and management approaches. Section two reviews basic research concepts (skill generalization and instructional programing for generalization) and the methodology to be used in the studies. In section three, four different approaches to the generalization process are addressed: an ecological approach to describing and then changing conditions within the educational environment; a performance pattern approach to describing and matching individual learning characteristics and instructional techniques; a self-control approach to teaching severely handicapped individuals to manage their own behavior; and secondary/post-secondary transition investigations on teaching strategies to improve generalization in the transition from school to community and work environments. A final section, section four, briefly discusses the contribution to educational practice of the four approaches. (CL)

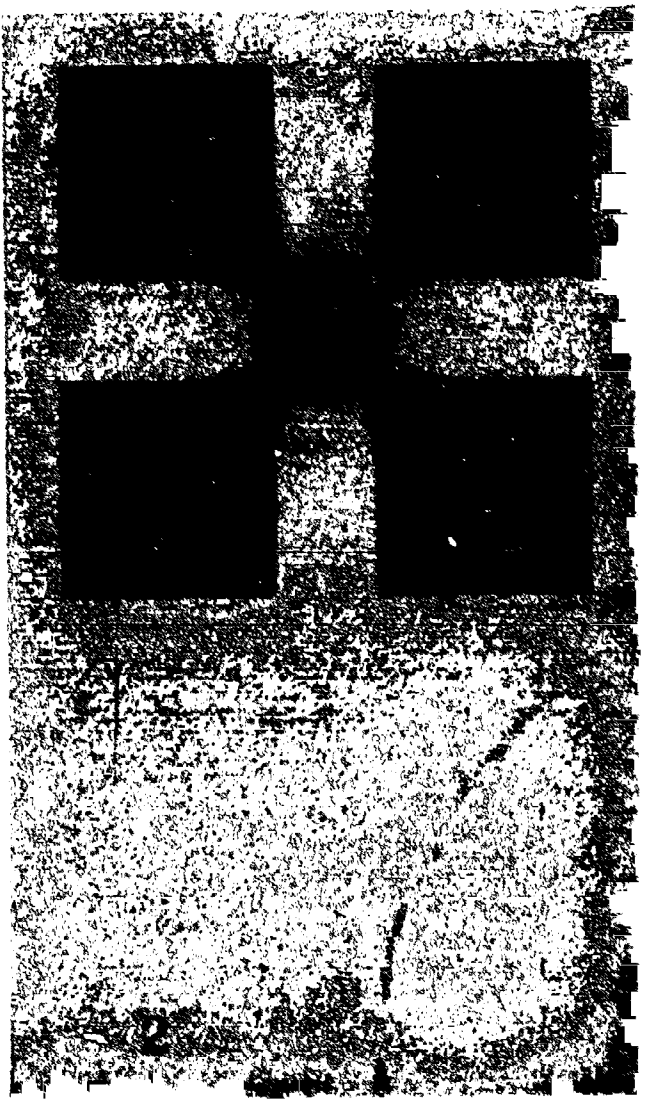
Washington Research Organization

Research in Education of the Severely Handicapped
University of Washington

INVESTIGATING THE PROBLEM OF SKILL GENERALIZATION

2nd Edition

Felix Billingsley
Norris Haring
Kathleen Liberty
Greg Weisenstein
and Owen White



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Foreword

It is only within the short span of the last two decades that teaching models for the severely handicapped have been successfully demonstrated. As a result of systematic instruction, the severely handicapped have demonstrated that they have the ability to acquire self-help, social, and vocational skills.

Having attained some success, educators of the severely handicapped must face another problem: Acquisition of skills rarely guarantees that the individual can apply those skills in natural settings. The process of adapting skills from instructional to natural settings is called generalization.

The generalization phenomenon has been recognized and studied in research laboratories for many years, but the need for strategies to facilitate generalization has never been more critical than it is now. As we face the integration of severely handicapped persons into all facets of society, we realize that the main stumbling block is the difficulty these individuals encounter in generalization.

As we examine the natural setting, we see the multitude of unpredictable variables that stand in the way of adaptation for the severely handicapped. Each new stimulus demands generalization within a class of responses to fit the particular situation in the environment.

Up to now, educators have relied upon two strategies for generalization. The first, what Trevor Stokes and Don Baer have called "train and hope," involves thorough

training during the acquisition phase and hope for later generalization. The second, identified by Lou Brown, utilizes the "criterion of ultimate functioning" to assure that all the skills taught have an ultimately useful purpose or function.

Educators, following the course of least resistance, have tried to conduct their instruction in the natural setting. This "practical" approach is simplistic and difficult to achieve. Educators must search for appropriate natural environments, but effective teaching involves unavoidable adaptation of those environments.

A further problem is that the natural setting may not provide sufficiently predictable opportunities for severely handicapped persons to practice particular new skills. Thus it is inefficient to develop large numbers of new skills in this way. The challenge raised by the current difficulties is to determine whether or not skills can be developed to an acceptable rate within an instructional environment and then transferred to the natural environment.

Educators and advocates all over the United States have expressed the need for solutions related to facilitating generalization. As a result, the U.S. Department of Education's Special Education Programs (SEP) has set aside funding for study and analysis of generalization processes with the severely handicapped. The Washington Research Organization is pleased to participate in these efforts.

Norris G. Haring
Principal Investigator
Seattle, 1984

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Ms. Cindy Burchart is pleased with her new job at the Seattle Hotel. She has loaded the industrial dishwasher for the first time: all of the plates on the bottom in neat rows and all of the glasses on the top. It was easy to figure out where they went. She closes the door with satisfaction. But where are the buttons to start the machine? They're not on the front of the machine, nor on the side. Behind the dishwasher, on the wall, Cindy sees a row of buttons, switches, dials, and lights. Some of the lights are dark, while others are glowing red or green. She stands bewildered before the display. The manager of the kitchen rushes over, glares at Cindy, and rapidly pushes some buttons, sets a dial, and flicks a switch. He barks, "Start on the next load," wondering why he ever agreed to give a retarded person a chance, anyway.

Mr. White gazes at the assessment data for Richard. He is depressed. This is the third year he has had Richard in his class, the third year he has conducted assessment, and the third year he must prepare instructional objectives for Richard's IEP. Last year he taught Richard to say, "My name is Richard Clark," when asked, "What's your name?" or "Who are you?" This year, he only answers with, "Richard." "That really won't help if he gets lost," sighs Mr. White. He ruefully writes the objective for "says own name" for the second year in a row. He looks at some more assessment data, collected over the first six weeks of school. It is taking Richard even longer to learn to say his address than it did to say his name, and it looks like there is no guarantee that he will remember that next year. Mr. White considers just getting him an i.d. bracelet, but remembers what Richard's parents said. He writes an objective for "says own address" and shakes his head.

Jody is screaming so loudly that his face is eggplant purple. Mrs. Loomis stares helplessly at him. She goes over and picks up the tennis shoes from the corner where he threw them moments ago. She knows that Jody's teacher told her that Jody was able to put on these very same shoes without any help. The screaming is now broken by gasps, as Jody winds up to an even higher pitch. Mr. Loomis yells up the stairs, "Where are you? We're all in the car waiting!" Mrs. Loomis quickly picks up Jody, puts his shoes on him, and carries him down stairs. Jody quits screaming when they go out the door. "Thank goodness," she says to herself.

ONE

THE WASHINGTON RESEARCH ORGANIZATION

The problem for Cindy, Richard, and Jody is generalization, or the lack of it, to be more precise. The setting changes, time passes, and it is somehow as if they had never learned what to do in the first place. This is one of the most important problems we have had to face since we began educating severely handicapped students. It is one that must be solved if education is to be an effective preparation for life in society.

The Washington Research Organization (UWRO), located on the campus of the University of Washington in Seattle, was awarded a five-year contract by the U.S. Department of Education's Special Education Projects (SEP) in October 1982. The mission of UWRO is to identify instructional strategies through empirical investigations that enable practitioners to promote generalized responding by severely handicapped persons. If the research we conduct is productive, we will develop practical instructional methods that ensure that severely handicapped individuals are able to use learned skills in environments outside of the training setting and that those skills remain useful long after formal education has ceased. We will also take steps to see that the methods we develop are available to all practitioners.

a sequence of objectives will need to be met if we are to be successful in accomplishing our mission. First, UWRO investigators will conduct descriptive and intervention research to identify specific environmental, instructional, and individual characteristics that affect the probability of generalized responding. Although variables so identified may increase our understanding of generalization, little of practical value is accomplished by identification alone. Our second objective is to conduct research designed to test the effects of manipulating or changing environmental, instructional, and individual performance variables. Third, UWRO investigators will conduct intervention research in controlled and natural settings to determine instructional and curricular strategies that increase the probability of generalized responding. This leads us to our fourth objective. Teachers and other practitioners will be trained in instructional methods and curricula identified by UWRO research, in order to determine whether procedures may be implemented effectively and practically, within operating and budgetary constraints of educational settings.

The success of meeting each objective will be determined by changes in pupil performance data, and by determining the overall practical impact of such changes. The effects of interventions will be evaluated according to the change in frequency, quality, and quantity of generalized responding from pre-intervention levels. The results of UWRO's studies will be evaluated according to psychological and educational research standards for reliability, validity, methodological considerations, and analytic techniques. The extent to which severely handicapped individuals successfully demonstrate generalized behavior will be the extent of our success in meeting these objectives.

The activities of the Washington Research Organization are designed to meet these objectives and are organized around four major activity categories ("tasks"): descriptive and laboratory research, research in natural educational settings, evaluation, and communication. These tasks will be supported by the activities of the Advisory Committee and by project management. This overview describes the activities of UWRO, basic concepts in generalization research, and our four different approaches to the problems encountered by Cindy, Richard, and Jody.

Research in Generalization

Research in generalization constitutes the major activity of the Institute. These activities are divided into two categories,

Descriptive and Controlled Laboratory Studies" (Task 1) and Research in Natural Settings" (Task 2). Task 1 activities are designed to identify precise variables that affect generalization and to test specific strategies under tight experimental control. They will be conducted primarily during the first two years. These studies are designed to provide the background information needed so desperately in our understanding of generalization.

Task 2 research will investigate the effects of interventions in natural educational settings. In the fourth project year, Task 2 research activities will include investigations of the efficacy of guidelines developed for practitioners from UWRO research. The guidelines will define how procedures are to be applied in natural settings. These investigations will seek to determine how applying the guidelines affects the generalization demonstrated by severely handicapped individuals, and also how guidelines might be improved for more accurate and effective implementation.

We are fortunate to have established cooperative arrangements with three local school districts to provide the settings and subjects for our research. These three local educational agencies are Lake Washington School District No. 414, Northshore School District No. 417, and Issaquah School District No. 411. Personnel from these districts will work closely with the Senior Investigators, providing the first contact with parents, guardians, and teachers and arranging for research settings.

Representatives of the districts will meet with UWRO staff as members of the Direct Service Consortium. Ralph Bohannon, Director of Special Services for Lake Washington, is an experienced researcher and has cooperated in previous University of Washington research projects. This large district is also represented by Nancy Wilson, Principal of the Gordon Hauck Center, Ruth Hayes, Special Education Administrator; and Joyce Vanden Hoorn, Technical Specialist. Fred Row, Director of Special Education, and Anne Boone, Principal of the C. O. Sorenson School, represent Northshore. Abby Adams, Director of Special Education, represents Issaquah. Joining the representatives of the cooperating districts is Greg Kirsch, Director of Special Education in the Office of the Superintendent of Public Instruction for Washington State.

Research will also be conducted in the Experimental Education Unit (EEU) of the Child Development and Mental Retardation Center located in the University Affiliated Facility at the

University of Washington. Karen Morris is the principal of the EEU, which currently serves severely handicapped pupils from seven surrounding school districts. Pupils are placed at the EEU when administrators, parents, and teachers determine they would be better served at the EEU rather than in their local programs. All of these pupils live with parents, guardians, or in group homes away from school. The EEU is in session all twelve months of the year, which will permit UWRO to conduct research during the summer.

Evaluation

Each of the objectives is a necessary step in achieving our mission. Evaluation of our progress in meeting the objectives is an ongoing process and constitutes Task 3 of the Institute. Three general classifications of data will be collected for overall Institute evaluation: intervention, formative, and summative.

Intervention data, which will serve as the primary basis for evalution, are measures of the actual performance of the subjects during instruction and in nontraining settings, collected during the research activities. UWRO is conducting a wide range of carefully designed studies in an attempt to identify and develop procedures which will help severely handicapped persons to generalize and effectively use the skills they learn. The data collected on the performance of severely handicapped pupils during the research studies will be analyzed by a variety of procedures, including visual inspection of graphed data, trend analyses, and time series analyses for repeated measurement of single subjects. Analyses of group data will utilize correlational and standard tests of statistical significance. Standard analytic practices will determine if an intervention has an effect on subject performance, and the extent of such effects. Data will also be compared to the performance of students participating in the long term study of educational environments, described in the first section of Chapter 3.

Some studies will begin in very special settings where the greatest control over conditions can be exerted. It should be noted, however, that all research studies include specific time lines for moving into applied settings -- schools, homes, and the community -- and evaluating the impact of findings in the "real world." Each line of study is designed to culminate in a material product, such as a manual or set of materials, which describes exactly how the parent, teacher, or other practitioner can use

UWRO's findings to facilitate skill generalization. Since things which are possible are not necessarily easy or efficient, cost studies will be undertaken to evaluate the time, energy, and resources required for implementing the procedures recommended by UWRO. If necessary, recommended procedures will be modified and retested to make them more easily understood and implemented within the typical applied setting.

Some research designs disregard the fact that statistically significant effects obtained in controlled studies may not have any practical value in normal situations. Therefore, the evaluation of the UWRO will rest very heavily on demonstrating that its work is actually having an impact on the lives of severely handicapped persons, not in special laboratories or experimental programs, but in their regular classrooms, homes, and places of work.

The purpose of formative evaluation is to demonstrate the extent that research and communication activities contribute to the development of UWRO's research and attainment of our overall mission. Formative evaluation will incorporate data and descriptions documenting existing research and demonstration procedures reviewed, applications and adaptations of existing procedures, and research activities utilizing existing procedures. Products which result from UWRO's contacts with other institutes and agencies will be reported. Any products disseminated as a result of either individual studies within UWRO or through contact and collaboration with researchers outside UWRO will also be documented.

Summative evaluation contributes to assessment of the lasting impact of UWRO's various activities. We will collect and analyze data on (1) the extent to which UWRO's research and intervention procedures and materials are adopted by local educational agencies, (2) evidence of the quality of research skills acquired by UWRO Research Assistants, (3) evidence of cost savings resulting from implementation of UWRO-developed procedures, (4) the adoption of UWRO-developed procedures in teacher preparation and inservice training courses, (5) changes in peer interactions resulting from UWRO research and intervention procedures and products, and (6) the overall attainment of UWRO's goals. These data will be disseminated to the other institutes and researchers in the field on an annual basis, for their information and to stimulate interaction with UWRO. This documentation also will serve as evidence of any "ripple effects" produced by UWRO efforts.

Finally, the overall impact of UWRO's efforts must be measured in terms of how much generalization is facilitated. This will be evaluated by conducting extensive inservice training seminars for teachers, parents, administrators, and other training professionals and determining, through follow-up evaluation, the extent to which the participants adopted the procedures and whether there was any demonstrable beneficial impact on the lives of their children or clients by increasing the nature or extent of generalization from "pre-UWRO" levels. That will represent the most meaningful evaluation of UWRO's success.

Communication

Communication about ongoing studies, training, and dissemination of procedures and products derived from our research is an important component of the UWRO mission. Cooperation with other researchers exploring issues related to skill generalization is the necessary first step in maximizing the potential benefits of UWRO activities. We will be working closely with the three other Institutes for Research in Education of the Severely Handicapped.

Two of these institutes will focus on methods of facilitating integration from restrictive to least restrictive educational environments. The University of Minnesota's "Consortium Institute for Education of Severely Handicapped Children" directed by John Rynders, and San Francisco State University's "California Research Institute on Transition of Severely Handicapped Students to the Least Restrictive Environment" directed by Wayne Sailor, will study the ways and means of integrating severely handicapped students with their nonhandicapped peers. Another institute will also study generalization. "Extending Competent Performance: An Institute for the Study of Generalization with Severely Handicapped Students" is under the direction of Robert Horner at the University of Oregon. Since the process of integration is likely to involve the necessity of generalized responding in "new," integrated environments, the work of each institute will relate directly to the work of the others.

The four institutes are committed to maintaining active interaction with one another. Researchers may assist each other by replicating various procedures or interventions. Conclusions drawn at one institute may be incorporated into designs for studies at other institutes. We will also be able to share our fail-

ures -- important information that is seldom published -- to prevent investigation of ineffective procedures. Methodological problems and solutions can be shared, preventing duplication of mistakes. Under normal circumstances, new data are seen by other researchers only after they appear in a professional journal. Since the publication process often takes as long as two years, relevant data may not be available when needed. This problem will be circumvented by monthly communication and inter-institute meetings. Data from the other three institutes will affect the direction and content of our research, and stimulate creative approaches to our work.

The second important communication activity is training. This activity will commence with the training of Research Assistants by Senior Investigators. Efforts will be made to employ Research Assistants who are students enrolled in graduate programs in Special Education and related fields. These potential researchers and professionals will acquire training in those skills required to conduct different types of research in laboratory and applied settings. At the same time, they will acquire experience in promoting generalization in educational settings. We expect training of Research Assistants to be conducted continuously during the project.

The results of individual studies in generalization conducted by UWRO, as well as the results of studies conducted within other research institutes, will be disseminated via courses taught by Senior Investigators who are also teaching faculty at the University of Washington. Consultations and workshops given by Senior Investigators at other agencies, colleges, and universities may include results to date.

During the third project year training in instructional and curricular procedures will involve personnel from Direct Service Consortium schools. Training will be conducted by UWRO staff. The nature of the training will depend on the requirements of the local educational agency and will focus directly on the application of procedures in natural settings. Opportunities for training will be extended to personnel from all local educational agencies in Washington during the fourth project year in cooperation with the Office of the Superintendent of Public Instruction for Washington State. As information from the "guideline" studies is collected, training content will be modified. During the fourth project year, it is expected that the training will emphasize the guidelines for each area and practical methods of integrating the approaches in educational settings.

Training is perhaps the most active communication process, but it will reach only a small percentage of interested professionals. In order to increase the potential benefits of UWRO procedures, technical information and the guidelines for practical application will be disseminated through publications and direct mailings

Technical information will include precise and detailed descriptions of research methodology, analytic procedures, the relationship between the research conducted by UWRO and the existing body of research information, and presentation and discussion of the results of individual studies. Technical information will be in the form of individual articles prepared for journals, in proceedings from the inter-institute conferences, in annual "Review of the Literature" publications, in Annual Reports from UWRO, in the Final Report, and in the Research Monograph to be produced during the fourth and fifth project years. This information will also be disseminated through discussions with researchers at inter-institute meetings, at national conferences, and at quarterly professional seminars conducted at the University of Washington.

UWRO will produce several publications of "best practices" guidelines. These materials will be assembled for specific audiences, including teachers, teacher trainers, parents, supervisors, administrators, curriculum specialists, and related professionals. A wide variety of persons interested in the research will receive this practical information, which will be disseminated via training, presentations at conferences, and mailing of project products. National dissemination targets will be identified, but persons interested in receiving project information will be able to contact UWRO directly and obtain any product at a small cost.

UWRO's activities will be of little ultimate value if the results are not available to those who need them. Communication activities will include cooperation, training, and product dissemination

Advisory Committee

To ensure that research will have practical application to a wide variety of potential consumers and to provide advice from professional perspectives, administrators, parents, researchers and others met during the formulation of the UWRO proposal. Now meeting as the Advisory Committee, they provide advice

on ongoing activities and assist the project in maintaining a practical approach to the education of the severely handicapped. The members represent the full range of professional activities and service delivery systems in the State of Washington.

Local educational agencies are represented by three individuals: Genevieve Fisher Frankenberg, Coordinator of Child Find and Staff Development for Tacoma School District No. 10, is Chairwoman of the Advisory Committee. Fred Row, Director of Special Education for Northshore School District No. 417, represents the UWRO Direct Service Consortium. Bill Tilley is the Director of Special Education for Seattle School District No. 1. Intermediate educational agencies are represented by Donald Whitney, Director of Special Services for Educational Service District No. 121, which serves 36 local education agencies. Judy Schrag is the Assistant Superintendent for the Division of Special Services in the Office of the Washington State Superintendent of Public Instruction and will be our liaison with the state educational agency. Al Bauer represents the 49th Legislative District in the Washington State Senate and sits on the Rules, Ways and Means, Financial Institutions, and Local Government Committees. Joseph Jenkins is Director of the Experimental Education Unit and a member of the faculty of the College of Education of the University of Washington. A noted researcher, he will contribute information from the perspective of a researcher and as a representative of an institution of higher learning. Margo Thornley is Executive Director of the Wiser Vocational Institute, which provides vocational evaluation and training to severely handicapped individuals. She represents other service agencies on the Advisory Committee. Kathleen Knowlan is a student in Speech and Hearing Sciences at the University of Washington. She has completed a B.A. in Communication Disorders and plans to complete a graduate program in Clinical Speech Pathology. She is the parent of a handicapped child. Together, these individuals will bring a wide background of experience, a variety of perspectives, and a sincere interest in the education of the severely handicapped to assist the Washington Research Organization in meeting its goals.

Administration and Management

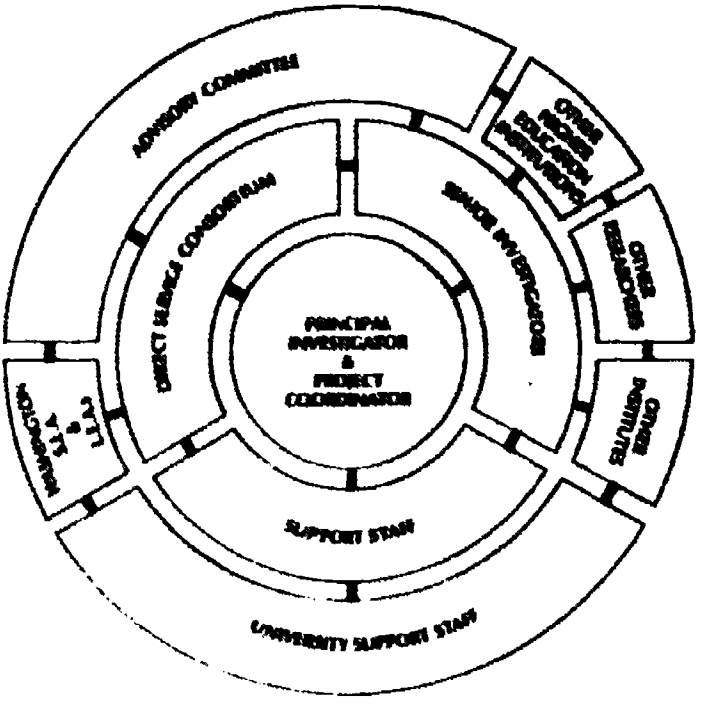
Administrative activities support the research, evaluation, and communication tasks of the Institute. General administrative tasks relating to employment, personnel management,

purchasing, budgeting, and federal reporting requirements are covered by this task.

While such administrative tasks are conducted in every organization, the structure of UWRO is designed to facilitate our unique activities. Rather than an hierarchical system where responsibility and information flows from "top to bottom," we have a circular structure. Information flow is both circular, within the rings, and linear, to and from each circle. In addition, most personnel will participate in more than one group, thus increasing the nonhierarchical structure of communication.

The overall responsibility for UWRO activities rests with the Principal Investigator and the Project Coordinator, but decision making is shared by all groups. Individuals will make decisions related to activities for which they are responsible. Decisions for group and intergroup activities will be reached by consensus. The model for communication at UWRO is shown in the following chart.

UWRO Organizational Structure



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TWO

BASIC RESEARCH CONCEPTS

Skill Generalization

Sometimes we want generalization to occur and other times we do not. For example, if we are successful in decelerating or eliminating maladaptive behaviors during training, such as spitting and hitting, we want those behaviors to not occur in other environments. The aim of such programs is generalization of nonresponding. Since special conditions and circumstances surround this kind of training, and since instances of maladaptive behaviors may actually decrease as skill and competence increase, very little of UWRO's research will be concerned with the generalization of "no response." Most of the time, as educators, we do want generalization to occur. If we train toileting at home, we want to see toileting at school. Generally, the behaviors we train may be called "skills" or "skilled behaviors," because they provide the student with the competencies needed for normal living; these will be the ones of most interest in our investigations.

Broadly speaking, skill generalization is appropriate responding in the absence of programmed training procedures. Severely handicapped individuals are taught specific responses under special conditions involving instructional techniques developed through experimentation. These techniques involve a variety of elements, including the events that immediately precede the response, such as verbal directions (e.g., "Get dressed." "Put on your shoes."). These antecedents may come to control the response and are then called discriminative stimuli for responding. The student responds when discriminative stimuli are present, and does not respond when they are not. Other discriminative stimuli may include specific materials or objects (e.g., T-shirt, shoes) used during instruction, the setting of the instruction (e.g., the desk, the room) and the trainers involved. Instructional techniques also involve events that follow one or more responses, like praise or candy (e.g., "Yes, that's the way to get dressed."), or feedback on incorrect responses (e.g., "No, that goes on your other foot."). These events are called consequences. Consequences are usually arranged to follow the response; their occurence is contingent upon the response. Contingencies are

scheduled during training, and may vary from one consequence for each response to one consequence for several responses.

Generalization is concerned with the performance of the response outside of training settings. When the specific events that occurred during training are not available, different stimuli may serve to signal the response. Outside the training setting, contingencies for responding are different; consequences may or may not follow the response. In analyzing why generalization does or does not occur, investigators have found it useful to examine separately each of the areas where differences exist: in stimuli, people, consequences, settings, and over time.

When the student responds appropriately to untrained instances, objects, or cues, "generalization across stimuli" is said to occur. For example, instruction in putting on shoes may have included only loafers; if the student is able to put on a slipper, using the same motor skills in her response, generalization across stimuli has occurred. In cases where generalization does not occur, it has been hypothesized that discrimination training has been so successful that the student will respond only to stimuli that are identical to the training stimuli. When the stimuli change, the student "recognizes" the change, and thus does not respond. If the student does respond to stimuli that are similar to the trained stimuli, then generalization has occurred.

Another problem area in generalization appears to involve the trainers. Often trained responses occur only in the presence of the people who trained the response, even if the same antecedents and consequences are involved. When the student responds appropriately to people who did not train him, "generalization across people" is said to occur. For example, if the student has been taught to say, "Hi, my name is Charles," and is able to respond to a stranger's introduction with those appropriate words, generalization across people has occurred.

Many instructional situations, especially during skill acquisition, involve consequences for each response. One to one contingencies are unusual outside of acquisition programs. Also, the consequences available during instruction, such as candy or hugs, may not be as available after instruction ceases. When the student responds appropriately in the absence of the consequences available in the training environment or to different contingencies of consequation, "generalization across consequences" is said to occur. For example, training procedures may

have included candy for each correct response. If the student responds appropriately and continues to respond with only intermittent praise, generalization across consequences has occurred.

"Generalization across settings" is a broad descriptor which incorporates each of the types described above and generally defines the incredible variety of changes that occur when the student is expected to respond in new settings. For example, training a pupil to identify buses by number, to enter the bus, to pay for his fare, and to exit from a bus at his destination may all occur within a classroom setting. However, the student must be able to apply this learning to actual travel. If successful, generalization across settings has occurred. The differences between the training setting and the actual use of city buses are so many and so varied that this category is used to describe the collective differences.

We include another category of generalization, "generalization across time." If the response continues to be performed appropriately after training ceases, generalization across time has occurred. This is also called "maintenance" or "retention," but since training has ceased, the conditions have changed (i.e., antecedents and consequences may be different or presented irregularly), and thus a response that maintains may be appropriately described as generalization.

So far, generalization has been described as occurring when the trained response is performed under untrained situations. However, the true purpose of teaching generalized responding is to provide the individual with means of adapting to new situations, solving problems, and living in different settings. Each response should be appropriate. "Hi, my name is Charles," may be said perfectly in a new setting, but if it follows the stimulus, "Put on your jacket," it is entirely wrong.

If the true aim is getting along in new environments, then the response must also be modified, or physically adapted, to fit the setting. Many instances of generalization involve changes in the physical actions that constitute the response. For example, putting on a T-shirt with long sleeves requires slightly different physical movements than putting on a short-sleeved T-shirt. In other cases very different physical responses will be required to achieve the same effect as that achieved by performing the trained response. For example, training a student to put on a shoe achieves the effect of covering and protecting the feet. Putting on a pair of rubber boots achieves the same effect, but physically different responses are usually involved.

Other problems must also be solved if the student is to respond successfully in new environments. One method of solving problems in new environments is to combine two or more responses that were learned separately. For example, the student may learn how to reach for and grasp something on a shelf above his head. In another training situation, he may be taught how to stand on a chair. If he were to successfully use both of these skills to get his lunch from a high, closet shelf without training or prompting, he would have solved a typical problem situation that may occur whenever he is in a different environment. When decisions are required, a response adapted, or a problem solved, generalization involves much more than simple application of a learned skill; it involves adaptation. UWRO investigators will study both types of generalization: application and adaptation.

Instructional Programming for Generalization

Until recently, many people expected generalization to occur spontaneously after training; a "passive" approach to instructing for generalization has been common. We know now that the "train and hope" method does not result in much generalized responding by the majority of severely handicapped students. Trevor Stokes, of the University of Manitoba, and Don Baer, of the University of Kansas, published a major analysis and summary of research in generalization in 1977. This article, and the discussion it provoked, had a major impact on shaping subsequent research in generalization. They argued that it is better to view generalization as an active process and to try to develop instructional methods that ensure that generalization does occur.

Stokes and Baer identified methods in addition to "Train and Hope" that had been reported in published research. In "sequential modification," the behavior is trained in one setting and then, if generalization does not occur in the next setting, training is programmed for that setting, and so on for each setting. This is actually not a very practical solution to the problem by itself, since it would mean that training would have to occur in every setting and each time the individual moved to a new setting.

A similar technique, which Stokes and Baer feel is more promising, requires including many different types of similar antecedents into the training situation. By "training sufficient exemplars," the individual is thought to learn a general category of items or objects to which to respond. For example, instead of

teaching "putting on a sweater" with just long-sleeved-crew-necked sweaters, V-necked sweaters, short-sleeved sweaters and so on are trained. With more varied instructional antecedents, generalization to untrained sweaters (e.g., turtlenecks) may occur.

An extension of this technique was classified by Stokes and Baer as "train loosely," in which many different antecedent events are introduced during training. For example, instead of prefacing each trial, "Put on your shoes," the student may hear, "Put it on," or "It's time to go outside, shoes on," or even be given the shoes without any verbal direction. The more specific "program common stimuli" technique would be to identify stimuli commonly found in different environments and include those in the training setting.

In addition to problems associated with antecedent stimuli, it has been hypothesized that generalized responding does not occur or maintain because the consequences available in natural settings either are not reinforcing to the individual or do not occur as frequently as they did during training. Research data has already shown us that if a response that has been frequently reinforced is performed under infrequent reinforcement, that response is likely to disappear -- to be extinguished. The technique "use indiscriminable contingencies" involves gradually replacing training consequences and schedules with those available in natural settings. In this manner, naturally available consequences acquire reinforcing powers through pairing with programmed consequences, before training consequences are discontinued. Similarly, the schedule of one consequence for each response commonly used during training is gradually replaced with a schedule of intermittent consequences, so that the student is unable to discriminate when a response is likely to be reinforced and when it is not. This method is designed to ensure that generalized responding will occur and endure with the infrequent natural consequences available outside of training settings.

Another method identified by Stokes and Baer is to gradually introduce the individual to "natural maintaining contingencies." This can be achieved most easily by teaching behaviors that are functional in nontraining settings. For example, teaching appropriate eating behavior would introduce the child to the contingencies that occur naturally for such behavior, such as compliments, access to different foods, opportunities to eat at restaurants, or outings with family and friends. The natural consequences would then reinforce "good eating behavior" after

training ceased. The student is introduced to natural consequences by teaching her a response that will be naturally reinforced in normal settings.

Another technique that has been used to "train to generalize" seems to be at odds with most established instructional methods directed at acquisition. In this method, consequation occurs only for generalized responding. In such situations, the learner would not be reinforced for learning a new skill, but only for using it appropriately outside of training situations.

A final category of research involves processes that Stokes and Baer identified as "mediate generalization." Teaching the individual new methods of thinking and acting or to use cognitive strategies is an example of teaching "mediated generalization" skills, rather than directing programming at generalization of specific skilled responses.

Each method shows some promise but to date no approach has demonstrated consistently good effects in controlled settings, and little research has been conducted in classrooms and homes with teachers and parents implementing the procedures. Our research will seek to extend and develop these and other approaches to the problem, using the methodology discussed in the next section.

Methodology

Subjects and Settings

The subjects will be students attending the Experimental Education Unit and schools of the Direct Service Consortium who meet local, state, and federal classifications as severely handicapped, profoundly handicapped, severely behaviorally disordered, autistic, childhood schizophrenic, deaf-blind, or multiply handicapped. In order to facilitate the identification of subjects while respecting the Rights of Human Subjects Guidelines, these districts will write letters to parents of students explaining the research. Parents or guardians will be given the opportunity to voluntarily consent to their child's participation in a specific study. Teachers of students for whom consent is obtained may also consent to participate in research studies.

Since we are investigating skill generalization, measurement of generalization will occur in a wide variety of natural educational

settings, including classroom, school, home, community, and vocational environments. Some studies will involve subjects working directly with a researcher in a separate room or in a part of the training or classroom setting. Results of research in such controlled settings will be applied to more normal settings. When this occurs, the setting is called an "applied setting." Other studies will involve students working individually or in a group with their regular classroom teacher. Studies in nonschool environments will involve parents, supervisors, peers, neighbors, or others who interact with the subject during normal daily routines.

Subject Responses

In each study, the performance of the student will be measured. Such measurements are used to determine the effects of different types of training, the effects of changing trainers, and the effects of changing settings. Performance data will provide the information we need to better understand the phenomenon of generalization and practical methods of achieving it for many different individuals and many different skills.

The selection of skills or behaviors to be measured will be determined by methodological factors, but will also involve educational considerations of functionality and age-appropriateness. Increasing emphasis is being placed on teaching severely handicapped individuals functional and age-apppropriate skills. It may be appropriate to teach playing with blocks to a preschool child as a leisure skill, but bowling is a far more age-appropriate leisure skill for a teenager. This concept also extends to the selection of instructional materials. While beads and blocks may be appropriate materials to teach a youngster to discriminate objects by shape, spoons and forks are more appropriate for teaching the same skill to a teenager. Furthermore, rather than teaching skills with limited use in most daily environments (i.e., making holiday ornaments), teachers are now concentrating instruction in areas more relevant to daily living and vocational success and ones which introduce the pupil to natural maintaining contingencies.

Some of our research will involve collecting data on behaviors targeted on IEPs, but other factors must be considered. For example, generalization might better be achieved for the group of dressing skills if training included practice with a wide variety of different types of clothing items (e.g., sweaters trained: cardigans, pullovers, zipback sweaters, v-necked sweaters etc.),

than with repeated practice on items of a single type (crewnecked sweaters). Conversely, generalization may be hindered for the class of grooming behaviors by training in a wide variety of items, but facilitated by teaching the student to check his own appearance. In some studies, therefore, grooming might be selected, while in others, dressing. As information about generalization accumulates, factors such as these may influence the selection of student responses for study.

In the selection of subject responses it is necessary, especially in the early stages of research, to make sure that any observed changes are the result of the intervention being tested. The researcher may need to ensure that experimental instruction is the only training affecting the performance of the subject. This control is very difficult to achieve if common functional skills are selected. How can the researcher who selects dressing skills be sure that instruction is not being conducted in the home or school, even incidentally? In order to eliminate such effects, tasks which are relevant only to the study may be selected. Effective strategies identifed by studies measuring artificial experimental responses will be applied to functional tasks later on.

Measurement of Generalization

The basic concerns of the collection of data on generalization include, in addition to standard research concerns of reliability and validity, the scheduling of generalization "probes" or measures, the frequency of measurement, and the quality of the generalized response. In most published research, generalization is measured by one or more "probes" or "tests" following the conclusion of training or after the subject has met a predefined criterion performance level on the trained skill. These data can provide us with evidence that generalization did or did not occur. However, if measured "after" only, we really can't determine when generalization began or compare performance with preintervention levels.

Measuring generalization both before and after provides information on the net impact of the training, but leaves other important questions unanswered. Does generalization begin to occur gradually, paralleling acquisition of the skill, or only as some level of mastery is reached? Do different methods of teaching generalized responding promote generalization earlier than others? Does generalization occur soon after training begins or only toward the end of training? With such information, we can begin to understand the relationship between skill acquisition,

fluency building, application, and adaptation. These questions can only be answered by measuring generalization during training and repeatedly over time, as UWRO will do. Repeated measures or opportunities to perform the generalized response will provide information on the progress of generalization as an ongoing, active process, rather than as a single spontaneous event. Not only will data be collected at different times in relation to an intervention, but multiple probes will be scheduled at each time.

Repeated measures of generalization will also provide information on another aspect of generalization, one that has received little attention -- "training savings." An individual who has been successfully instructed in one skill may learn another skill very quickly as a result of the previous instruction. For example, a student may complete all of the steps required to boil an egg accurately (i.e., without breakage or overcooking) and fluently (i.e., in the time it takes an average adult to boil an egg) in seven training sessions of 15 minutes each. Following egg training, the student may need only one session to master broccoli cookery. This may be compared with another student who was taught to boil broccoli without egg training, and who took eight sessions to achieve the level of mastery the first student achieved in one. This "savings" of time spent in instruction is another important dimension in building generalization skills and is of practical significance to educators.

Measures of generalization often include only "yes/no" data on whether generalization occurs and/or a statement of the accuracy of performance (e.g., "80% correct"). These factors alone are probably insufficient for a thorough understanding of the quality of the generalized response. We know that the "time" of the response, expressed as either rate, latency, or duration, is required in addition to accuracy data in order to understand how severely handicapped individuals acquire and build fluency in skills. The length of "waiting" time before responding (i.e., latency), the rate of responding, and the duration of the response itself each provide important information on the quality of the response.

A good example of the importance of the temporal quality of generalization is dressing. If a child is taught to dress herself accurately and to finish within 10 minutes during training, it is important to know not only whether or not dressing occurs at home (i.e., yes-no data), how many items of clothing are put on correctly (i.e., accuracy data), but also how long it takes her (i.e.,

fluency data). Presumably the 10-minute training criterion is set to allow the child to complete dressing within a time limit that is functional for her home environment (e.g., a morning schedule which does not allow for more than 10 minutes dressing). Thus, if training in dressing produces accurate and speedy dressing in the home, the training may be regarded as entirely successful. However, what is the quality of generalization if the child dresses accurately, but takes 35 minutes to do so? Obviously, the significance of the generalization achieved is less than in the former case. Thirty-five minute dressing may even have more serious consequences for behavior maintenance. The parents, anxious to see the child dressed and breakfasted before the school bus arrives, may decide to "help" the child dress or even dress her themselves. Over time, the opportunity to dress is withdrawn and we would expect that the skill of dressing may even be lost. In order to measure all of the important dimensions in generalized responding, UWRO researchers will collect yes/no, accuracy, and fluency data as measures of skill generalization.

Procedures for Descriptive Studies

UWRO's research activities will begin with studies designed to provide additional information about variables already identified, such as the stimuli, contingencies, consequences, settings, and conditions in environments where generalized responding is desirable. Descriptive studies will also include examination of other variables that may affect skill generalization, such as the scheduling of instruction or the learning characteristics of the individual.

The collection of descriptive data will involve three different types of analyses. Analyses of data collected previously may be used to generate hypotheses, since it is unlikely that the experimenter's bias could affect the data. Similarly, analyses of published research using statistical summaries across studies and discriminate analysis techniques may provide additional information. Descriptive studies will also include data collection in educational settings, without any intervention.

Procedures for Intervention Studies

UWRO's intervention studies include both controlled laboratory studies and investigations in applied settings. The intervention

research will utilize two distinct methodological approaches in investigating generalization in severely handicapped individuals: "single subject" and "group" designs. In each methodology, our interest is in determining the effects of various interventions on generalization of the subjects involved in the study.

Single subject research designs include repeated measurement of the target behavior, and thus provide information on the process of change of the behavior. Data are collected on the target behavior over a period of time before an intervention is introduced. The effect of the intervention is determined by comparing performance before, during, and after the intervention. The relative strength of an intervention is tested by withdrawing the intervention and analyzing any changes. If the intervention cannot be withdrawn, as when an intervention has taught a new way of responding, the intervention is implemented with other behaviors and with other subjects. The data collected on each subject are studied individually and analyzed to determine the process of change involved. Replicating the studies will provide information on the generality of the results.

In group designs, subjects are selected to be representative of a large population and then randomly divided into two or more groups. Sometimes a measure of performance of the target behavior is used as a pre-measure or pre-test. One group is chosen as the control group and another as the intervention group. There may be several different types of interventions tested, but usually only one per experimental group. Following the intervention, a post-test or measure of performance is taken. The effects of the intervention are determined by comparing the performance of the experimental group with that of the control group. The data on each group are studied as a single unit to determine the product or net effect of the intervention. The performance of a single individual is important only as an indication of individual differences within the group. Inferences and results obtained by studing a group may lead to information about how procedures may be likely to affect the population from which the group was originally drawn.

THREE

UWRO'S APPROACHES TO GENERALIZATION

UWRO's research will involve four different but interrelated lines of inquiry to approach the fundamental questions about generalization: Why do some students generalize and others not? What can we educators do to see that all students are able to generalize? These approaches are distinguished by their basic assumptions and by the types of the intervention strategies investigated. The four approaches to these questions are:

(1) an "ecological" approach to describing and then changing conditions within the educational environment;

(2) a "performance pattern" approach to describing and matching individual learning characteristics and instructional techniques;

(3) a "self-control" approach to teaching severely handicapped individuals to manage their own behavior; and

(4) "secondary/post-secondary transition" investigations on teaching strategies to improve generalization in the transition from school to community and work environments.

The time lines for the research activities of the Institute proceed generally from descriptive studies and tightly controlled laboratory intervention studies to intervention studies in natural environments. The longitudinal descriptive study of existing conditions in training and nontraining settings will continue throughout the project. The hypotheses of the studies designed to intervene in existing ecological conditions are, of all of the areas, most firmly rooted in existing research. Therefore, intervention studies will begin initially in applied settings (e.g., public school classrooms).

The performance pattern research will begin with descriptive studies involving analyses of existing data sets, and then proceed to the collection of descriptive data in public school classrooms. The descriptive information will be used to determine a set of experimental data decision rules for matching specific instructional methods to individual performance which will be tested in intervention studies in applied settings during the third and fourth project years.

RESEARCH TIME LINES

	Ecology of Training Settings	Performance Pattern Studies	Self-Control Studies	Secondary/ Post-Secondary Studies
Year 1 82-83	Descriptive Environment X Indiv Characteristics (Group 1) Intervention (Applied) Massed v Distributed Trials	Descriptive Existing Data Sets	Intervention (Laboratory) Self-Monitoring	
Year 2 83-84	Descriptive Env X Charac (Group 1 & 2) Intervention (Applied) Competing Behaviors Instructional Schedules Environmental Simulation	Descriptive Existing Instruction X Perf Patterns	Intervention (Applied) Self-Monitoring Intervention (Laboratory) Self-Reinforcement	Intervention (Applied) Cue-Fading
Year 3 84-85	Descriptive Env X Charac (Groups 1, 2 & 3) Intervention (Applied) Instructional Schedules Environmental Simulation	Descriptive Existing Inst X Perf Patterns Intervention (Applied) Decision Rules	Intervention (Applied) Self-Reinforcement Self-Monitoring Intervention (Laboratory) Self-Reinforcement Combined Strategies	Intervention (Applied) Cue-Fading Intervention (Applied) Fading Reinforcers & Contingencies
Year 4 85-86	Descriptive Env X Charac (Groups 1, 2, 3 & 4) Intervention (Applied) Environmental Simulation Guidelines	Intervention (Applied) Decision Rules Guidelines	Intervention (Applied) Self-Instruction Combined Strategies Guidelines	Intervention (Applied) Fading Reinforcers & Contingencies Intervention (Applied) Combined Fading Strategies Guidelines

Without existing data sets or even very much applicable literature, studies in self-control will begin with tightly controlled intervention studies under laboratory conditions. Each self-control skill will be investigated in the laboratory before intervention research begins in applied settings.

Studies in secondary/post-secondary transition will investigate strategies for fading cues, reinforcers, and contingencies. This research area also has few precedents and very little applicable literature. Strategies will be investigated in natural settings, including a local vocational technical institute and job placement sites in the community.

During the fourth year of the planned research, guidelines for the application of each method of facilitating skill generalization will be tested in natural settings. According to the contract plan, the research activities of the Institute will be concluded by the first part of the fifth project year. Our final activities will emphasize dissemination of the research findings. The background, design, expected results, and first-year's findings of each of these approaches will be discussed in this chapter.

Studies in Ecological Variables

While educators frequently lament the failure of pupils with severe learning handicaps to generalize, research has suggested a variety of instructional strategies which could potentially be applied in educational programs to increase the probability of obtaining generalization. Broad categories of modifying instruction for generalization were discussed in the preceding chapter. However, the degree to which these practices have been incorporated into education is unknown, as are factors in educational settings that may limit the effectiveness of these strategies. We will use the word "ecology" to refer to the total of all observable factors and conditions which comprise the educational setting. The purpose of research in this area is to explore the current educational ecology of severely handicapped pupils and selected ways in which ecological conditions might be modified to enhance generalization.

Ecology studies will begin with a four-year descriptive study. The longitudinal descriptive study will serve two purposes. The data collected will be used as a general baseline for all of UWRO research, to determine the extent to which our procedures are

adopted, as a basis for cost comparisons, and as a general indication of the level of generalized responding with and without UWRO procedures. However, the primary purpose is to explore a variety of the factors in educational settings that may influence generalization. Factors so identified will be investigated in a series of intervention studies.

Design of Longitudinal Descriptive Study

This four-year study will explore five major issues:

(1) The nature and number of pupil goals and objectives that include the intent to promote generalization or include behaviors require generalization in order to be of functional value.

(2) The extent that pupil performance data indicate attainment of goals/objectives related to generalization.

(3) The degree to which formal instructional programming is designed to facilitate generalization, the nature of programming provided, and the extent to which informal practices are employed which seem likely to promote generalization.

(4) The degree to which generalization occurs as a result of formal or informal programming.

(5) General ecological conditions which might facilitate generalization.

Ecological conditions which may be examined include the number of managers administering formal or informal programs throughout the day, the number of intraschool environments in which programming occurs, the percent of the school day in community environments, the degree of interaction or opportunity for interaction with nonhandicapped or with lesser handicapped peers, and the number of school/community cooperative programs administered following school hours (e.g., programs administered by parents). Other conditions may be identified through observation and factor analysis.

The descriptive study will include two types of activities. First, a review of existing records (e.g., IEPs, formative data, and lesson plans) for the original sample of approximately 25 severely handicapped pupils selected from Direct Service Consortium schools will be undertaken to collect information on objectives and educational plans. Second, interviews with teachers, parents, and/or other caregivers, as well as data collec-

tion in classrooms and other environments by members of the project staff, will be necessary to gather information related to current conditions, implementation of procedures, and pupil performance.

Selected members of the original pupil sample will be followed up each year for three additional years in order that a longitudinal record may be developed of generalized skills as they are acquired. This study will also record the changing nature of conditions to which pupils are exposed over time. In addition, new pupils will be selected and added to the sample each year, with similar information collected on each.

Analytic techniques applied to the data will be primarily descriptive and exploratory in nature. Ultimately, the results will be of value in determining which currently employed instructional strategies have a high probability of success, whether certain skills are more likely than others to generalize in the absence of formal programming for generalization, and the basic conditions within community, home, and work environments which should be considered when designing, implementing, and evaluating programs to facilitate generalization for severely handicapped persons. The data collected will be used in the selection of ecological intervention studies and in the selection of variables and methodologies for other UWRO investigations.

Design of Intervention Studies

The second set of ecological investigations will study interactions between factors identified in the descriptive study and the effect of changing one or more of the existing conditions on the occurrence, quality, and quantity of generalized responding. Factors that are likely to be studied include pupil response variables, general task and setting variables, stimulus variables, response demands, and reinforcement variables as they pertain to the development of generalization.

Although it is impossible to predict all factors that will be investigated, previous studies have identified likely areas. Past research leads us to believe that when generalization does not occur, the individual may have previously acquired a behavior that achieves the same outcome as the behavior you are training. This behavior may compete with the trained behavior in the critical effect of a response. For example, tantrumming to be fed may compete with feeding oneself or asking for food, if each gets

the same results. At least one study will be conducted to investigate methods of identifying and managing undesirable competing behaviors and assessing the impact of the interventions on generalization of more desirable responses.

Another intervention study will examine the relationship of generalization to the scheduling of instructional trials. Instructional opportunities, or trials, are frequently grouped into a single block, with one trial immediately following the next. For example, 10 or 15 trials of "buttoning" instruction might be presented daily from 10:00 to 10:30 a.m. An alternative to this practice would be to provide buttoning instruction at times when a natural need exists to button one's clothing (e.g., upon getting up in the morning, before going outside, after gym, or after using the toilet). This method for scheduling instruction would result in the provision of trials spaced or naturally distributed throughout the day.

Scheduling instruction at the times when the target behavior would occur in natural environments could prove beneficial for several reasons: (1) it would increase the similarity between the instructional situation and the conditions in which generalized responding is desired. (2) It might increase the likelihood that unprogrammed reinforcers would be available in the natural, generalized setting. (3) It may avoid problems often noted with severely handicapped students, like "poor attention spans," fatigue, and reinforcer satiation. This series of investigations will provide data on the relative impact of different trial scheduling formats on generalization.

The methodology of the intervention studies will be single subject designs replicated across subjects. Repeated measurements of the accuracy and either the rate, duration, or latency of performance of the subjects during the instructional sessions and in the generalization setting will serve as the primary independent variable. In cases where training occurs in the "natural environment," generalization will be measured in different but similar settings. Analytic techniques will include visual inspection of graphed data, time-series statistical techniques, and an overall statistical summary of performance for comparison between studies and with the data collected in the longitudinal descriptive study.

Expected Outcomes and Products

The studies in this area should result in the development of a "best practices" manual, incorporating at least five areas:

(1) guidelines which identify current best practices existing in public school settings will result from the descriptive studies,

(2) guidelines for identifying competing behaviors and methods for counteracting their effects in nontraining environments,

(3) guidelines for how to schedule instructional trials and learning opportunities for different classes of skills,

(4) guidelines for how to (a) identify critical elements in the "natural" environment and (b) introduce those elements in the training environment, and

(5) other possible guidelines may be developed depending on information from the descriptive studies and the nature and results of the intervention studies.

Summary of First Year's Findings

Five descriptive studies of the ecological conditions of educational settings were initiated during the first project year. Two to four research assistants worked with Dr. Felix Billingsley on the longitudinal ecological studies, which were conducted with subjects from two local public school districts. For more information on these studies, see Billingsley, F., Berman, A., & Opalski, C. (1983).

The general approach of this investigation was to measure, through direct observation, surveys, interviews, and/or record reviews, selected variables within the educational ecology of severely handicapped pupils. Those measurements were then employed to determine the match between existing conditions and those conditions which ought to exist if the principles outlined by Stokes and Baer (1977) were generally applied.

Study I: Generalization in IEPs. The first study was undertaken to determine whether teachers indicated the intent to promote generalization across situations or persons in IEP objectives, and whether the objectives were of such a nature that skill performance was likely to have adaptive value. IEPs for the previous and current school years were reviewed.

Perhaps the most dramatic findings were related to the variability in total number of objectives included on IEPs and the very small percentages of objectives which specified generalization intent. The total number of objectives included on IEPs varied from 2 to 26, with a median of about 10.5. For at least some children, therefore, the number of skills being taught which could even potentially be generalized was quite low.

In both sites, the number of objectives in which generalization intent was specified was negligible. Overall, 7% or less of the coded objectives specified generalization intent. If IEP objectives accurately indicate desired instructional outcomes, then it must be concluded that generalized skill performance was not a high priority with the members of the educational team responsible for writing the IEPs reviewed.

Combining sites, 66% of objectives coded from last year's IEPs were considered functional, as were 65% of the objectives from the current year's IEPs. There is no empirical basis upon which to determine whether percentages in the mid-60s are to be commended or criticized. If, however, these data indicate that approximately one-third of the objectives possessed minimal adaptive value and were unlikely to generate reinforcers in nontraining settings, then it may be that teachers are spending considerable time teaching behaviors which have relatively low probability of generalization and, therefore, minimal utility to the learner.

Study II: Parent ratings of objectives and student opportunity to generalize skills to home. The next objectives of the project were to:

1. Determine the opportunities available to utilize instructed skills in home environments, since opportunities to perform are necessary in order for generalization to occur. Furthermore, we would expect instruction to be aimed at skills which the student will in fact have an opportunity to use.
2. Determine if skills were appropriately or inappropriately performed in the home, since generalization could not be said to have occurred if the skill is performed appropriately in the classroom but not elsewhere. In addition, if a skill is already performed appropriately in the home, the value of further instruction is questionable.
3. Determine if parents were providing training in the

home, to see if such training or the lack thereof has an effect on generalized performance.

On the whole, the parents felt that IEP objectives clearly stated the required behaviors. They also indicated that they considered the vast majority (91%) of the behaviors taught to be functional. Parents at both sites indicated that, outside of school, their children had the opportunity to perform only slightly over 60% of the behaviors included in this or last year's IEP objectives.

Regarding appropriate performance of behaviors outside of school, parents indicated that approximately 50% of IEP behaviors did occur at appropriate times. In other words, about half of the behaviors targeted for instruction in school were said to be occurring in nonschool settings. This is, of course, good news in the sense that generalized performance of skills seems to be occurring at a level which is likely to have a meaningful impact on the lives of the pupils. It is not such good news, however, in the sense that a number of skills on which instruction was in-progress, appeared to have already been acquired by the subjects.

Relatively few behaviors were noted to occur at inappropriate times within nontraining settings. However, over one-fourth of the parents of subjects at one of the sites indicated that behaviors included in last year's objectives occurred at inappropriate times.

Parents reported home training for 57% of last year's objectives, and for 54% of this year's objectives. This is an encouraging finding which is generally consistent with principles for development of generalized responding; however, the frequency and precise nature of the home training is unknown.

It was found that 85% of the behaviors which parents indicated were being performed appropriately were also being trained, at least to some extent, at home. This degree of concordance tends to support the possible value of sequential modification and underscores the importance of parent involvement in the educational process.

Study III: Access to setting and manager changes. We have hypothesized that more and frequent changes in settings and managers will promote more generalization. Therefore, following the record review and survey efforts, an observational study was undertaken to examine:

1. the frequency with which subjects encounter new managers (i.e., teachers, aides, therapists, etc.),
2. the frequency with which subjects accessed new settings,
3. the amount of time subjects spent in unsupervised activity,
4. the largest amount of time subjects spent with any one manager, and
5. the largest amount of time subjects spent in any single setting.

The data indicate that the percent of time subjects spent in a single setting ranged from 32% to 86%, with a median of approximately 60%. It may also be noted, however, that within settings, subjects spent relatively small percentages of their time with any one manager (about 30% on the average), and they generally were under some supervision or direction rather than simply being left alone. Average percentages of supervised time were greater than 70%, with a high of 98%. The frequency with which pupils encountered new managers and accessed new settings was considered impressive by the project staff.

The results suggest that pupils encountered a considerable variety of managers during the school day and that amounts of time spent with any one manager were within reasonable limits. The balance between amounts of supervised and unsupervised time generally appeared acceptable; however, one subject did spend more than 50% of the observation period in unsupervised, undirected activity. The conditions seemed favorable, on the whole, to the development of generalized responding across persons. On the other hand, it was found that, although relatively large numbers of settings were accessed, large portions of subject time were spent in a single setting (approximately two-thirds of the time, on the average).

Study IV: Peer interaction. Interaction between severely handicapped students and their peers is another ecological factor which may have an effect on skill generalization. When interaction does not occur, generalization (particularly of social and communication skills) might suffer. This study had two objectives. The first objective was to obtain an estimate of the amount of time during the school day in which subjects had the opportunity to interact with nonhandicapped or lesser handicapped peers. The second objective, derived from observations that spontaneous interactions between severely handicapped and lesser or nonhandicapped peers are infrequent in the absence of

educational programming, was to determine whether managers prompt or reinforce interactions when opportunities for interaction exist.

The data indicate that the amount of time available for interactions in or out of school was highly variable and low, with medians ranging from 0% to 21%. Only 4 of the 10 subjects participated in community activities which provided opportunities for interaction, and the time spent in such activities was small (0.25 to 4.0 hours per week). Types of in-school activities with interaction opportunities included music, physical education, swimming, recess, and assemblies, while opportunities for interaction in the community included swimming and horseback riding.

Despite the dramatically low levels of interaction observed, it was found that managers typically failed to provide either cues or encouragement for interaction. Subjects were thus unlikely to interact with lesser handicapped peers and, due to a lack of educational programming, were considered unlikely to display increased involvement in the future.

Study V: Cross-setting generalization. The findings of the first four studies in this series indicated that elements of the educational ecology of subjects did not greatly favor the development of skill generalization across situations and persons. This study was conducted during the final weeks of, and immediately following, the academic year to determine through direct observation whether skills being taught to a subset of subjects did generalize to other settings.

Several of the findings were unexpected. The most surprising, however, was the frequency with which substantial degrees of cross-situational performance (i.e., generalization) were observed. Generalized responding was noted in 8 of the 10 programs studied. For four of the programs, correct responding occurred on 100% of the opportunities. It is possible that instruction within the school context is being undertaken on a variety of skills which pupils not only already have in their repertoires, but which are generalizing to other situations. This is underscored by the fact that impressive levels of correct responding were noted for three of the five programs which teachers thought were not generalizing. Subjects scored 100% correct on two of those programs and 80% correct on the third program.

Strong and significant relationships were found between average generalization and two manager and setting variables. The large positive correlation between new managers per hour and average generalization suggests that generalization may increase as pupils encounter greater numbers of managers throughout the day. The substantial negative correlation between generalization and the largest percent of time spent in any one setting indicates that subjects who were confined to a single educational setting (i.e., a single classroom) displayed lower levels of generalized responding than other subjects.

Discussion. Certainly, the findings of these studies must be considered both tentative and limited due to the small number of schools, subjects, teachers, and observations involved, the structure of observations, and the inaccuracy which might result from information gained from surveys rather than from direct observation. In many cases, however, the findings were so consistent across subjects, years, and sites as to instill a fair degree of confidence in the reliability and validity of findings in at least the participating sites. In the coming years, data collection will be extended to include not only a subset of the subjects who participated in the present series of studies, but additional subjects, teachers, and sites through a state-wide IEP survey. As data accumulates, extant conditions within the educational ecology of severely handicapped pupils should become more clearly defined, and critical variables more discernable.

Given caveats as indicated above, the data suggest some specific, although tentative, implications for structuring the educational environment of severely handicapped pupils in a manner which should increase the probability of generalized skill performance:

1. Specify generalization intent in IEP objectives.
2. Examine objectives to insure functional value.
3. Provide examples of relevant and irrelevant stimulus dimensions in training.
4. Communicate frequently with parents regarding pupil performance across settings and environmental requirements for skills being taught.
5. Expand opportunities for interaction with lesser and nonhandicapped peers in school and community situations and, when such opportunities exist, provide systematic encouragement.
6. Finally, provide manager and setting variation with each school day. Be particularly attentive to schedules for children displaying the most severe intellectual deficits as they may be at greatest risk for confinement to single settings for extended periods of time.

Studies in Performance Patterns

Most people agree that each pupil is an individual and that what might work with one student may not work with another. There is a need to individualize not only in the selection of behaviors to teach, but in how we teach. Individualization usually begins with an identification of the skill areas and behaviors to be taught. Next, detailed inventories of the pupil's skill in each area of the curriculum are conducted to determine, for each behavior selected, the exact level or curricular step at which instruction should begin. Major pupil characteristics which might indicate the need for a particular instructional approach are also identified. The teaching procedures which might prove most effective with mentally retarded children, for example, might be quite different from those which work best with the deaf-blind. Surveys of "learning channels" and "reinforcement preferences" could also be used to help in the development of specific instructional plans. Overall, there is much that can be done to select and develop highly individualized approaches for meeting a pupil's needs.

For the most part, however, educators tend to think of the factors which might determine the effectiveness of an instructional approach as being rather fixed and unchanging. The student is and always will be deaf-blind; the student is "visually oriented," or "prefers juice instead of hugs." In reality, instructional approaches which work quite well on one day may hinder further learning on the next. Truly individualized instruction will involve the continuous assessment of daily pupil progress to determine exactly when and how instructional procedures should be modified to keep pace with the changing needs of the pupil.

For the most part, however, educators tend to think of the factors the way pupils' learning changes from day to day. Each pattern can be related to specific instructional needs. For example, there is a surprisingly consistent relationship between a pupil's overall fluency in performing a task and the need for additional guidance. If a pupil is performing a task very slowly (even if overall accuracy is fairly good), strategies such as increased cues, prompts, and corrective feedback may facilitate further progress. However, if the pupil is performing the task fairly quickly, those same strategies may be quite ineffective. After noticing the ineffectiveness of one strategy, teachers may need to try three or four different approaches before finding one that

works. Of course, soon after finding one that works, the pupil's needs change once more and the process of trying to find effective instruction begins all over again.

By examining the performance characteristics of students who were acquiring or building fluency in a skill, researchers found certain elements of performance to be very important. These included the student's correct rate or frequency of performance, the accuracy of the response, the weekly rate of learning or progress, and the variability of responding. Five constellations of these elements were identified as specific performance patterns. By examining those characteristics, researchers were able to predict whether or not a specific strategy would help or hinder the student's learning. To replace the guesswork in programs for acquisition and fluency-building, rules were developed to help teachers match instructional strategies to changing pupil needs. Research shows that teachers who follow the rules are able to choose an effective strategy ten times out of twelve.

As successful as the performance pattern rule research has been, to date it has only looked closely at the way in which pupils learn and master new skills in specific instructional situations. Very little is known about the relationship between those patterns of learning and the chances that the new skill will generalize to other situations. It will be the purpose of the performance pattern research at UWRO to investigate those same elements to discover their relationship to generalization. We will then try to match specific patterns with instances and noninstances of generalization. If necessary, we may look at other elements in responding, but we hope that the same elements will prove predictive of generalization. We will attempt to identify the instructional procedures with the highest probability of promoting generalization. If we are successful, we will be able to match particular types of instruction with student's individual needs in order to facilitate generalization.

Design of Descriptive Studies

A great deal of potentially useful information concerning the relationship between patterns of learning and generalization already exists. For example, a published research study, originally conducted to determine the usefulness of feedback in promoting generalization, might be evaluated to look at the relationship between performance patterns and generalization. Similarly, the data already being collected in many classrooms

to monitor pupil progress may yield certain clues. There are at least two advantages in using existing data -- it is far less expensive and there is no chance that our expectancies of what should happen might somehow affect what does happen. The disadvantages in using existing data lie in the fact that they may not provide all of the information required for the study (e.g., most researchers have expressed performances in terms of simple percentages, or accuracy statements, rather than in both accuracy and fluency as desired for the current research), and some questions often exist concerning the reliability of the data and/or the exact nature of the procedures employed to facilitate generalization. At this time some 84 research studies have been evaluated, and have provided at least some information of use to the Performance Patterns research. To supplement those data, however, it became necessary to begin direct observations of our own during the second project year.

Experience in special education research has shown that valuable data can be obtained from scientific observation of what is already happening in the classroom before making any changes. During this phase of the research, the project has been monitoring and documenting what is already going on and how those activities appear to relate to generalization. Severely handicapped pupils with a wide range of disabilities from two different classrooms have been included in the study. In previous performance pattern research on skill acquisition and fluency, basic pupil characteristics (i.e., type and level of handicap, age, sex, etc.) were not strongly related to the way in which performance patterns predicted the success of various instructional approaches. Nevertheless, detailed records of pupil characteristics are being kept and evaluated to determine whether those characteristics do relate to the usefulness of performance pattern rules in predicting when and how generalization might be facilitated.

Teachers volunteering for the study collect (and allow project staff to collect) specific information concerning daily pupil progress in a sampling of instructional programs. Concurrently, project staff monitor each pupil in a variety of other situations to determine if, when, and how the pupil begins to demonstrate new skills outside of the instructional setting. General observational studies have provided the research staff with the information needed to refine specific hypotheses, and have provided the basis for more directive interventional studies.

Design of Intervention Studies

During the latter part of the second project year, specific studies are being conducted to clarify the relationship between performance patterns in an instructional situation and the likelihood of generalization. For example, noninterventional studies conducted earlier during the second year suggested that pupils who achieve a specific level of fluency in the instructional setting are more likely to generalize their skills, so a study is being conducted to test that relationship by bringing skills up to a level of fluency and noting whether generalization actually does occur. When a reasonably comprehensive set of rules has been developed, the impact of those rules will be tested by training new teachers in their use and evaluating the effect of rule use on generalization. Direct intervention studies will continue throughout the third and fourth project years.

During earlier performance pattern studies, the success of a program change was judged by the immediate impact on performance, the change produced in average weekly progress, and the net effect of those two factors on eventual skill mastery. Those same variables are being used to monitor the basic effectiveness of any changes made in the instructional situation to improve generalization, but special probes of the pupil's behavior in a variety of other situations are also conducted to examine generalization. Initially, the degree of generalization at any point in time is being described in terms of the number and type of noninstructional situations in which the behavior is observed to occur, and the degree to which performance characteristics in the noninstructional setting approximate those observed in the instructional situation (in terms of fluency, accuracy, and improvement over time).

Expected Outcomes and Products

If the proposed studies are as successful as earlier work, it should be possible to develop a set of rules which teachers can use to evaluate individual pupil performance and decide if, when, and how they might change instructional procedures to facilitate generalization. Rather than impose a single approach to developing generalization, the rules would help teachers to choose the best method, from among a variety of possible instructional procedures, to meet the individual needs of a pupil at a given point in time. With such rules, it will be possible to truly individualize instruction to take into account each pupil's changing needs.

In addition to a series of research papers and monographs documenting the progress of individual studies, the performance pattern research should result in the creation of a brief "user's manual" which explains how the rules can be used to facilitate skill generalization with severely handicapped pupils. The manual will be written in a manner which is easily understandable to teachers and other educational practitioners and will be as self-contained as possible. The manual will not assume that the reader has any prior knowledge of the skills necessary to use the rules. The actual usefulness of the manual will be tested on a group of teachers toward the end of the fourth project year. The feedback gained from that trial implementation will be used to make modifications during the fifth and final project year.

Summary of First Year's Findings

Our first step was to review the existing literature to identify strategies that had a high probability of promoting skill generalization. In addition, studies that presented precise individual and repeated measures of skill generalization were identified to begin the process of identifying parameters of performance that might be linked to the matching process.

The general procedures for the retrospective analysis of published data include the developing of a form for coding information about the studies, establishing coder reliability on the content and format of the coding form, reading and coding articles, entry of coded information in a computer, summarization of the data collected, and analysis. During the year, one to three research assistants worked with Dr. Norris Haring and Dr. Owen White on the Performance Pattern Studies. For more information on these studies, see White, O. R., Haring, N. G., and Miller, S. B. (1983).

Development of the coding form. A "Generalization Study Coding Form" was developed to standardize the review of each article and provide a system for categorizing and evaluating generalization data. The form is accompanied by a set of descriptors and instructions for its use.

The coding form has been systematically revised through several phases to improve its clarity and to ensure that the items addressed on the form are those which will be of most value for future research. Coders worked independently, with reliability checks taken at regular intervals. To date, coder reliabilities have

been maintained at a level of 80% or better. The results of the first year's review are summarized below.

Behaviors studied. Most behaviors studied fell into one of six major classifications: social, communication, vocational/prevocational, self-help/independent-living, cognitive/academic skills, and cognitive strategies. Somewhat surprisingly, 13% of the studies investigated general cognitive strategies, while only circa 10% of the studies investigated vocational or prevocational skills. The great majority (93%) of behaviors selected for study were perceived by both the original investigators and the reviewers as being of immediate functional utility to the subject. Training targets varied considerably in complexity, ranging from simple one-step behaviors to 180-step tasks; most contained fewer than ten subtasks.

General settings and conditions during initial training. Many studies involved initial training within public school settings (37%), but the most common training setting was a special laboratory or room (47%). Very few studies conducted initial training within the community or home (10% each). The majority of studies (77%) employed a member of the research staff to implement initial skill training programs. Only 10% of the studies employed the subject's regular teacher, therapist, or counselor during initial skill training, and only circa 7% employed the subject's parent or guardian.

Antecedents and consequences. A wide range of instructional cues and prompts were used during initial skill training. Only 23% of the cues and prompts could be considered specifically designed to promote a form of generalized response class. Moreover, most cues were "artificial," with only three studies employing a mixture of what might be considered "natural" and "artificial" cues, and only a single study employing what might be considered "all natural" cues.

Most studies employed some mixture of social consequation, correction procedures, and/or repeated trials during initial skill development. More studies used at least a mixture of natural and artificial consequences than was the case with cues or prompts, but only a single study used what might be considered "all natural" consequences during initial skill training.

Approximately two-thirds of the studies employed continuous schedules of consequation (i.e., 1:1) during some part of initial training. One third of the studies did eventually employ some

systematic method for adjusting or fading the frequency of consequation, but somewhat more studies employed fixed schedules of consequation rather than variable schedules. Finally, only one study attempted to base consequation (at least in part) on a temporal feature of the behavior. In that study the subject was allowed 10 seconds to respond before correction procedures were undertaken. It would seem, therefore, that fluency of response in most studies was not considered of sufficient concern to warrant contingencies which might explicitly facilitate its development.

Unlike the literature of a decade ago, the great majority (87%) of studies were able to teach all subjects the initial training task. It seems that skill acquisition is less of a problem than it once was, and that a focus on the development of procedures which facilitate generalization after initial skill acquisition is appropriate.

Generalization conditions and strategies. Virtually all of the training strategies identified by Stokes and Baer (1977) which might lead to generalization were represented in the studies reviewed. As found by Stokes and Baer, the most common "strategy" (actually, a lack of strategy) was the simple "train and hope" model. A somewhat greater proportion of the recent literature employed "loose training," "sufficient exemplars," and "natural maintaining contingencies" than Stokes and Baer observed, but no studies were reviewed that employed the use of "indiscriminable contingencies" and only two studies used procedures which involved specific contingencies designed to foster the development of skill variation/generalization per se. One additional strategy, not originally mentioned by Stokes and Baer, appears to have gained considerable popularity, "training in the natural environment." A few studies conducted comparative analyses of at least two strategies, but in virtually all of those studies the comparison was limited to "train and hope" versus a more formal procedure for promoting generalization. Very little information is available, therefore, concerning the relative efficacy of alternative strategies specifically designed to promote generalization.

Assessment data. Training data were provided in 87% of the studies reviewed, but in only six of the cases was it possible to identify precisely how many responses were made during each training session. The remaining studies reported data in "blocks of sessions" or as some computed statistic. Such summaries can seriously distort the actual nature of an acquisition curve and obviate meaningful analysis of its relationship to eventual skill

generalization. Finally, only two (7%) of the studies reported time-based data for initial training, obviating the possibility of evaluating the relationship between initial response fluency and eventual generalization. The lack of time-based data during initial training also limits the evaluation of changes in response characteristics during generalization probes.

In order to form a complete picture of the relationship between initial training and eventual skill generalization, systematic probes for generalization should probably occur before, during, and after each phase of skill training. Unfortunately, that was not always the case. Seven studies (23%) did not probe for skill generalization prior to the initiation of training. In most of those cases, baseline training probes (i.e., probes to determine pretraining level of performance in the training situation) indicated less than criterion performance, so one might assume that no satisfactory generalized responding would occur. However, UWRO's Billingsley, Berman, and Opalski (1983) discovered that many behaviors may indeed be performed at acceptable levels outside the "training" situation before criterion in the training situation is reached, so the lack of pretraining generalization probes may be quite serious.

Eight studies (27%) failed to probe for generalization after the termination of training. Such studies did probe for generalization at least once near or at the end of training, but would have no measure of "maintenance" of effect, even over very brief periods. Five studies (17%) probed for generalized responding only after training had been concluded. In those studies, no assurances are provided that generalized responding did not occur prior to training, nor is there any estimate of when generalized responding might first have occurred.

Experimental design. The demonstration that a particular procedure is capable of facilitating skill generalization does not necessarily further the development of a precise instructional technology. In order for such a technology to evolve, studies must be conducted which systematically analyze variations in approach in a manner which allows specific controlling variables to be identified. Unfortunately, most of the reviewed studies did not lend themselves to such analyses. Most studies merely compared a given approach with the "train and hope" paradigm, demonstrating at best that some directed attempt to facilitate generalization was better than no formal attempt. In those studies which did make some attempt to compare alternative strategies for the active promotion of generalization, the

"favored" strategy almost always followed an attempt to produce generalization with less favored strategies, raising the possibility of an intervention sequence confound. Overall, reviewers were of the opinion that only 13 (43%) of the studies provided information useful in systematically refining an instructional technology for promoting skill generalization with severely handicapped persons, and many of those studies still contained potentially serious experimental confounds. The remaining 17 (57%) of the studies may have provided an example of how one might facilitate skill generalization, but did not provide sufficient information to enable the scientist to refine hypotheses concerning controlling variables, or the practitioner to make an informed choice among viable instructional alternatives.

Studies in Self-Control

Typical instructional procedures for skill acquisition and fluency-building rely almost exclusively on a teacher or other trainer acting as the focal point. In almost every research and/or curriculum report, the handicapped person is seen as the one whose behavior is to be changed, rather than the individual who is to change her own behavior. This emphasis is evident when you consider that in most training programs:

(1) The behaviors to be changed are selected by others.
(2) The training materials and procedures are selected by others.
(3) The training procedures are implemented by others.
(4) Changes in behavior caused by training are monitored by others.
(5) Decisions about changes in training procedures are made by others.

Although this instruction has been effective in teaching specific skills, the collective effect of many years of such training may be to teach the handicapped individual total dependence on others for control in each situation. Generalized responding may fail to occur simply because the individual is waiting for someone to give step-by-step instructions in what to do.

Self-control procedures offer an alternative. In self-control training, individuals are taught how to use different techniques to direct their own behavior. It is easy to find examples of self-control techniques in everyday activities. One common self-

management procedure is self-monitoring, or counting the occurrence of one's own behavior. A person who says, "This is only my third cigarette today," is monitoring her own behavior. We've probably all heard someone say, "I'm getting fat, I'll skip dessert." Such individuals are not only monitoring their own behavior, but they are making a decision based on the information as well.

Another technique we use to manage ourselves is called self-instruction; directing the sequence of activities we are performing or are about to perform. People facing several different tasks or a particularly complicated task will often audibly list, to themselves, the sequence of things they are going to do. For example, "I'll start the water for the noodles, then I'll cut up the asparagus, then I'll put the noodles in, next start the asparagus, and hope that they are finished cooking at the same time." A third typical procedure is self-reinforcement, including selecting and delivering consequences for activities. For example, a person may reward himself with time to read the newspaper after he has washed the dishes.

While instances of these activities abound in our daily lives, until recently, little research in self-control has been reported. It is known that many people do not learn to use self-control skills without direct training in the skills. Research does show that self-control skills are usually just as effective as external-control procedures in changing behavior. Moreover, self-control may be better at facilitating maintenance and generalization, since the individual learns independence, rather than dependence.

Can we teach self-control skills to persons with severe handicaps? Only a few researchers have worked with handicapped individuals in teaching self-control skills, so this question has not yet been answered. We can develop empirical studies to determine if precise skills, such as pushing a button on a counter following task completion (i.e., self-monitoring), can be learned. We can also determine if other self-control activities help the person to change her own behavior and if they are effective in changing other behaviors in new settings. A second puzzle for research concerns the nature of the training. If the methods used to teach self-control skills rely on an external agent, will that method counteract the development of independent control? What other types of training can be used?

It is the purpose of research in this area to investigate whether or not severely handicapped people can be taught to use methods of self-control. If so, what are the best methods of training? And

if the self-control skills can be used by individuals to change their own behavior, do such skills improve generalization?

Design of Studies

The variables that will be investigated in these studies will include:

(1) the accuracy and fluency of the performance of the self-control skill,
(2) the length of time required for acquisition and fluency of the self-control skill,
(3) the instructional procedures used to teach self-control, and
(4) the effect of the self-control skill on the target behaviors (i.e., does the self-control skill facilitate generalization).

Although it is difficult to predict the course of future research, we will attempt to investigate each of the three primary self-control skills: self-monitoring, self-reinforcement, and self-instruction.

Three other self-control techniques will be integrated into the studies: self-determination of behaviors for change, self-determination of consequences, and self-determination of the ratio of behaviors to consequences. Subjects will be able to select consequences and behaviors to change in most instances, so that they can immediately begin participating in the behavior change process. Individuals who do not respond to questions (e.g., What would you like to work for? What will you do if you make a mistake? How many do you want to earn?) will be presented with a multiple choice situation via pictures, objects, or words during each training session.

Each study will include several different phases for the self-control behaviors as well as for the target behaviors (i.e., the ones we hope to change or affect by the self-control skill). Repeated measurement data will be collected on the self-control and target behaviors in training and nontraining settings. Data will be summarized and analyzed according to the accuracy and fluency of the response, and by changes in the individual's level and direction or trend of performance. Data will be collected in training and in nontraining settings, with the subjects' regular teachers and with persons unfamiliar to the subject.

Following the collection of baseline data, the subject will be taught to use a self-control skill by her teachers. The effect of the self-control skill on the target behavior will be measured: (a) to see if and how the performance of the target behavior in the training setting and with the teachers is affected; (b) to see if and how the performance of the target behavior outside of the training setting and/or with nontrainers is affected; and (c) to see if the self-control skill is generalized across settings and/or across behaviors. Opportunity to overtly apply the self-control behavior may then be withdrawn (e.g., by taking the counter away from the subject).

Expected Outcomes and Products

Since there are so few precedents for teaching self-control to severely handicapped students, it is difficult to predict the sequence and nature of the studies. Findings from one study will probably change the direction and methods of subsequent investigations. We will begin with only a few subjects. If results are encouraging, later studies will involve more subjects. If initial studies are successful, classroom teachers will be taught how to include self-control skills in their curricula. It is also possible that parents and others may participate.

Ideally, this research approach will yield information on which self-control skills can be taught and how to teach them to severely handicapped individuals. We hope that the product of UWRO's research in self-control will be a package of materials for trainers to use in teaching self-control skills to severely handicapped individuals in school, home, community, and vocational settings. Whatever the results, we expect that research in self-control will produce information vital to our understanding of and training for generalization.

Summary of First Year's Findings

The first year's self-control studies were designed to investigate questions relating to self-monitoring: if and how self-monitoring skills can be acquired by severely handicapped students, and the effect of self-monitoring on skills in training and generalization settings. Four studies were conducted by Dr. Kathleen Liberty; in two studies, extensive cooperation was provided by Mary Ann Paeth of Central School District 13J in Independence, Oregon. For more information on these studies, see Liberty, K. A. (1984), Liberty, K. A. & Paeth, M. A. (1983a, 1983b).

Self-Monitoring I: The acquisition of self-monitoring and its effect on the production rate of a severely handicapped adolescent. The purpose of the first study was to examine: (1) the acquisition of self-monitoring by a severely handicapped student through an avoidance training procedure and (2) the effects of self-monitoring on the target behavior.

The subject was 19 years and 5 months old (IQ of 35 and MA of 4 years, 6 months). During the training phases, the subject was taught to push the plunger of a counter placed on the table next to his work, using an avoidance training procedure. In the second training phase, the subject wore the counter on his wrist. In the last phase, a general contingency for tantrumming was introduced, and was in effect throughout the school day.

The avoidance training procedure produced rapid acceleration of independent use of the counter without the addition of specific reinforcement for self-monitoring. Very high levels of reliability were obtained without specific reinforcement for reliability, and without specific cues directed at pushing the counter only one time. However, since perfectly independent and reliable self-monitoring was not produced until indiscriminable contingencies were introduced, training in the use of a counter may be accelerated by providing reinforcement specifically for independent and reliable self-monitoring.

Data on the target behavior indicate that self-monitoring acted as a positive reinforcer sufficient to maintain performance of the target behavior. Thus, self-monitoring itself is reinforced by the counter and the act of self-monitoring functions as a self-controlled positive reinforcer for production. Overall, however, the changes in production during the course of the study are unlikely to have any practical impact on the subject, both because overall improvement did not move the subject significantly closer to a normal work rate, and because the work itself is not performed outside of classroom settings.

Self-Monitoring II: Maintenance and generalization of self-monitoring and its effect on two target behaviors. The purposes of this study were to: (1) examine the maintenance of self-monitoring skills; (2) determine if self-monitoring generalized within stimulus classes and across responses, and if so, the extent and nature of such generalization; and (3) examine the effect of self-monitoring on the target behaviors.

Self-monitoring maintained at high levels of reliability and independence. The data also provide a measure of the generalization

of self-monitoring across different stimulus conditions within the same class. When the stimulus materials were changed, reliable self-monitoring was established in one or two sessions. This level of maintenance and generalization may be interpreted as of practical value, since instruction time is "saved," but its ultimate value is questionable, since some level of avoidance prompting was required.

Independent and reliable self-monitoring did not transfer across behaviors. The subject did not actuate the counter when he had the opportunity to do so. In this study, the two behaviors were not of the same response class, and were performed under conditions (i.e., supervision, stimulus materials, setting, time of day) totally unlike one another. The failure to transfer presents a significant challenge to the training procedure used. In future studies, methods of changing the training procedure to enhance the probability of transfer will be examined.

When the self-monitoring avoidance prompting procedure was introduced for assembling sack lunches, a few prompts were sufficient to produce generalized counting of the next ten sacks at 100% reliability. However, avoidance prompting procedures were not sufficient to maintain counting throughout the period. It was only when a variable schedule of avoidance prompting was instituted that reliable and independent self-monitoring was maintained throughout the work period.

The most powerful effect on bagging was produced during the second phase, when the subject had the opportunity to self-monitor, although he was not observed to do so. Wearing the wrist counter produced an increase in rate that is of practical significance to the subject, whose median production rate increased to 67.5% of normal, and reached 114% of the normal rate on his best day.

Once the subject was trained to actually self-monitor, the highest production rates were associated with days of perfect reliability of the rated sacks, even though the self-monitoring added a movement to be completed. However, once the opportunity to self-monitor was removed from production, bagging rate dropped. This also suggests that self-monitoring mediated some of the differences between the settings. When the opportunity to self-monitor bagging was withdrawn, bagging began to decelerate.

Self-Monitoring III: Effects of self-monitoring training on expressive communication: Mediation across settings. The purpose of this study was to extend and replicate results of Self-Monitoring II, with different behaviors and with a different subject. Specific issues examined included:

1. the effects of wearing a wrist counter on two behaviors, one instructed and the other uninstructed, prior to any training in the use of a counter, and whether effects produced in the training setting would transfer to the probe setting;
2. the effects on the instructed and uninstructed behaviors of training self-monitoring of the instructed behavior, in both the training setting and the probe setting;
3. whether self-monitoring would transfer from the behavior on which it was trained (i.e., instructed behavior) to another behavior (i.e., uninstructed behavior); and
4. Whether self-monitoring would transfer from the setting in which it was trained to the probe setting.

The subject of this study was an 11 year-old girl, attending a special school for handicapped children. School records indicate that IQ testing had never yielded a valid score, but psychologists' estimates were of an IQ between 30 and 32.

Independent variables included an instructed response and an uninstructed response, measured in both a training setting and in a probe (i.e., generalization) setting. The instructed response (i.e., instructed in the training setting only) was two-word answers to questions. The uninstructed response was two-word initiations. Data were also collected on actuation of a wrist counter, and the independence and reliability of self-monitoring.

Despite acceleration of two-word answers in the training setting, generalization of the instructed response to the probe setting was low, and slightly decelerating during the phase, with a median level of 18%, and ending at 15%. Instruction in self-monitoring of two-word answers in the training setting produced rapid acceleration of independent self-monitoring.

Self-monitoring may not have affected any change in the instructed behavior in the training setting; however, the opportunity to wear the counter in the probe session resulted in an immediate and sustained change in the target behavior. The

median level of two-word answers in this phase is 43%, more than twice the level of generalization in the previous phase. The subject was observed to actuate the counter in the probe setting. When the opportunity to self-monitor in the probe setting was withdrawn, performance decelerated to an ending level of 19%, comparable to performance in the first baseline. In addition, when the subject was given the opportunity to wear the counter during the final probe setting session, performance was comparable to that of the previous phase. Both the instructed and uninstructed target behaviors generalized to three- and four-word utterances. However, such generalization did not occur in the probe setting until self-monitoring phases.

These results support and expand the conclusions of the earlier two studies. By itself, the wrist counter does not substantially affect responding. However, once training in use of the wrist counter is initiated, the counter itself is able to mediate the differences in consequation between settings. Although the level of generalization of two-word answers mediated by the counter is a substantial improvement over nonmediated responding, the level of generalization attained is likely to be insufficient to result in practical improvement for the subject. However, training self-monitoring does seem to be a simple and somewhat efficient way to mitigate differences in settings when skill transfer is desired.

Studies in Secondary/Post-Secondary Transition

Preparation of severely handicapped individuals for adult roles has, to this point, focused primarily on preparation for sheltered employment. While significant progress has been made in this area, especially in the acquisition of complex assembly tasks, options such as competitive employment and post-secondary vocational training have generally not been accessible to persons with severe handicaps. While these settings offer a more normal environment, the amount of individualized training and support available is limited. Therefore, it is critical that students receive adequate preparation before entering such vocational training and employment settings. The use of instructional strategies to enhance generalization can greatly increase the effectiveness of preparatory activities for post-secondary training and employment, and can also help to facilitate a smooth transition from secondary programs to post-secondary activities.

The purpose of this study is to investigate strategies which facilitate cross-setting generalization in the transition process to post-secondary settings. The specific strategies to be investigated are the fading of artificial and exaggerated cues, reinforcers, and contingencies.

Artificial and exaggerated prompts and cues have been established as powerful components of systematic instructional procedures in the education of severely handicapped students; unfortunately, research indicates that these artificial cues may become so strongly associated with the behavior that generalization of the behavior they direct is inhibited because such cues are not available in nontraining environments. Current information suggests that the elimination of such cues will enhance the probability of generalization and maintenance of behavioral gains produced in the training setting. Thus, cue-fading is recommended to teachers of severely handicapped students, but rules for determining precisely how to fade cues have not been discovered. Researchers have identified several techniques for fading such cues, either by reducing the topography of the cue, or by introducing a delay in cue delivery. Unfortunately, research in this area has resulted only in idiosyncratic applications of these procedures, which, of necessity, prohibit widespread application in training settings.

Similarly, typical training procedures often involve the use of reinforcers that are not "natural" for the behavior (e.g., reinforcing communication with food) and/or high fixed ratio contingencies of reinforcement (e.g., FI1, often called "one-to-one reinforcement"). Evidence indicates that such reinforcers and contingencies of reinforcement may inhibit generalization or provoke the failure of maintenance because they do not occur outside of training settings. Logically, then, an effective means of promoting generalization is to reduce contingencies in the training setting until they approximate those which occur in nontraining settings, and to change reinforcers until they are the equivalent of those available in natural nontraining settings (or in settings to which generalization is expected/desirable). As with cues, research to date has identified several methods of fading reinforcers (e.g., through a procedure known as pairing) and contingencies (e.g., through manipulation of the schedules of reinforcement). However, research has been directed at individual behaviors, which does not lend itself to the development of systematic strategies easily applicable in the majority of training settings.

This research will investigate specific strategies for guiding the fading of the typical cues, reinforcers, and contingencies used in standard instructional procedures which facilitate cross-setting generalization. Successful strategies will be those that promote generalization across a variety of settings, and that are applicable to a wide variety of behaviors as instructed in training settings.

Design of Intervention Studies

We plan to begin with an investigation of cue-fading, and proceed to investigations of simultaneously fading reinforcers and contingencies. If we are successful, we will be able to develop a set of guidelines for use by classroom teachers and other trainers that provides for the systematic elimination of three important barriers to generalization, and thus promotes the successful transition of individuals from training to home, community, and work environments.

Our first studies in this area will investigate one set of systematic strategies for cue-fading. Results of the study will contribute toward formulation of cue-fading rules which can be utilized by practitioners

The research will be conducted at a local, public school-operated vocational technical institute (VTI) in two types of settings: a "training setting," in which the experimental instructional strategy will be employed, and a "generalization setting," in which the subject will be observed to probe for generalization of the instructed behavior. The training setting will be the existing self-contained classroom for handicapped students at the VTI. The generalization setting will be the work environment of the student within the VTI (e.g., the cafeteria or the greenhouse) or at a community work experience placement.

Target behaviors for this investigation will meet the following criteria: (1) the behavior is not performed appropriately in the work setting or the performance of the behavior in the work setting needs to be improved, (2) the behavior can be instructed in the classroom setting, (3) performance aims (including time and quality performance criteria) can be identified, (4) the natural cues to which the student should respond in the generalization setting can be identified, and (5) the behavior can be measured in such a way that the data required by the research may be collected

The research design will consist of two phases: baseline and instruction. During baseline, the target behavior will be measured in the training and generalization setting. In the second phase, cue-fading strategies will be implemented in the training setting. As cues are faded in the instructional setting, probes of the generalization setting will be used to indicate the effect of the instructional procedure on the behavior in the generalization setting.

Future studies will utilize the same design with other students and other behaviors. Modified decision procedures for cue-fading will, in all likelihood, also be utilized.

Expected Results and Outcomes

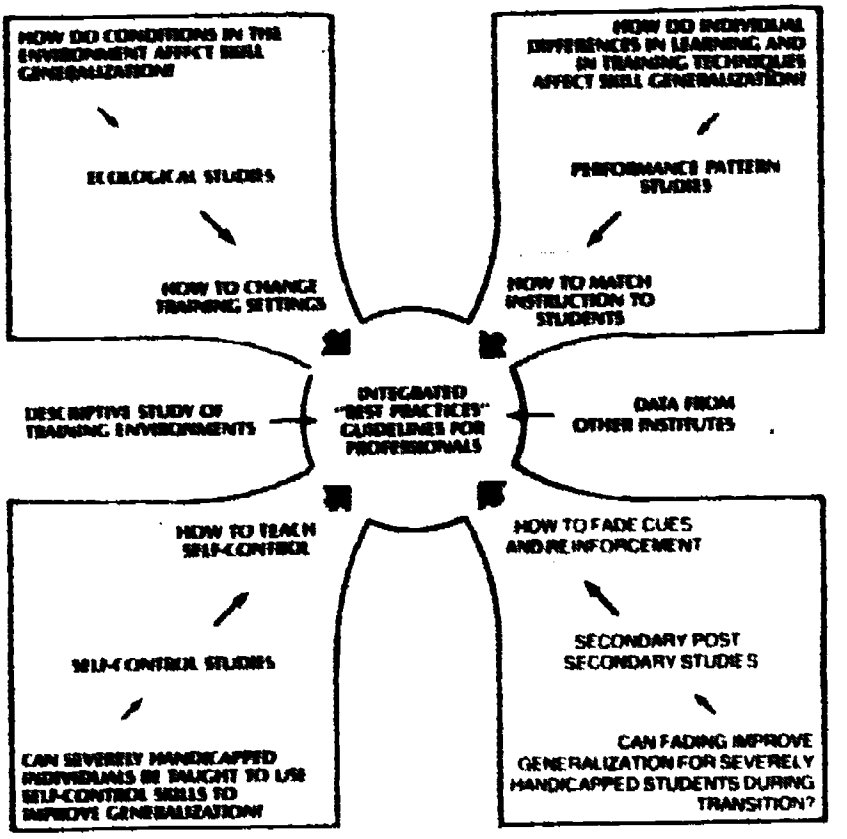
We hope to identify strategies for fading cues, reinforcers, and contingencies that will facilitate skill generalization across settings, thus promoting successful transition from school to work and community settings. If we are successful, we hope to "discover the rules" for practical methods that will allow teachers to utilize fading strategies in regular school environments. We will then be able to produce not only a series of research reports and publications, but also a manual for teachers to use in preparing their students for the transition from school.

FOUR

PUTTING IT ALL TOGETHER

Guidelines for identification and manipulation of a wide range of conditions within educational settings will result from the studies in the ecology of training settings. The performance pattern studies will contribute a set of guidelines specifically for instructional methods that educators can use to ensure generalization. Guidelines from the ecology studies will be directed at fairly global management of the instructional setting, while decision rules from the performance pattern studies will be directed at the selection of precise instructional methods used in individual programs.

UWRO Research Schematic



During the fourth project year, methods will be developed to combine the guidelines from the ecology and performance pattern studies with other empirical data, into an integrated set of "best practices for generalization." Such guidelines would probably establish a decision hierarchy for use at administrative, training setting, small group, and individual pupil levels. For example, a sequence of decisions might include:

(1) Determine what skills should be programmed for generalization.

(2) Determine the appropriate instructional settings (i.e., home, school, or community) for each skill.

(3) Determine the characteristics of the setting in which generalization is desired.
(4) Determine for each student the percentage of each school day to be spent in each setting, or how to integrate factors from the generalized setting into the training setting.
(5) Determine if instructional trials will be massed or distributed.
(6) Determine the specific instructional procedures for each student.

The guidelines that may result from the studies in self-control and secondary/post-secondary transition will affect the curricula of training settings by suggesting changes in the skills that are currently taught. Recommendations, such as the inclusion of self-monitoring in the curriculum, will be accompanied by precise directions as to whom to teach such skills and how such skills might be most effectively taught. It is expected that information on other curricular changes that affect generalization, produced by the work of other institutes, would be used to produce a set of integrated guidelines for curriculum content. If all conditions are ideal; perhaps the guidelines for curricula will be integrated with the guidelines for intervention in the setting and included as an aspect of the decision rules, producing a fully integrated single set of practices.

At this time it is difficult to predict the nature of the various guidelines to be developed or if the guidelines will fit together, since they must be based on empirical evidence that the strategies do, in fact, promote generalized responding. The Institute will be able to draw on the expertise of the Advisory Committee and the Direct Service Consortium in the development of guidelines. We will also have access to results from the other institutes. All of the information available will be integrated into the guidelines eventually produced. It is our hope that the four approaches will provide solutions converging into an integrated set of guidelines for users. The schematic, shown on page 54, illustrates how UWRO hopes to increase interaction and integration of the results as research proceeds, to the development of an integrated set of guidelines for practitioners.

The Washington Research Organization combines four different and complimentary conceptual approaches to the problem of skill generalization. We believe that pursuit of these four lines of inquiry represents a strategy with the highest probability of defining replacements for the "train and hope" methods on

which educators currently rely. Implementation of the concept of a free appropriate public education in the least restrictive environment for all students should not be undermined by ignorance. The contributions the Washington Research Organization makes to the development of a technology of skill generalization are contributions to the work of all who strive for the realization of our social commitment to an effective and lasting education for all severely handicapped individuals.

Cindy is apprehensive her first day on the job at the Pacific Oyster Bar. She failed so badly at the Seattle Hotel. She looks carefully at the dishwasher, and loads the bowls and cups. She closes the door. She searches and finds the buttons on the side of the machine. They are strange, but the little stickers just below them are just like the ones at school. She confidently pushes the series, and smiles when the dishwasher hums into action. At the end of the day, the kitchen supervisor says, "Good work today, Ms. Burchart." He smiles as Cindy gets her coat and leaves. Still smiling, he looks again at the little stickers the trainer from the Seattle Training Center had put on each of the dishwashers. He thinks, "Well, you learn something new every day."

Richard leaves the office of the head housekeeper. As he wheels himself toward the chain of pink cabins of the Sunset Motel, he repeats to himself, "Knock. Then say, 'Housekeeping here.' " Over and over he says these instructions, just as Mr. White taught him to do when he was teaching him to say his name and address, all those years ago. He is pleased that he can practice by himself. At Cabin 1 he stops, squares his shoulders, and knocks briskly. "Housekeeping here." He unlocks the door and goes in to earn his first wage.

Jody is screaming so loudly that his face is eggplant purple again. Mrs. Loomis smiles to herself, and walks out the door to join the rest of the family waiting in the car, leaving Jody's jacket on the floor where he threw it. She gets in the car. "Now where's Jody?" asks Mr. Loomis. "Just wait," she replies. In 30 seconds, Jody comes flying out the door, zipping his jacket. "Don't forget to shut the door," cries his mother. She thinks with satisfaction of Jody's teacher -- she was right, after all! Jody does know how to put on his jacket.

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