

1988 Eleanor Clarke Slagle Lecture

Occupational Therapy Knowledge: *From Practice to Theory*

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Theory building is requisite to the orderly production of knowledge in occupational therapy. Theory fosters both the development of articulated knowledge and the organization of knowledge for education and practice. This paper presents a point of view on theory development. I believe that the techniques used in occupational therapy practice are an important source for theory. Therefore, the focus of this paper is on technology and technological theory. Technology is a generic term, like science, used to include the whole of technical knowledge in a given practice profession. As used in this paper, technology includes both processes and products. Thus the technology of medicine includes processes such as surgery and products such as drugs.

Occupational therapy technology is our body of knowledge of assessment and intervention techniques. Occupational therapy practice includes a few technological products such as splints and adaptive equipment and many technological processes, such as activity group therapy, oral-motor treatment, and training in self-care.

The first topic of this paper is technology as one category of knowledge needed in occupational therapy practice. I will identify categories of professional knowledge and discuss the differences, characteristics, and uses of the various categories. This will allow further definition of technology and highlight its place in practice.

The second topic is the development of scientific technology. This will be discussed in the context of the development of knowledge and theory in general as well as in the context of the similarities and differences between science and technology.

The third part of the paper will focus on one specific area of occupational therapy technology, that of object manipulation, particularly in children with neurological disorders. I will present a history of the treatment of disorders of fine motor function in cerebral palsy and present some suggestions for the development of a technological theory.

Technology: A Category of Professional Knowledge

Categories of Professional Knowledge

There are many ways of categorizing the knowledge needed in professional practice. The one I have selected begins by classifying human knowledge into ordinary knowledge and specialized knowledge (Bunge, 1983a). Ordinary knowledge is knowledge that is generally accessible to everyone within a culture, it is what everybody knows. For the professional, I would also include knowledge gained in a liberal arts education, because this knowledge is accessible to everyone in higher education and is considered to be an essential foundation for professional education.

The second general category of human knowledge is specialized knowledge. Specialized knowledge is defined as knowledge one obtains because one seeks to enter a particular field or vocation (Bunge, 1983a). Specialized knowledge can also be divided into two broad areas. In occupational therapy, specialized knowledge can be divided into knowledge that is needed by health professionals and practitioners in general, and occupational therapy knowledge—knowledge that is peculiar to the practice of occupational therapy.

Generic health professional knowledge includes information about the administration of health programs, health policy, individuals, and social systems such as the family. Llorens (1984) identified such knowledge as that which is needed for occupational therapists to fill a broader role in health care.

Knowledge Specific to Occupational Therapy

For this discussion, I have identified three categories of occupational therapy knowledge: philosophy, technology, and science.

By philosophy, I mean our value system and the philosophical beliefs and assumptions that guide our practice. Our value system reflects our commitment to a holistic and humanistic practice. Our belief system includes our “commitment to the occupational nature of humans” (Kielhofner & Burke, 1983, p. 38) and to the importance of purposeful activity in recovery and adaptation. Generic frames of reference such as Occupational Behavior and the Model of Human Occupation “explain the overall philosophy of values and beliefs of occupational therapy” (Reed, 1984, p. 97).

Scientific knowledge, the knowledge on which we base our practice, includes knowledge from the founding sciences such as anatomy, physiology, and psychology that we have selected as relevant to our discipline as well as knowledge of the science of occupation, which we are in the process of developing.

Technology is the knowledge that tells us how to use purposeful activity to help our patients reach independent function. When we speak of occupational therapy practice we are often thinking of our technology. However, practice is based on more than technology. A practitioner must be knowledgeable in all the categories I have mentioned; he or she must possess knowledge common to health professionals, knowledge of professional values and beliefs, and scientific knowledge, as well as technology.

The classification I have presented was selected for two reasons: first, to allow me to stress the importance of each category of specialized knowledge; and second, as a basis for discussing differences between the various categories of knowledge.

Importance of Each Category of Professional Knowledge

I think we all agree that a therapist entering practice must have both knowledge specific to occupational therapy and knowledge of the health care systems in which our practice is set. I also think everyone agrees that sciences are an important foundation for practice, although we may not agree on what those sciences should be. However, I am not sure that we agree about the relative importance of philosophy and technology, and it appears to me that there is a lack of clarity about the role of each in guiding practice. Therefore, I will discuss these two categories in some detail.

Over the past 15 or more years many voices have been raised calling for a reaffirmation of the value of occupation in human well-being (e.g., Bing, 1981; Kielhofner & Burke, 1983; Reilly, 1962; West, 1984; Wiemer, 1979). I fully support the movement that called for the reestablishment of the philosophical principles on which occupational therapy was founded, making beliefs and assumptions about occupation central to occupational therapy practice. The efforts of scholars and writers have been successful and have resulted in the formal adoption of a philosophy by the American Occupational Therapy Association (1979, p. 785).

However, in my review of editorials and papers, I have found very little praise for the growth of occupational therapy technology, which to me appears to be phenomenal and a great source of professional pride. It is my impression that in their concern for the reestablishment of occupational therapy philosophy, writers have often—perhaps unintentionally—deemphasized or even disparaged technical knowledge.

Therefore, I wish to state my point of view: that occupational therapy technology is an essential part of our professional knowledge and is equal in importance to occupational therapy philosophy. Not more important, but as important. This is not a new concept (e.g., McGourty, 1986; Mosey, 1981, 1985; West, 1979), but it is one that deserves repeated emphasis. It has, perhaps, been most clearly stated in a paper published in 1983 by Tristram Engelhardt titled “Occupational Therapists as Technologists and Custodians of Meaning.” In this paper, Engelhardt stressed the importance of occupational therapy’s continual commitment to its original humanistic concerns for “the importance of patients as individuals and the significance of activity for health . . . including joy in performing physical tasks” (Engelhardt, 1983, p. 143). But Engelhardt also said that occupational therapists must be scientist-technologists, concerned with musculoskeletal, sensory motor, neurological, and intrapsychic states to help patients regain independent function. He states the following:

It must be recognized that there need be no competition between a technical or scientific account of therapy, human function, and habits, and accounts in the spirit of Adolf Meyer. These must instead be seen to be complementary, as integral to two distinct but inseparable elements of the profession of occupational therapy. (Engelhardt, 1983, p. 144)

Both philosophy and technology are essential to the practice of occupational therapy because they serve different functions in guiding practice. Our beliefs and values tell us what

we should do and technology tells us what we can do and how to do it (Bunge, 1983b, Vol. 7, p. 34). Our philosophical assumptions and humanistic values tell us about the meaning of occupation and our technology tells us about the application of occupation.

Why do I consider it important that we differentiate between categories of knowledge? After all, in practice all our specialized knowledge is used and intertwined in the daily decisions we make with our patients, and that is how it should be. I have, however, three reasons for highlighting the differences.

First, it is only by understanding that these are two separate domains of knowledge that we can place them in the proper perspective in practice and recognize that both philosophy and technology are essential to practice but that neither one can stand alone. If we rely too much on technical skills, treatment will be incomplete or inappropriate. If we rely too much on our philosophical assumptions, we may circumscribe practice and deny the patient the best treatment occupational therapy can offer.

Second, if students are to appreciate the importance of values and beliefs in practice professions, they must learn to differentiate philosophical concepts from technological concepts. Understanding the differences, they can learn how to ensure that their philosophy and technology are congruent and to use both in their clinical reasoning.

Third, this differentiation between philosophical frames of reference and technology has clarified for me some of the controversial issues in the profession and, perhaps, may help you to do so also.

Consider the controversy over specialization and the related issue of professional unity. Concern has been expressed that specialization fragments the profession (e.g., Gillette, 1967; Johnson, 1973; "Task force," 1974). The lack of a single unifying base has been held responsible for separate paths for clinical research and theory development and for a haphazard accumulation of knowledge and technique (Kielhofner & Burke, 1983, p. 43). The issue is resolved if we separate philosophy and technology. Gilfoyle suggested in her Slagle lecture that our professional unity lies in our philosophical heritage, that it is a system of values that potentially unites practice and practitioners (Gilfoyle, 1984).

In a discussion of the merits and pitfalls of specialization in occupational therapy, West (1979) wrote the following:

All occupational therapists should be *both* generalists *and* specialists. We are *generalists* through the common bond of our use of occupation in the sense of purposeful activity for the general therapeutic effects it has on dysfunction and making possible a more productive and satisfying life. We are *specialists* in the use of occupation, still in the sense of purposeful activity, but now also age-appropriate and problem-oriented for its therapeutic effects in meeting needs of the particular client group served. (p. 46)

The controversy disappears when we say "both . . . and." We need both generic occupational therapy as expressed in models that, as Reed (1984) has indicated, explain overall philosophy of values and beliefs. And we need specialty occupational therapy as expressed in technological models appropriate to specific disability areas and practice settings. I believe we should continue to foster specialization and to provide both advanced education and recognition for specialty practice. At the same time we should ensure through basic education and

professional dialogue that our fundamental values and beliefs permeate both our practice and the ways in which we communicate with those outside our profession.

One final difference between philosophy and technology: Our philosophical values and assumptions are enduring. Technology can, however, be expected to change. Science is constantly changing, and techniques grounded in science will also change.

Summary

In summary, I believe it is important that we give equal value to our assumptions and our techniques, but that we differentiate between the uses of philosophical knowledge and the uses of technical knowledge. We need to be unified in our fundamental assumptions, but diverse in our technical knowledge. We need to recognize that the characteristics of philosophical frames of reference and technical knowledge differ. Philosophical values are humanistic, holistic, generic, and relatively unchanging. Technical knowledge is pluralistic, relatively reductionist, diverse, and reflects changes that occur as a result of the evolution of science and theory. Understanding the differences should strengthen the place for each in our profession.

The Development of Scientific Technology

My discussion thus far has focused on the place of technology in occupational therapy practice. I now turn to a consideration of *scientific* technology and the ways in which it develops.

Scientific Technology

How does scientific technology differ from other technology? Occupational therapy, in common with other practice professions, includes a wide variety of treatment strategies that have been used successfully and handed down in practice, but that have not been validated through research. Such knowledge would be considered prescientific. Scientific technology is technology that has been shown to be successful through intervention research, that is, knowledge that has been tested by scientific methods (Bunge, 1983b, Vol. 7, p. 121).

Scientific technology differs from other technical knowledge in two ways. First, it must involve theory or general principles abstracted from knowledge of what works, and second, the principles must be shown to be successful in a high percentage of cases (Bunge, 1967b, Vol. 2, p. 128). There is no clear demarcation between scientific and prescientific technology. Rather, some technologies are more scientific than others.

All practice professions are a mix of scientific technology, technology based on cumulative experience, and the skilled observation and judgment of the practicing therapist. I think this will always be true for any profession dealing with the uncertain and unique nature of real-world problems. The goal of research is to increase the *proportion* of scientific technology in professional knowledge.

Technology and Science

Scientific technology differs from other technology, but it also differs from science. Those who write about technology make a clear differentiation between pure science, applied

science, and technology (e.g., Bunge, 1983b; Feibleman, 1983; Jarvie, 1983), and I find their definitions useful in considering scientific technology and technological theory.

Pure science and applied science are both knowledge-producing systems. They differ in that the aim of pure science is merely to discover and describe natural laws, whereas the aim of applied science is useful knowledge. Applied science is therefore a bridge between pure science and technology (Bunge, 1983b).

Technology uses the scientific method. However, technology is not science. Science is “know that”; technology is “know how.” Science tells us what is true and sometimes why technology is effective. Technology tells us what works in the world—what is effective (Jarvie, 1983). Scientific technology, then, differs from science in that although it uses the methods of science, its purpose and goals are not the same. It has been said that “whereas scientists, whether basic or applied, change things in order to know them, technologists study things in order to change them” (Bunge, 1983b, Vol. 7, p. 239).

How can we increase the scientific base for our technology? Central to the growth of scientific technology is the development of technological theory. It is instructive to first consider how scientific theory develops.

Approaches to Theory Development in Science

Two major approaches to the development of theory in science and applied science have been identified: the analytic method, which Reynolds (1971) has termed the “research then theory” method, and the synthetic method, which Reynolds calls the “theory then research” method. In actuality, elements of both analytic and synthetic approaches are needed in theory development. The differences lie in how one chooses to begin the process.

The analytic or “research first” approach begins with data. The process begins with the measurement and description of characteristics of small units or components of the phenomenon under study. The findings are then analyzed for the discovery of relationships between the components that have been identified. A conceptual pattern of the whole is built, and theoretical statements are developed from the patterns identified (Bunge, 1967a; Reynolds, 1971). Ayres’s early research appears to follow this pattern. Sensory perceptual deficits in learning-disabled children were selected for study, tests were developed, the data were subjected to factor analysis, and the patterns that were found were formalized into sensory integration theory (Henderson, Llorens, Gilfoyle, Myers, & Prevel, 1974).

The synthetic or “theory first” approach begins with the development of a holistic theoretical structure. From this structure, a hypothesis is derived and tested in research. Either the hypothesis is accepted and the theory is supported or it is rejected and the theory is changed. This approach is characterized by the development of theory from a model of practice such as the Model of Human Occupation (Kielhofner, 1985) or Occupational Behavior (Rogers, 1983).

Each of these approaches has its weaknesses. The analytic method fails when data gathering is scattered and unrelated to any whole, and when research goes no further than the study of components in isolation. On the other hand, starting with a grand synthetic view has often proven to be unscientific (Bunge, 1967a, Vol. 1, p. 30) because the theoretical

statements are too vague or general to be testable. Good theory development needs to be a process of both analysis and synthesis.

The “research then theory” strategy has characterized, and been the more successful in the development of, physical and biological sciences (Bunge, 1967a). Reynolds (1971), however, suggests that the “theory then research” strategy is more appropriate for the study of social phenomena because of their complexity. Since the study of occupation is grounded both in social science and in biological science, I would like to suggest that both approaches are needed in occupational therapy: the first to study phenomena resulting from biological disorders, and the second to study the meaning of occupation, or purposeful activity, in human existence.

Approaches to Theory Development in Technology

Technological theory differs from scientific theory. Scientific theory is designed to explain the world. Technological theory is made up of principles for action. Dickoff and his associates termed scientific theory as *situation relating*, or predictive, and technological theory as *situation producing*, or prescriptive (Dickoff, James, & Wiedenbach, 1968).

Although technological theory differs from scientific theory, approaches to their development are similar in some ways. A more synthetic approach would be to derive technological theory from scientific theory (e.g., Dickoff et al., 1968). A more analytic approach would be to abstract general principles from practical knowledge. The literature on technology suggests that technological theory develops both ways (Bunge, 1967b).

The derivation of technological theory from science is a theory-to-practice approach. The development of a science of occupation will yield knowledge from which technological theory can be derived. Practice models and philosophical frames of reference can be translated into a structure of theoretical statements that can generate testable hypotheses. These theory-to-practice approaches are important to the development of scientific knowledge in occupational therapy.

Technological theory is on firmer ground when it is based on scientific theory. Certainly, proposing a technological theory incongruent with known scientific knowledge would not be appropriate. However, although generating technological theory from science is ideal, it is often not practical. Scientific theory is seldom either pertinent or sufficiently developed to provide insights for needed action. Historically, many achievements in technology arose without science (Feibleman, 1983). For example, bridges were built before the physical sciences were developed. In my early practice, I made successful splints before the relevant neurophysiological and musculoskeletal knowledge was available to me. It is therefore most practical to approach theory development in more than one way.

The practice-to-theory approach would begin with the knowledge of what treatment strategies work. The knowledge of what works in practice settings would be enhanced if tested by intervention research. Research directed toward the validation of treatment strategies is directly useful to practice; however, I am suggesting that it can be more than that. I believe that such research can also provide the building blocks from which theory can be developed and tested.

I am not talking about grand theories encompassing the occupational therapy process, but rather of the building of small technological theories that will guide aspects of practice, that is, guide the use of specific techniques for specific disorders. For example, a small theory could be developed around the adaptation of habits, objects, or environment to make possible independence in self-care. I foresee that, as such theories are validated, relationships between theories will be discovered and more generic and parsimonious theory will be developed.

A third approach to theory building is somewhere between the approaches I have described. This approach begins with a discrete practice problem. The practitioner-theorist would go to the scientific literature to seek answers to the problem and develop a working theory from which treatment strategies would be derived. This is the approach that seems to be used the most and can be illustrated by an account of the development of a treatment approach.

Margaret Rood began with a practice problem, that of determining better ways of improving motor performance in children with cerebral palsy. Rood went to the scientific literature in neurophysiology and derived a rationale for a new technology, which she developed into practice-specific treatment techniques based upon that rationale. Such a treatment rationale provides a logical basis for intervention. However, Rood's approach, as well as the other neurophysiological approaches, falls short of being scientific because it has never been formally tested. Treatment rationales are seldom tested and are often not testable. To evolve into scientific technology, the rationale must be converted to sets of hypotheses, which are then systematically tested.

Summary

To summarize the second topic of this paper, let me say again that we have a wealth of time-tested technical knowledge in occupational therapy. The purpose of technological theory and research is to strengthen the scientific base of that knowledge. Three approaches to the development of technological theory are the theory-to-practice approach, the practice-to-theory approach, and an approach that combines the two. I believe that occupational therapy needs researchers following each of these approaches.

Object Manipulation in Cerebral Palsy

To illustrate the development of a specific technology and the ways in which its scientific base might be created, I present for your consideration techniques used to develop competency in the manipulation of objects by children with cerebral palsy.

It seems to me that it is particularly appropriate for occupational therapists to have the responsibility for the treatment of hand dysfunctions: first, because of our knowledge of the motor, perceptual, cognitive, and psychological components of hand use; and second, because hand function is basic to areas of occupation such as play and self-care. Moreover, hand dysfunction appears to me to be an area in which theory development has been

neglected. It is an area ripe for applied research, research which I believe occupational therapists can do better than anyone else.

A comprehensive technological theory of the treatment of disorders of the hand would include all the performance components; however, I am limiting this account to one segment of treatment, that of motor functions of the hand, in which I include reach and carry, grasp and release, bilateral hand use, finger use, tool use, and in-hand manipulation (Exner, 1987). These basic functions required for object manipulation may be selectively disturbed by biological dysfunction.

I will begin with the presentation of a brief history of the treatment of basic hand dysfunction in children with cerebral palsy. My historical review will focus primarily on textbooks and early journals. Textbooks can provide clues to changes in technology and to continuity and discontinuity in the development of a technology. The early journals provide insight into our philosophical heritage in the treatment of hand dysfunction. I found this heritage first in my study of the early use of activity in the treatment of physical disabilities.

Early History of Treatment of Physical Disabilities

Occupational therapy for the restoration of physical function has its roots in the days when the profession was founded. A major impetus came from the need for rehabilitation of soldiers disabled in World War I (Baldwin, 1919; Dunton, 1919). The use of activities as exercise for the restoration of hand function was developed by reconstruction aides during and following the war. Mock (1918) describes occupational therapy's role as restoring usefulness, overcoming deformities, and teaching new functions to compensate for lost abilities.

The early use of activity in the restoration of physical function demonstrated the advantages of occupation for psychological as well as physical purposes (Woodside, 1971). Therapists sought to find activities that both provided the needed exercise and stimulated interest (Faulkes, 1924). Time was a valuable asset to therapy as patients spent the large part of the day in the craft shops (Green, 1922). The importance of occupational therapy was in the dual advantages of active voluntary muscle action and the work psychology provided by the production of articles.

The Treatment of Children With Cerebral Palsy

The first mention of the treatment of physical dysfunction in children was by Susan Tracy. In her book *Invalid Occupations*, published in 1910, Tracy discussed the treatment of hand deformities at the Industrial School for Crippled Children in Boston. She notes that clay modeling had been found useful for deformed hands, but her emphasis was on giving "one hand lessons" and on adaptive equipment such as clamps and vises to "supply the assistance given by the less active hand" (Tracy, 1910, p. 67).

Articles on occupational therapy for the restoration or development of physical function in children began to appear regularly in the latter half of the 1920s. Most of the work in pediatrics was designed to meet the activity needs of hospitalized children (Smith, 1927; Tracy, 1910), but by the late 1920s, occupational therapists were being employed not only in hospitals, but in schools for crippled children (e.g., Paisley, 1929; Smith, 1927) and in programs

in curative workshops (Goodman, 1928; Graham, 1928). At this time, the treatment of cerebral palsy began to emerge, primarily for children with spastic hemiplegia (Graham, 1928; Paisley, 1929, 1930). The early emphasis was on correct hand posture and the stimulation of coordination in the use of the handicapped extremity by using toys, games, and craft activities. Treatment of cerebral palsy stressed voluntary effort, the importance of posture and postural support, and rhythm in activity (Paisley, 1931).

In 1937, bilateral activities such as bead stringing and rhythm toys were mentioned for the training of the spastic hand, as was the use of both hands in daily tasks of lifting objects, buttoning, tying, and typing (Johnson, 1937).

By 1940, cerebral palsy was clearly considered a specialization separate from orthopedics (Hurt, 1940). Different types of cerebral palsy were identified and differentially treated (Martin, 1939). The emphasis in treatment was now on training in self-care as well as on hand activities. Montessori boards were introduced for learning clothing fastenings, and techniques developed for feeding, hygiene, writing, and typing were described. Coordination of hand use was combined with self-care training. Primitive splinting and supported seating were introduced.

During the next two decades, the dual emphasis on fine motor skill and self-care skill continued and the technology expanded (Willard & Spackman, 1947, 1954). Practice was considered necessary for the acquisition of skill (Brunyate, 1949; James, 1951). This period saw, therefore, a development of adaptive equipment and toys both to facilitate self-care and to provide practice opportunities in the training of basic hand skills.

A major theoretical development was the identification of developmental factors in training in self-care and basic hand functions. The research of Gesell and his associates was used to chart normal development as a guide to treatment (Hadra, 1950a, 1950b). In 1957, Frantzen published a guide for the use of toys for the development of hand skills. The publication was based on a 3-year research study of 130 disabled children and 60 normal children. The development of skill was studied, and the arm and hand functions needed for the use of various toys were analyzed. The reported finding was that the order of the stages of development of hand functions was the same for the normal as for the disabled infants.

After this promising beginning, in the late 1950s the growth of technology for the treatment of motor functions of the hand virtually ceased. Textbooks continued to mention hand skills in cerebral palsy, but with decreased detail and emphasis (Willard & Spackman, 1963, 1971). Very few articles on hand skills were published in the 1960s and 1970s. We have no data on the degree to which therapists continued to incorporate manipulation skills in their cerebral palsy treatment repertoire, but it is probable that it was not universal or extensive. From personal experience, I know that treatment of hand functions was supplanted by perceptual training and gross motor activities in many clinical settings.

Factors Affecting the Treatment of Hand Functions in Cerebral Palsy

Why did the treatment of motor functions of the hand in children with cerebral palsy not continue? One reason for the discontinuation of a technology is that something has

happened to make it unnecessary or obsolete. However, the recent resurgence of attention to motor functions of the hand in cerebral palsy makes this unlikely. Rather, it seems that the hiatus in the growth of this technology resulted from development in other areas of professional practice.

One change that occurred was in the use of assessment tools. The early developmental checklists for evaluating self-care and reach, grasp, and prehension were replaced in many clinics by the more formal assessments of development such as the Denver or Bayley tests. These had the advantage of being standardized and of providing an overall developmental profile, but the items were less useful for the independent assessment of the motor components of hand function.

A second factor was the development of technologies that competed with the technology directed toward the development of competency in hand functions in cerebral palsy. Three of these technologies were the treatment of perceptual motor, gross motor, and oral-motor dysfunctions.

The recognition that perceptual deficits can have a large impact on fine motor skill in some children with cerebral palsy led to the expansion of treatment to include perceptual motor training. In time, the focus on the perceptual component of skill supplanted the technologies directed toward the motor component. In a similar way, the development of oral-motor therapy changed the focus in feeding from hand skills and tool use to control of the lips, tongue, and jaw.

However, the technology that had the greatest impact on the treatment of cerebral palsy was gross motor therapy. The extent of its impact is shown in articles and in textbooks in which the term *motor development* includes only the development of postural and locomotor functions. Gross motor therapy was more than a competing technology. The treatment rationales on which it was based worked against the continued treatment of hand skills. The major theoretical streams that emerged during this period were the neurophysiological treatment approaches of Rood, Bobath, and others. These treatment approaches not only emphasized the development of automatic postural responses, but suggested that hand use should not be encouraged (Bobath, 1964). It was thought that hand functions would emerge naturally or more readily as a result of the development of postural stability.

The rationales of the neurophysiological approaches to treatment were based on a scientific theory of the peripheral control of movement. Neurophysiological theories have undergone considerable modification since the 1960s, and the newer concepts of the central control of movement show concepts of peripheral control to be neither appropriate nor adequate to the understanding of the motor functions of the hand ("Central Control," 1971). Furthermore, the motor tracts of the central nervous system have been reclassified into medial and lateral systems; the medial system is thought to be responsible for postural functions, and the lateral system for fine finger function (Brinkman & Kuypers, 1972; Kuypers, 1982; Lawrence & Kuypers, 1968a, 1968b).

A second source of treatment rationale was the developmental postulate that proximal skill develops before distal skill (Ayres, 1954; Stockmeyer, 1967). However, several recent

research studies have failed to support this proximal-distal hypothesis (Fetters, Fernandez, & Cermak, 1988; Loria, 1978; Wilson, 1983).

I have cited these examples of treatment principles that were derived from science, and yet turned out to be wrong in respect to the hand, because of their negative impact on the development of technology for the improvement of object manipulation skills in cerebral palsy. However, I must point out that each of the competing technologies also had positive effects on practice with children with cerebral palsy.

In the last few years, attention has again been given to the object manipulation skills of children with cerebral palsy. Developmental hand dysfunction is being evaluated and treatment strategies are being designed (e.g., Boehme, 1988; Erhardt, 1982; Exner, in press; Peterson & Peterson, 1984). This can be the beginning of the development of a technological theory of competency in object manipulation in cerebral palsy. To foster this development, I suggest we do the following:

1. Describe and classify techniques currently used in practice for the development of object manipulation skills.
2. Conduct intervention research studies that compare different approaches to treatment of motor dysfunction in hand use.
3. Take the practice problem of object manipulation to science: to the neurophysiology of dual motor systems, to motor learning theory, and to the developmental psychology of motor skill.
4. Conduct research in normal and abnormal hand skill development and recovery of hand function, particularly beyond the first year of life.
5. Formulate and test general principles abstracted from the information gained. The theoretical statements should specify what works and with whom and under what conditions the procedures result in the expected outcomes.

Conclusion

I have used object manipulation as an example of a technology in occupational therapy. All areas of practice have an equal potential for theory development.

In the approach I have presented, it is the clinician who has the initial responsibility for theory development. Occupational therapy technology has its roots in the creativity of the individual practitioner who finds out what works or does not work in the real world of practice (Schön, 1983). The insightful, inventive practitioner uses his or her specialized knowledge together with skilled observation and clinical judgment to both evaluate and develop our technology.

However, something else is required of the clinician. The discovery of successful strategies must be communicated, and in writing, if it is to endure. Only then can the knowledge be used to build theory.

From the knowledge of the treatment strategies that clinicians have found to work, as well as from the findings of intervention research, the theorist can begin the process of developing, classifying, and abstracting general principles from the practice knowledge. From the

conceptual pattern that emerges, theoretical statements can be made and tested. That theory, as it evolves, will further guide practice.

In conclusion, we must take pride in our wealth of technology even as we strive to improve it. We must recognize the importance of theory in the growth of professional knowledge. We must see theory building as something we *can* do, and each of us must accept responsibility for our part in theory development. The broader the base of participation in this process, the greater the potential for the growth of knowledge in occupational therapy.

Acknowledgments

I wish to express my appreciation to the American Occupational Therapy Association and to my colleagues who supported my nomination for this award. My appreciation also goes to the faculty and staff of the Department of Occupational Therapy of Boston University–Sargent College of Allied Health Professions for their support in the preparation of this paper, with special thanks to Sharon Cermak for her time and effort on my behalf.

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