

AN ABSTRACT OF THE THESIS OF

Donald R. Ackley for the degree of Master of Science in  
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Title: The Effect of a Horticultural Therapy Program  
on Cerebral Palsied Children

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R. Lee Cole

Horticultural therapy is the use of plants and plant-related activities as an adjunct therapy assisting medical, psychological and other rehabilitative therapies in the improvement of physical and mental health. Although long associated with having a beneficial effect upon people characterized as mentally ill, mentally deficient, socially maladapted and physically disabled, horticultural therapy had never been documented as to the effectiveness of its therapeutic process. The purpose of this study was to research horticultural therapy and then design a series of horticultural exercises that would identify whether or not an adjunct horticultural therapy program had a statistically significant impact on the treatment subjects.

A literature review provided the theory and practice of horticultural therapy and identified cerebral palsied children as representative of those physical, mental and

social afflictions claimed to be responsive to horticultural therapy.

Forty-four institutionalized cerebral palsied children were divided into treatment and control groups and then pretested. The treatment group was subjected to a series of horticultural therapy exercises while the control group continued their normal agenda. The groups were posttested upon completion of the program and the scores were compared by an analysis of covariance statistical procedure. There was no significant difference between the performance of children who had been exposed to the horticultural therapy program and those children who had not. It was concluded that an adjunct horticultural therapy program taught by a volunteer teacher on a part-time basis was of limited value. It was recommended that a more extensive experiment evaluate a full-time professionally staffed horticultural therapy program.

The Effect of a Horticultural Therapy Program  
on Cerebral Palsied Children

by

Donald R. Ackley

A THESIS

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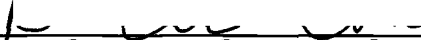
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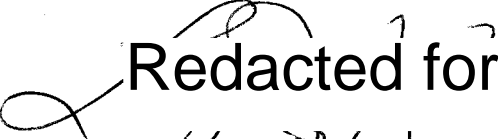
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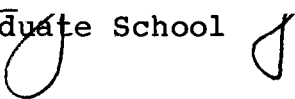
Redacted for privacy

  
\_\_\_\_\_  
Associate Professor of Agricultural Education  
in charge of major

Redacted for privacy

  
\_\_\_\_\_  
Head of Department of Vocational Education

Redacted for privacy

Dean of Graduate School 

Date thesis is presented August 13, 1985

Typed by Carol J. Sovers for Donald R. Ackley

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THE EFFECT OF A HORTICULTURAL THERAPY PROGRAM  
ON CEREBRAL PALSIED CHILDREN

I. INTRODUCTION AND LITERATURE REVIEW

Statement of the Problem

PLATITUDE--An idea (a) that is admitted to be true by everyone, and (b) that is not true. Henry Louis Mencken (McDaniel, 1976)

Horticultural therapy was recognized as a broad and general term referring to "plants and plant related activities to help people with problems" (Relf, 1980). A review of the literature revealed that horticultural activities have had a long history of association with normal functioning adults. As early as 1699, it was written that

Would men be ruled by me, I would advise them to spend their spare time in the garden, either in digging, setting out or weeding than which there is no better way to preserve their health--Leonard Meager (Griffiths, 1976)

This belief was extended to people with specific mental illnesses by 1798 (Hefley, 1973), social disabilities by



1890 (Flinn, 1980), mental deficiencies by 1900 (Griffiths, 1976) and physical disabilities by the end of World War I (Tereshkovich, 1973).

Despite this long and multi-faceted history, there had been little quantifiable research that would justify horticultural therapies' utilization as a legitimate "activity therapy" (Relf, 1980), as opposed to the common platitude that "growing things is good for you":

It is quite a problem that most magazine and newspaper articles say how great horticultural therapy is, and how wonderful it is, then give you only one or two anecdotes about something that's happened to change an individual. But we don't have data we can take to professionals and say we have substantiated that particular changes come about and how these changes happen, that you can anticipate this benefit from this type of activity. It is a direction we must go (Relf, 1980).

Morreau made a similar observation that horticultural therapy, despite its longevity, lacked documentation:

The philosophy underlying the field has endured for thousands of years, thereby standing the test of time. The specialized terminology has existed for approximately thirty years, and the pedagogy for teaching has been established for about ten years. What doesn't appear to be available is solid documentation as to the effectiveness of the therapeutic process (Morreau, 1979).

Morreau went on to attribute this problem to the following three factors:

1. Subjective terminology used to describe outcomes
2. An orientation towards broad group services

3. A number of stereotypes for disabled individuals. By "subjective terminology used to describe outcomes", Morreau was referring to terms often found in horticultural therapy literature such as increased "self-esteem", "self-satisfaction", and "self-confidence" or phrases such as "an increased sense of accomplishment" and "sense of usefulness". These terms and phrases could be construed in many ways because they were unmeasurable as stated. "All of these descriptions represent something; the question which must be answered if they are to be used is what? Professionals must define the behaviors and characteristics that represent these states" (Morreau, 1979).

"An orientation towards broad group services" was also characteristic of horticultural therapy readings. Much of the data utilized was portrayed as applicable to broad general groups like the deaf, the mentally retarded, and the physically disabled, ignoring the individual, his/her particular history, personality and uniqueness as well as the severity and identity of his/her affliction. Hence what little data was subjected to statistical analysis was limited in application. "Program development and evaluation must focus on individuals regardless of arbitrary categories to which they are assigned" (Morreau, 1979).

This criticism was also applicable to Morreau's third factor--the stereotyping of disabled individuals (and

designed programs based on that stereotype). As an example, a common stereotype of cerebral palsied persons was that they became frustrated when their body wouldn't do what they told it to. The frustration led to withdrawal and reluctance toward any further participation in the prepared program. Therefore, it was assumed, therapy programs should be designed within the current capabilities of participating cerebral palsied persons if we were to expect a satisfactory level of participation! This type of generalization ignored the individuality of the person who had cerebral palsy and also had a unique level of frustration and a particular way of dealing with it, which may or may not have included withdrawal. "The design of programs based on stereotypes will lead to inadequate results because of the many unique human beings who happen to have a particular handicapping condition" (Morreau, 1979).

In summary, horticultural therapy was an old and valued but undocumented therapy based on the platitude that "growing things is good for you". The term, undocumented, was used because previous studies had used inadequate, unquantifiable, subjective terminology to describe outcome and had designed their programs and experiments based on group generalities and stereotypes.

### Purpose of the Study

The purpose of this study was to identify whether or not an adjunct horticultural therapy program had a statistically significant impact on the treatment subjects. The study was also designed to meet Morreau's criticism of previous studies in the following ways:

1. Criticism: Subjective terminology used to describe outcomes.

Response: This study used scores from the American Association on Mental Deficiency (AAMD) Adaptive Behavior Scale--a standardized test with verified validity and reliability figures.

2. Criticism: An orientation towards broad group services at the expense of the individual.

Response: The horticultural therapy treatment was individualized by utilizing the results of the pretest to design the individual client's approach to horticultural activities.

3. Criticism: The stereotyping of disabled individuals in both designing and evaluating horticultural therapy programs.

Response: The treatment and control groups were composed of children afflicted by cerebral palsy--a condition characterized by such individuality in each particular incidence that broad generalizations would be rendered meaningless.

### Definitions

#### Adaptive Behavior

The effectiveness or degree with which the individual meets the standards of personal independence and social responsibility expected of his age and cultural group (Grossman, 1973).

#### American Association on Mental Deficiency (AAMD) Adaptive Behavior Scale for Children and Adults

A behavior rating scale developed by the American Association on Mental Deficiency for mentally retarded, emotionally maladjusted, and developmentally disabled individuals (Nihira, 1974). In the interests of brevity this study will refer to this test as the AAMD Adaptive Behavior Scale.

## Cerebral Palsy

A disorder dating from birth or early infancy, nonprogressive, characterized by examples of aberrations of motor function (paralysis, weakness, incoordination) and often other manifestations of organic brain damage such as sensory disorders, seizures, mental retardation, learning difficulty and behavioral disorders (Grossman, 1973).

## Children

Childhood is traditionally defined as that period of time during which a person grows from infancy to puberty. Angel View Crippled Children's Hospital, the host institution for this study, modified this definition in recognition of the delayed development often characterized by cerebral palsied children and provided care and therapy for school-aged children through the age of 21. This study will define children as any cerebral palsied individual participating in the therapeutic and residential program at Angel View Crippled Children's Hospital.

## Horticultural Therapy

The use of plants and plant-related activities as an adjunct therapy facilitating, assisting and supplementing other medical, psychological and sociological therapies

and rehabilitative practices in the improvement of physical and mental well-being.

### Limitations of the Study

1. The sample size confined the statistical analysis to Part I and Part II composite scores of the AAMD Adaptive Behavior Scale. The AAMD Adaptive Behavior Scale was constructed in such a manner that the multivariate nature of adaptive behavior was measured by 24 discretely scorable categories called domains. An individual statistical treatment of each domain would have helped to establish which facets of adaptive behavior were most affected by horticultural therapy. Domain scores, however, varied widely in the number of test items per each domain category and hence in the statistical power applicable to the analysis of covariance. A sample composed of 22 treatment and 22 control subjects required a test with 100 items to attain a statistical power of 0.80, the power level accepted for this research. The Part I and Part II AAMD Adaptive Behavior Scale composite scores contained 278 and 548 items respectively, therefore exceeding the number of questions required to meet the predetermined power level of this study.
2. The study sample was drawn from the population of a

single institution. During the course of the horticultural therapy program, the institution experienced a severe financial crisis, released a number of key personnel and cut back on a number of programs. The turnover for the primary subject caretakers (the aides) was also very high. Disruptive change, then, was a part of these children's routine at the time of the study.

3. The horticultural therapist was a volunteer teacher from the Agriculture Department at the College of the Desert, a local community college, and was not a staff member of the hosting institution. Therefore, the following problems were encountered.
  - a) The therapist did not have access to medical records which made exact client diagnosis and knowledge of medications administered difficult to ascertain with any degree of confidence.
  - b) The therapist was limited in the choice of test instrument to the one in use by the institution for its annual client evaluation (the AAMD Adaptive Behavior Scale).
  - c) The therapist was limited in knowledge regarding the kind and degree of other therapies applied to either the treatment or the control groups.
  - d) The therapist was limited to 6 hours of treatment per week with other institutional activities given



priority over horticultural therapy for the children participating in this study.

### Horticultural Therapy

There was no one, mutually agreed-upon, definition of horticultural therapy, although all definitions revolved around using plant materials and plant cultural practices to help people with various kinds of problems. A representative sample of definitions follow.

"Horticultural therapy" was used to refer to "rehabilitation through contact with nature" (Tereshkovich, 1973). "Horticultural therapy uses plants and gardening, greenhouse and florist skills as tools to develop a relationship with the client. The relationship will assist the client with problems of adjustment and encourage him to develop a broader interest in his surroundings" (Rothert and Daubert, 1981a).

"Horticultural therapy is concerned with manipulation of plants, not as an end in itself, but rather as a means of achieving specific benefits for people" (Lewis, 1979).

"The term horticultural therapy is used in a very broad and general way, as simply anything that uses plants and plant-related activities to help any people with problems" (Relf, 1980). It is important to note that practitioners

of horticultural therapy did not claim that it was a therapy that could stand alone:

The general purpose of horticultural therapy has been the improvement of physical and mental well-being. It has never been thought of as a distinct therapy or one that would supersede existing forms of therapy. It is merely one form of activity that has been used with others in the form of treatment or prevention of illness and for the improvement of mental and physical well-being (Watson, 1967).

Nor did they claim that horticultural activities possess any particular monopoly on the healing process:

Why use Horticulture? One of the things I want to emphasize is that I don't know any horticultural therapists who are out there saying that horticulture is the answer: if you'll use horticulture in your program you can change people, you can change the world and bring about all sorts of marvelous things (Relf, 1980).

Horticultural therapy, then was seen as a supplemental therapeutic and rehabilitation process, characterized by high popularity, but not so distinguished that it could stand alone as a singular therapeutic entity.

### Benefits of Horticultural Therapy

What, then, was the attractiveness of horticultural therapy? The answer was in a unique combination of practicality, economy, and adaptability in association with a host of general psychosocial benefits. Horticultural therapy was characterized by a broad

spectrum of activities ranging from flower centerpieces to the operation of completely working greenhouses. It was led by volunteers, university students in accredited horticultural therapy programs or nationally registered horticultural therapists. It was adaptive in that little equipment and materials were needed, it appealed to all ages, and its tasks ranged from simple observation to highly skilled plant breeding. It was economical in that staff, material and equipment requirements range from guest speakers to trained registered professionals, from donations to purchase of rare plant materials, and from milk cartons to glass greenhouses. In short, horticultural therapy was deemed applicable to any size budget, any facility, any patient and any degree of staff expertise! (Watson, 1967; Tereshkovich, 1973; Hefley, 1973; Griffiths, 1976; Rothert and Daubert, 1981a and 1981b).

In terms of general psychosocial benefits the list was long. According to Hefley, horticultural therapy supplied the following benefits:

#### Intellectual Benefits

1. Attainment of new skills
2. Improved vocabulary and communication skills
3. Aroused sense of curiosity
4. Increased powers of observation
5. Vocational and prevocational training
6. Stimulation of sensory perception

#### Social Benefits

1. Interaction within the group
2. Interaction outside the group

#### Emotional Growth

1. Improved confidence and self-esteem
2. Opportunities to relieve aggressive drives

- in a socially acceptable manner
3. Activities which promote interest and enthusiasm for the future
  4. Opportunities for the satisfaction of creative drives
- Physical Benefits
1. Development and improvement of basic motor skills
  2. Increased outdoor activities
- (Hefley, 1973).

The Chicago Horticultural Society listed similar benefits under the following subject headings:

The program options value--adaptability and economy  
 The physical value--stimulation, exercise and motivation  
 The psychological value--self-esteem, feedback, independence  
 The recreational/leisure value--stimulation, challenge, enjoyment  
 The environmental value--contact with nature  
 The community integration value--participation, exposure  
 The self-earning power value--monetary self-sufficiency  
 The public relations value--human interest value  
 (Rothert and Daubert, 1981a)

A sister publication lists similar benefits for mentally handicapped clients:

Developing feelings of self-esteem and usefulness  
 Using plants to develop specific skills  
 Using plants to stimulate socialization  
 Plants for increasing intellectual development  
 Plants as productive leisure activity  
 Horticulture as a vocational option  
 Plants and horticulture to help gain community acceptance  
 The value of plants in the environment  
 (Rothert and Daubert, 1981b).

In summary, while the practicalities of horticultural therapy were readily apparent, the discerning reader would

have noted that Morreau's criticisms of the psychosocial claims of horticultural therapy were valid--"All of their descriptions represent something; the question which must be answered if they are to be used is 'what'?" (Morreau, 1979). An examination of the theories behind horticultural therapy provided an explanation. There were two complementary theories which attempted to explain "the mechanisms by which horticultural activities bring about beneficial change" (Relf, 1981).

#### Theory of Horticultural Therapy-Kaplan

Rachel Kaplin, an environmental psychologist, published the results of an experiment which sought to explain why people participated in gardening and what benefits were reaped. In the process of setting up her experiment she hypothesized that:

There are intuitive grounds for expecting at least two distinct benefits from the gardening experience. One theme running through the anecdotal reports of the value of gardening and of the value of nature experiences in general is that of fascination. People describe themselves as fascinated by growing things, fascinated by wild animals and so on. Such feelings evoke memories of William James' descriptions of "involuntary attention". While voluntary attention requires effort and is difficult to sustain, involuntary attention is effortless. If nature in general and gardening in particular can lead to involuntary attention, this has several obvious benefits. First, it provides a rest from the effort otherwise required for attention. Second, since attention by definition excludes competing thoughts, a rest is provided from whatever worries or cares of the day might otherwise be uppermost in a person's mind. This hypothesized benefit

centering upon fascination is clearly distinct from the more prosaic but still powerful benefit of harvesting one's own food, of participating in a basic survival process (Kaplan, 1973).

Kaplan went on to devise a questionnaire/interview experiment that queried home gardeners, plot gardeners and community gardeners about "the benefits that people get from gardening, farming and other outdoor activities" (Kaplan, 1973). The results of her survey identified three categories of psychological benefits:

The Primary Garden Experience of being outside, watching things grow, working in the soil and learning about gardening.

The Sustained Interest Scale of diversions from the routine, aesthetic pleasures from plants, opportunities for relaxation, sense of accomplishment, valuable way to spend time and the ability to sustain interest.

The Tangible Benefits of the enjoyment of producing some of one's own food, of cutting food expenses and of harvesting (Kaplan, 1973).

The sustained interest or "fascination" aspect of gardening was rated highest by each group of gardeners. Furthermore, there was evidence of a "developmental variable" based on the gardener's choice of plant: vegetable or vegetables and flowers.

It would seem that people tend to begin gardening by growing vegetables and the tangible benefits are essential to that phase of gardening. The more experienced gardeners tend more to flowers. Thus fascination may have to be discovered; a novice gardener may not yet realize how he will react to the gardening process. Further, fascination may require a certain level of competence which, like

self-knowledge, takes time to acquire (Kaplan, 1973).

A horticultural therapy program then might be enhanced by designing the first phase of the program with "tangible benefits" to the client. Kaplan concludes by citing another work that also indicated properties that constitute a powerful source of fascination.

First, it calls on the basic informational processes that humans do so well and presumably care so deeply about. It not only permits, but actually invites recognition, prediction, control and evaluation (Kaplan, 1972).

It does this by both providing knowledge and requiring it. It is a setting that allows for order, but that order is deeply embedded in uncertainty and change. Thus it challenges the human information-processing capability, and to the extent that the challenge is met, both reward and more challenge are forthcoming. Second, it is a nature-based activity, and nature per se has been shown to be the object of preference to a striking degree (Kaplan, 1972).

Finally, both of their virtues, the informational and the natural, are in the garden setting concentrated and intensified. The garden is a miniature, a slice of nature compressed in space and a pattern of information compressed in time. Rarely is so broad a spectrum of nature and natural processes found in so little area. Rarely are so much nature-based action and so full a view of the life cycle so vividly visible and so rapidly completed (Kaplan, 1972).

### Theory of Horticultural Therapy-Relf

Diane Relf (1980, 1981) expanded on Kaplan's works and attempted to synthesize the mechanisms of horticultural therapy by dividing them into three categories:

a) Interaction, which is concerned with how people interact within the horticultural setting, b) Action, which is concerned with persons actively working with plants, and c) Reaction, which is concerned with peoples' response to passive involvement with plants (Relf, 1981).

### Interaction

In the first instance, interaction, there was evidence that horticultural activities facilitate communication by reducing tension and anxiety which in turn "enhances the patient's receptiveness to being approached by another person" (Stamm and Barber, 1978).

Relf cited two other studies which accounted for plants and plant-related activities being described as an ideal setting for communications atmosphere: the "peacefulness and tranquility" associated with gardening (Kaplan, 1973) and the "non-threatening and non-discriminatory" aspects of the plant world (Lewis, 1978).

Once a patient was approachable there were three types of interaction that may facilitate treatment: therapist-client, client-client, and client-nonclient. In the therapist-client domain, Relf cites Stamm and Barber's work with patients exhibiting severe emotional disturbances, and a long-standing fear of people. He reported that the:

...task orientation of horticultural therapy is ideal for such a patient, for it allows him to enter gently into a relationship with another person in a non-verbal way without the threat of



being confronted with interpersonal closeness too soon as may occur in a one-to-one verbal psychotherapy (Stamm and Barber, 1978).

Furthermore, many psychologically threatening topics such as "sex" and "death" were easily approached and discussed in botanical terms during the course of a horticultural project. "Encountering their topics in horticultural therapy may bring forth opportunities for discussions that can ultimately lead to communications and insights in the far more complex areas of human death and human sexuality" (Relf, 1981).

In the client-to-client domain Relf illustrated the work of Stamm and Barber (1978) and Corpus (1972) as evidence that "appropriate interaction between patients or clients can be an essential step towards their integration back into the community or certainly toward a fuller, more socially active life within an institution" (Relf, 1981).

Lastly, in the client-community domain the reports of McCandliss (1967) and the writings of Menninger (1957) are offered as examples of community works in which "patients picture themselves often for the first time as productive members of society" (Menninger, 1957).

#### Action: Working with Plants

Relf's second mechanism of horticultural therapy, Action, dealt with "...the specific functions and experiences that can be activated and rehabilitated by direct involvement with plants" (Relf, 1981).

Although Relf identified seven specific functions and experiences as helpful in rehabilitation, only four of these were well supported by other studies: 1) integration of biological and psychological factors, 2) responsibility, 3) intense concentration, and 4) the purely physical benefits of working with plants.

#### 1. Integration of biological and psychological factors

In this instance, Relf was concerned with the relationship of the newly acquired physical disability to the rest of the individual's personality. The biological disability often came to dominate the victim's personality, and was not integrated realistically. Bardach is cited as stating that "a physical activity that simultaneously deals with aspects of the disability itself, the emotional meaning of that disability, and the possibility that the consequences of that disability are not inevitably dire may foster integration of mind and body" (Bardach, 1975). Hence, the horticultural practice of staking or trellising plants may help a paraplegic come to terms with his/her need for supporting structures.

#### 2. Responsibility

Here the emphasis was on the feeling of responsibility and the dependency of the plant for care. Relf cited a study in which a group of elderly residents in a nursing home were either given full responsibility for their plants or had the care for the plant made the responsibility of staff members. "The first group showed

a significant improvement in alertness, active participation and a general sense of well-being" (Langer and Rodin, 1976).

### 3. Intense Concentration

Reference to Kaplan's study on the psychological benefits of gardening (Kaplan, 1973).

### 4. The Purely Physical

In this instance the physical movements involved in manipulating plants was cited by Relf as an excellent muscle toning exercise. Reference was made to the experiences of Hiott (1978) with a quadriplegic's transference of skills from potting plants to feeding himself.

### Reaction: Passive Experiences with Plants

In the last of Relf's triad of beneficial mechanisms, she focused on the hypothesis that "man has a basic psychological need for plants in the environment" (Iltis, 1974). This theory was supported by a number of observational studies in which patient, staff or employee responded to the introduction of plants into their immediate environment (Talbot, 1976; Lewis, 1978; Murphy, 1978; Laviana, 1981). This response was explained as an evolutionary development promoted by a survival advantage in the early history of human beings:

The idea that man has a specific response to plants due to the evolutionary development of perceptual system was put forth by Iltis. In discussing the co-evolution of color vision and fruit color, he theorizes that improved color

vision enhanced identification of colorful fruit as a source that increase dissemination of seeds of the more colorful food types. He goes on to theorize that as color vision improved, and as fruits evolved, there evolved in the mammal brain a pleasurable feeling at the sight of brilliant color. This was inducement to look for food. Gradually, in evolution the aesthetic feeling developed (Relf, 1981).

Rachel Kaplan reports that specific types of landscapes are predictably preferred by a wide range of individuals; these landscapes can be interpreted as having positive potential for providing information (Relf, 1981).

A previous study by Stephen Kaplan (1973) pointed out that the survival potential of certain natural landscapes was very high, thereby illustrating the early importance of plants in the environment for survival reasons.

Horticultural therapy, by virtue of providing a plant environment, improved a patient's sense of security and well-being by appealing to basic biological instincts.

In summary, Relf's explanation of the Interaction, Action, and Reaction mechanisms which characterized horticultural therapy drew together and summarized relevant research and theories into a coherent whole. This constituted a necessary but still incomplete response to Morreau's criticisms. What was needed was a representative horticultural therapy program predicated on these three principles and applied to a population characterized by a disability that would benefit from their application. Cerebral palsied individuals represented such a population.

## Cerebral Palsy

Cerebral palsy was identified as a non-progressive, neurological disorder usually caused by an oxygen deficiency at birth or shortly thereafter. The affliction was considered a particularly thorough test of horticultural therapy because of the individuality of the specific cases:

It is important to understand that the different types of cerebral palsy are often very complicated, and with severe and widespread brain damage a child may display more than one type of damage. No hard-and-fast rule may be applied to the description of any one case. All really need to be judged individually (Oswin, 1967).

Definitions of cerebral palsy emphasized the motor aspects of the disability and although all authors were quick to note the many accompanying complications, "difficulty in controlling certain muscles is the one common aspect all children with cerebral palsy share" (Marks, 1974). The definition used in this study was that adopted by the American Association on Mental Deficiency.

Although cerebral palsy had been characterized and often described in terms of motor impairments, it was identified as a central nervous system disorder and may have involved other areas of the brain as well:

Since the brain is the center not only of muscular control but also of intelligence,

behavior, personality, and many other functions, defects in the motor system are often combined with lesions in other parts of the brain. Mental (intellectual, emotional), perceptual (visual, auditory, association) and sensory (hearing, seeing, feeling) disturbances can co-exist (Marks, 1974).

Furthermore, the psychological and sociological ramifications of this disability on the developing child and his/her family could have resulted in a host of behavior disorders ranging from spitting, crying, and laziness, to giggling, disinhibition and extreme goodness (Oswin, 1967).

### Etiology

It is important to observe that interference with oxygenation of the brain is a common etiological role when considering the cerebral palsy child's total handicap (Marks, 1974).

This interference with oxygenation (anoxia) usually took place prenatally, perinatally or postnatally in the history of the cerebral palsied person. The temporary loss of oxygen resulted in lesions in the central nervous system proper where regeneration did not take place.

### Description and Classification

Cerebral palsy was usually described in terms of location and type of neuromuscular involvement. With respect to location the following terms were used:

Monoplegia--one extremity involved

Hemiplegia--one side of the body involved

Paraplegia--both legs involved

Triplesia--three extremities involved

Quadriplegia--four extremities involved

The type and incidence of neurological involvement was described by Allen and Jefferson (1962) as:

Spasticity-65%

Dyskinetic (Athetoid)-30%

Ataxic-2%

Flaccid-<2%

Mixed-<2%

The most common types of cerebral palsy were the Athetoids and the Spastics; a brief description follows:

Descriptively, the spastic is usually identified by stiffness, and the musculature motions of the extremities are made slowly and with great effort. And when attempts are made to bend the various joints, the opposing muscles contract, blocking the patients' efforts (Allen and Jefferson, 1962).

The Athetoid, unlike the spastic, moves his body even when he does not want to. The body and its extremities are usually in constant motion. The patient has difficulty in controlling and directing movements (Allen and Jefferson, 1962).

As an example, one subject was a mild spastic hemiplegic--he exhibited a marked stiffness in his left arm and leg. Another subject was a severe spastic quadriplegic--she had control of her neck and facial muscles only.

Cerebral palsy was also characterized by a number of other neurological disabilities which impeded both normal childhood development as well as therapeutic efforts.

They included the following:

Speech impairment--50%-75%

Mental Retardation--50%

Vision Defects--50%

Hearing Impairments--35%

Convulsive Disorders--35%

(Allen and Jefferson, 1962; Mysak, 1980)

Lastly, it was noted that cerebral palsy was a non-progressive affliction. Once the causal factor (anoxia) was removed, lesion-forming activity was halted. "Once it has occurred, the damage to the brain is circumscribed and stationary" (Marks, 1974). Developmental deformities, however, often resulted from muscle disuse, muscle spasms or contractures.

### Prognosis and Therapy

Cerebral palsy resulted from an incurable, non-progressive brain lesion. The damaged neurons of the central nervous system could not be regenerated by current medical techniques. Treatment was limited to compensation and adjustment through physical therapy, pharmacological and orthopedic management.



It was generally agreed that all such treatments were based on the concept of the brain as a sequentially developing organ. Cerebral palsy interrupted this sequence early in life:

The brain-injured child does not follow atypical roads to bizarre maturity; rather he becomes arrested along the road as his deficiencies become apparent (Denhoff and Robinault, 1960).

Hence, medical treatments, particularly those involving physical therapy were most effective when applied early in life.

This start (physical therapy) should be as early as possible, preferably while the child is still a baby, so that physiotherapy can have its maximum influence (Finnie, 1975).

Horticultural therapy, which was usually applied to school-aged children, as opposed to infants, toddlers and preschoolers, was not expected to exert its greatest influence as an adjunct to physical therapy. Although all the subjects in this experiment were subjected to a physical therapy program, the horticultural therapy program and the test instrument were designed to aid and measure psychological and sociological development.

#### Psychological and Social Development in Children With Cerebral Palsy

Children afflicted with such a crushing burden at the onset of life often exhibited various degrees of

psychological and sociological dysfunction in the course of their development. Hourcade and Parette (1984) cited numerous studies estimating the prevalence of emotional disturbance in cerebral palsied individuals from 48% to 80% compared to a study of 12,000 general population school-aged children with a psychiatric disorder rate of only 6.8% (Graham and Rutter, 1968). Hourcade and Parette (1984) went on to summarize three possible etiologic bases for "this consistently reported overrepresentation of emotional disturbances among individuals with cerebral palsy":

These include (a) direct effects of the inherent central nervous system pathology, (b) frustrations and other secondary problems growing out of the motoric handicap, and (c) an ecological model involving distorted parent-child interaction patterns (Hourcade and Parette, 1984).

Other studies lent individual support to a multivariable etiology: a crippling from birth (Block, 1955), institutionalization (Oswin, 1967), a lifelong disability (Batshaw and Perret, 1981), strained family relationships (Podeanu-Czehofsky, 1975), physical appearance (Richman and Harper, 1978), speech deficits (Anderson, 1982), mental retardation (Kirk, 1983), visual and hearing deficits (Lowenfeld, 1971; Wiley, 1971), and limited social interactional experience (Oswin, 1967). Taking into account this multiplicity of variables:

Freeman (1970) concluded that the concept of multiple causation of emotional disturbance for those with cerebral palsy is most practical, acknowledging the direct etiological effects of the central nervous system pathology, while also taking into account the impact that the disturbed and potentially maladaptive family interaction patterns may have.

(Hourcade and Parette, 1984)

Lastly, it was noted that although cerebral palsy had been associated with an array of psychosocial developmental problems and etiologies, there was no evidence of a specific cerebral palsy disability-related emotional syndrome (Schontz, 1975). Cerebral palsy remained as individual in its accompanying psychosocial dysfunction syndromes as it did in its pathology.

A horticultural therapy program that, in conjunction with other recognized therapies, identified, treated and significantly improved the sociological and psychological performance of individual cerebral palsied children above those improvements attained by the other recognized therapies alone would satisfy Relf's call for substantiating "that particular changes come about" (Relf, 1980) as well as Morreau's call for "solid documentation free of stereotypes, subjective terminology and an applicability limited to broad general groups at the expense of the individual" (Morreau, 1979).

## II. METHODOLOGY

The purpose of this research was to obtain information on the effect of an adjunct horticultural therapy program on cerebral palsied children as measured by the AAMD Adaptive Behavior Scale. A review of the literature indicated that this study would differ from previous research on horticultural therapy as previous studies relied upon personal anecdotes and case histories which did not provide quantifiable data from standardized tests.

### Identification of the Population

Cerebral palsied children were selected as the population for this study because a review of the literature revealed that such children were characterized by a wide variety of individual physical, mental, and sociological problems with varying degrees of intensity. Horticultural therapy had been traditionally applied as an adjunctive therapy to individuals exhibiting some degree of maladjustment, but the majority of reported cases were applicable to groups such as the mentally retarded or to very specific individual anecdotes. There were no published reports of horticultural therapy upon a

population exhibiting such a broad array of developmental handicaps as the cerebral palsied.

### Selection of the Sample

A survey of eastern Riverside County revealed that there was one institutional facility which provided living accommodations as well as several rehabilitative therapies for physically handicapped children: Angel View Crippled Children's Hospital of Desert Hot Springs, California. This institution was considered particularly attractive because horticultural therapy was defined as an adjunctive therapy to be used in conjunction with other more traditional therapies such as physical therapy, psychotherapy, speech therapy, group therapy, as well as other mainstreaming activities designed to enable the child to enter into and function as a normal member of society within the physical limits of his/her handicap.

There were 51 children in residence at Angel View during the experimental period. Two children were discharged and two were admitted during the treatment phase and were, therefore, excluded from the data analysis. Three children were identified as non-cerebral palsied clientele and were also excluded. Data were collected and analyzed on 44 children consisting of 29 males and 15

females with ages ranging from 6 years to 21 years of age with a mean age of 13.8 years.

The children were randomly assigned to treatment and control groups prior to the pretest according to a random assignment procedure described on pages 651 to 652 of the fourth edition of Educational Research, (Borg and Gall, 1983). The random assignment process resulted in 22 treatment subjects and 22 control subjects.

According to Cohen (1977), a statistical power of 0.80 was considered to have a high probability of correctly rejecting a false null hypothesis at the 0.05 level of significance on a nondirectional hypothesis test. In this study the instrument was composed of 2 composite scores of 278 and 548 items, and there were 22 subjects in each group. Utilizing the power analysis table presented by Cohen (1977) on page 377, this translated to a power level in excess of 0.90, which was beyond that required for this study.

### The Test Instrument

The first requirement of a test instrument for this research problem was that the test measure some observable, quantifiable aspect of behavior affected by horticultural therapy and cerebral palsy.

A second consideration was that the children in this study were all characterized by a diagnosis of cerebral palsy--a neuromuscular involvement presenting "difficult assessment problems" (Breslin, 1968).

The major difficulties exist with respect to the examination of those of moderate and severe neuromuscular involvements. In such cases, communication is a problem, both regarding the use of verbal responses by the subjects and, in some cases, regarding the sensory impairments of such cerebral palsied children. In some instances, these children are physically unable to speak and have difficulty in pointing. In addition to the problem of communication, there are those of the meaninglessness of the rigid time limits, the wide age range, the possible relatively higher fatigability as compared with nonhandicapped, the possible interference of more and greater emotional factors such as excessive dependence (Breslin, 1968).

These "assessment difficulties" had led many researchers to rely upon a type of test that interviewed a significant "other" person knowledgeable of the subjects' behavioral characteristics. This type of test would be administered equitably to cerebral palsied children regardless of the severity of their affliction because the child would not attend or participate in the assessment process. While this approach had the disadvantage of excluding the subjects from representing themselves, it did circumvent a serious problem affecting self-reporting measures: subjects who deliberately lied or distorted their answers were prevented from doing so. Borg and Gall (1983) had cited three response sets that resulted in atypical or fake answers: a) social desirability--the set to present

oneself in a favorable light, b) acquiescence--the set to respond true no matter what, and c) the set to respond deviantly. After considering the difficulty of administering a test equitably to children with such a wide-ranging degree of handicaps and that a real potential for irregular self-reported answers existed, it was decided to exclude the subjects from direct participation in the assessment procedure.

Further test requirements included acceptable reliability and validity test statistics, the desired statistical power, the number of children available to be tested and the ease of administration.

The staff at Angel View Crippled Children's Hospital was also required to annually test the children to evaluate their therapeutic programs in accordance with state regulation. Their staff had examined many testing instruments and had chosen a measure of adaptive behavior (see Definitions, page 6)--the AAMD Adaptive Behavior Scale For Children and Adults as the instrument which most closely fit the desired criteria of a cerebral palsy therapeutic evaluation measure. The staff requested that the AAMD Adaptive Behavior Scale be utilized for the task of evaluating a horticultural therapy program's effect on cerebral palsied children because horticultural therapy had claimed psychosocial benefits, and the test was already utilized in the evaluation of other ongoing therapies. Adopting the institution's testing instrument



would also avoid duplicate testing efforts and the potential for cross-contamination.

### The AAMD Adaptive Behavior Scale

The AAMD Adaptive Behavior Scale is a behavior rating scale for mentally retarded, emotionally maladjusted and developmentally disabled individuals, but can be used with other handicapped persons as well (Nihira, 1974).

Also described as a multipurpose instrument, the test was specifically recommended for the evaluation of the suitability of a client's curriculum or training program (Nihira, 1974). The test was to be administered to that person who spent the greatest number of waking hours with the individual in question, and could be completed without any special training by a semi-professional person involved in the care or therapy of handicapped individuals. Constructed to measure the two separate components of adaptive behavior, the Adaptive Behavior Scale was divided into two parts: Part I was a measure of ten behavior domains (coherent groups of related activities) considered important to the development of personal independence in daily living:

- I. INDEPENDENT FUNCTIONING
- II. PHYSICAL DEVELOPMENT
- III. ECONOMIC ACTIVITY
- IV. LANGUAGE DEVELOPMENT

- V. NUMBERS AND TIME
- VI. DOMESTIC ACTIVITY
- VII. VOCATIONAL ACTIVITY
- VIII. SELF-DIRECTION
- IX. RESPONSIBILITY
- X. SOCIALIZATION

(Nihira, 1974).

Part II was designed to measure maladaptive behavior domains related to personality and behavior disorders:

- I. VIOLENT AND DESTRUCTIVE BEHAVIOR
- II. ANTISOCIAL BEHAVIOR
- III. REBELLIOUS BEHAVIOR
- IV. UNTRUSTWORTHY BEHAVIOR
- V. WITHDRAWAL
- VI. STEREOTYPED BEHAVIOR AND ODD MANNERISMS
- VII. INAPPROPRIATE INTERPERSONAL MANNERS
- VIII. UNACCEPTABLE VOCAL HABITS
- IX. UNACCEPTABLE OR ECCENTRIC HABITS
- X. SELF-ABUSIVE BEHAVIOR
- XI. HYPERACTIVE TENDENCIES
- XII. SEXUALLY ABERRANT BEHAVIOR
- XIII. PSYCHOLOGICAL DISTURBANCES
- XIV. USE OF MEDICATIONS

(Nihira, 1974).

Each domain was composed of a series of subdomains which were in turn composed of a number of item observations. The party interviewed could fill out the scale item by item directly (first person assessment, or a type of interview could be utilized when multiple inputs were required or the party interviewed was considered insufficiently trained to administer the scale (third party assessment/interview method).

The item scores were summed to form subdomain scores which were, in turn, summed to form the completed domain score. Raw domain scores were then to be statistically analyzed or converted to national norm percentile scores and plotted on a profile summary sheet. In this study the pretest and post-test scores of the treatment and control groups were summed into four composite Part I and Part II scores and then subjected to an analysis of covariance statistical procedure.

### Reliability

The AAMD Adaptive Behavior Scale had been recently revised. Initial mean reliability on 4000 subjects was 0.74 Pearson product moment coefficient on Part I of the scale and 0.67 on Part II.

The AAMD Adaptive Behavior Scale manual (Nihira, 1974) cited a small reliability study of the new revision on 133 residents at three state training schools who were rated independently by ward personnel from different

shifts. Part I reliability ranged from 0.71 to 0.93 with a mean Part I reliability of 0.86. Portions of Part II data were limited in range and severely skewed and therefore dichotomized and estimated by a Phi coefficient. The range varied from 0.44 to 0.77 with a mean Part II reliability of 0.57, although the manual noted that the revision for Part II was of a minor nature and that the revision population differed in a number of ways from the original sample population, it therefore concluded that the revision reliability estimates were conservative (Nihira, 1974).

### Validity

The AAMD manual cited three practical validity studies that indicated placement and evaluative usages, but cautioned that concurrent validity must await further research (Nihira, 1974). A study by Roszkowski (1980) investigated the concurrent validity of the AAMD Adaptive Behavior Scale as assessed by the Vineland Social Maturity Scale--a measure of adaptive behavior similar to Part I of the AAMD Adaptive Behavior Scale--by revealing a high degree of correlation (0.79 Pearsons) between the Vineland and Part I of the AAMD Adaptive Behavior Scale (convergent validity) and a low degree of correlation (0.11 Pearsons) between the Vineland and Part II of the AAMD Adaptive Behavior Scale (discriminant validity).

### Method of Procedure

After Eastern Riverside County had been surveyed for an institution specializing in the care of cerebral palsied children, the administrator of Angel View Crippled Children's Hospital was contacted and a meeting was arranged during which the research proposal was explained. Upon his suggestion, an exploratory meeting with the professional staff of Angel View was proposed to explain the proposal and to elicit cooperation and suggestions. Staff response was enthusiastic, and the hospital donated financial support and materials for specially constructed raised-bed gardens accessible by wheelchair as well as potting soil, fertilizer and other accessories.

The children were divided into treatment and control groups by a random number procedure and then pretested by assigning a specialist in psychological assessment to guide the children's personal aides through the AAMD Adaptive Behavior Scale--first person assessment. Neither the children nor the aides knew that the children were involved in an experiment, and the supervising testing specialist did not know which children were treatment subjects and which ones were control subjects.

Upon the completion of the testing process, the pretests were scored and utilized in the design of a horticultural therapy program to be applied to the

treatment group. The treatment children were scheduled for twenty gardening sessions of three hours and fifteen minutes duration twice weekly over a ten-week period. The control group children continued their normal routine during the scheduled horticultural therapy period. Both groups of children continued their individual therapeutic programs.

Upon completion of the horticultural therapy program, the children's aides retested the subjects with the AAMD Adaptive Behavior Scale in a first person assessment procedure similar to that utilized in the pretest, including the availability of a supervisor. The post-tests were scored and the data analyzed.

### The Horticultural Therapy Program

The horticultural therapy program was designed to meet the following criteria: a) to provide exercises representative of the horticultural therapy programs described in the Review of the Literature and specifically those exercises prescribed to aid in psychosocial development, b) to be representative of Kaplan's and Relf's theories of the mechanisms of horticultural therapy, c) to provide these exercises in a manner that recognized and compensated for the degree and severity of the individual's cerebral palsy syndrome, and d) to

accompany the application of other therapies. The first five exercises and their application to criteria a) and b) were detailed as follows:

Session 1: Vegetable Orientation--the identification, examination, taste and sales potential of vegetables (Kaplan's "developmental variable" and "tangible benefits", the Chicago Horticultural Societies' self-earning power value").

Session 2: Mixing Potting Soil--the demonstration of the water-holding capacity of sand vs. potting soil, the demonstration of mixing vermiculite, peat moss and sand, and the assignment of each child to one portion of a soil-mixing production line to form a community pool of potting soil (Kaplan's "informational processing", Relf's interaction "between therapist and client" and "between patients", Hefley's "interaction within the group", and the Chicago Horticultural Societies' "using plants to stimulate socialization").

- Session 3: Seeding Transplant Vegetables--demonstration of freezer-damaged seedlings and the need to anticipate frost damage and plan ahead, hand planting and the importance of seed depth (Relf's "action-being responsible", Hefley's "aroused sense of curiosity" and "increased powers of observation").
- Session 4: Irrigation System Construction--the communal assembly of a pvc mini-sprinkler system for the raised bed plots and the assignment of each child to a watering schedule (Relf's "interaction between patients/therapist" and "action-being responsible/intense concentration", Kaplan's "sustained interest" and the Chicago Horticultural Societies' "developing feelings of self-esteem and usefulness").
- Session 5: Planting Flower Seeds for a Future Gift--a child's choice of three types of flowers from a wide selection of flower seeds to create a bouquet for mother or a primary



caretaker on Mother's Day (Hefley's "activities which promote interest and enthusiasm for the future", "opportunities for the satisfaction of creative drives", and "interaction outside the group", the Chicago Horticultural Societies' "developing feelings of self-esteem and usefulness" and "using plants as a productive leisure activity" and Relf's "interaction between the client and the rest of the world" and "reaction-sense of aesthetics").

The remaining exercises also consisted of tasks representative of the theory and practice of horticultural therapy and were listed by title in the interest of brevity:

- Session 6: Planting Seeds (Spacing Requirements)
- Session 7: Planting Tiny Herb Seeds
- Session 8: Fertilization of Raised Bed Plots
- Session 9: Planting Beans to Climb Corn
- Session 10: Bulb Planting
- Session 11: Planting Radishes on Shallow Soil
- Session 12: Tip Cuttings for Personal Houseplant
- Session 13: Melon Plot Preparation: Digging the

	Site
Session 14:	Melon Plot Preparation: Manuring
Session 15:	Melon Plot Preparation: Drip Irrigation
Session 16:	Houseplant Growth Center Construction
Session 17:	Houseplant Growth Center Operation
Session 18:	Sidedressing Fertilizer
Session 19:	Transplanting Out
Session 20:	Summer Assignments and Vegetable Auction Preparation

The criterion for individualized treatment was based upon the subject's physical disability and psychosocial development by examining the pretest results and consulting with the professional house staff in an attempt to rank and group subjects in order of degree of physical handicap and/or psychosocial dysfunction and then applying treatments to these individuals on a therapist-subject sliding scale, exposed time basis. There were 3 low functioning individuals who were treated on a one subject-one therapist basis for a 20-minute session per treatment. There were 7 high functioning subjects who were grouped together and treated on a one group-one therapist basis for a 45-minute session per treatment and 12 intermediate subjects divided into three groups and treated on a four subjects-one therapist basis for a 30-minute session per treatment. The groups were

addressed and demonstrated to as a whole and then individually assisted according to their disability and the task assigned. The individually treated subjects were physically assisted and personally tutored in the specifics of the assigned task. In all therapeutic sessions the task and its association to daily life was discussed informally in an attempt to establish therapist-client rapport. The children were also encouraged to play in and around their gardens in the absence of the horticultural therapist by assigning specific assignments such as watering or houseplant care and by providing easy access to the garden area and houseplant station.

Lastly, in accordance with the definition of horticultural therapy as an adjunct therapy, both the treatment and control group children were subjected to their prescribed Angel View therapeutic program of speech therapy, physical therapy, occupational therapy, medical therapy, and psychological counseling (individual and group therapy) as well as the public school curriculum for exceptional children. The details and results of these programs were unavailable to the horticultural therapist in accordance with state law and institutional policy.

### Study Hypothesis

Null Hypothesis I. There will be no significant difference between the mean composite AAMD Adaptive Behavior Scale-Part I posttest scores for the treatment and control groups.  $H_0: \bar{X}_{tmt} = \bar{X}_{ct}$

Alternative Hypothesis I. There will be a significant difference between the mean composite AAMD Adaptive Behavior Scale-Part I posttest scores for the treatment and control groups.  $H_1: \bar{X}_{tmt} \neq \bar{X}_{ct}$

Null Hypothesis II. There will be no significant difference between the mean composite AAMD Adaptive Behavior Scale-Part II posttest scores for the treatment and control groups.  $H_0: \bar{X}_{tmt} = \bar{X}_{ct}$

Alternative Hypothesis II. There will be a significant difference between the mean composite AAMD Adaptive Behavior Scale-Part II posttest scores for the treatment and control groups.  $H_1: \bar{X}_{tmt} \neq \bar{X}_{ct}$

### Method of Analysis

Arndt (1981) had published a study in which a factor analysis had been used to determine whether multiple

domain scores offered a more detailed view of adaptive behavior than did a simple summing of the Part I and Part II domain scores. The summed scores accounted for over 90% of the multiple domain score variance leading to the conclusion that adaptive and maladaptive behavior be measured using Part I and Part II summed scores.

Therefore, in this study the Part I and Part II domain scores of the AAMD Adaptive Behavior Scale were summed to form two composite scores for statistical analysis.

The underlying assumption of a statistical comparison of the two sample posttest mean scores required that the two sample groups were essentially equal. If the treatment and control groups differed in some independent variable prior to the treatment, that difference may have resulted in a statistically significant difference between the treatment and control group posttest scores that did not exist (type I error). The two randomly assigned groups of cerebral palsied children in this experiment would have been very unlikely to be equal considering the individuality of the syndrome and therefore the data generated required a statistical correction for such differences. An analysis of covariance procedure was a type of multiple regression analysis that compared the treatment means of the posttest using the pretest scores as a covariate. This procedure adjusted the posttest means and compensated for any pretest inequities (Borg and Gall, 1983). An F test was used to determine whether or

not these adjusted mean scores were significantly different from one another. For the purposes of this study an analysis of covariance was the statistical procedure applied.

## III. FINDINGS AND DISCUSSION

Findings

Upon completion of the scoring procedure, the pretest and the posttest composite scores were then keypunched into datacards for analysis by the Oregon State University CDC Cyber 170 mainframe computer's Statistical Package for the Social Sciences.

The first analysis to be carried out was a comparison of treatment and control group regression lines to verify the assumption of parallel slopes prerequisite to an analysis of covariance. If the regression lines of the treatment and control groups were not parallel, then a treatment-slope interaction was indicated and the treatment could not be assumed to have an equal effect across all subjects. A direct comparison of means through an analysis of covariance under these circumstances would not be appropriate. The regression equations for the Part I composite scores were:

$$\text{Control: POSTTEST COMPOSITE} = 4.71 + 1.02 \text{ PRETEST COMPOSITE}$$

$$\text{Treat: POSTTEST COMPOSITE} = 19.04 + 0.93 \text{ PRETEST COMPOSITE}$$

The regression equations satisfied the assumption of parallelism as shown on FIGURE 1.



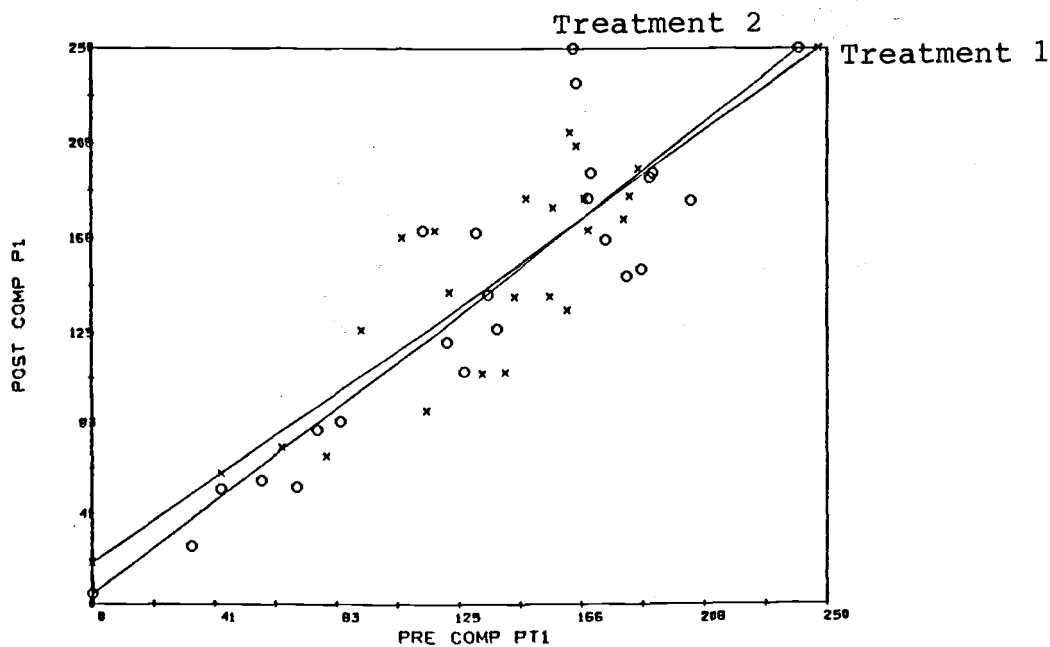


FIGURE 1. Parallel Slopes of the Part I  
Pretest-Posttest Regression Equations  
for the Treatment and Control Groups

The Part II regression equations differed substantially in slope as shown on FIGURE 2 and the potential for treatment-slope interaction indicated that an analysis of covariance would be inappropriate:

$$\text{Control: POSTTEST COMPOSITE} = 2.15 + 0.98 \text{ PRETEST COMPOSITE}$$

$$\text{Treat: POSTTEST COMPOSITE} = 16.74 + 0.29 \text{ PRETEST COMPOSITE}$$

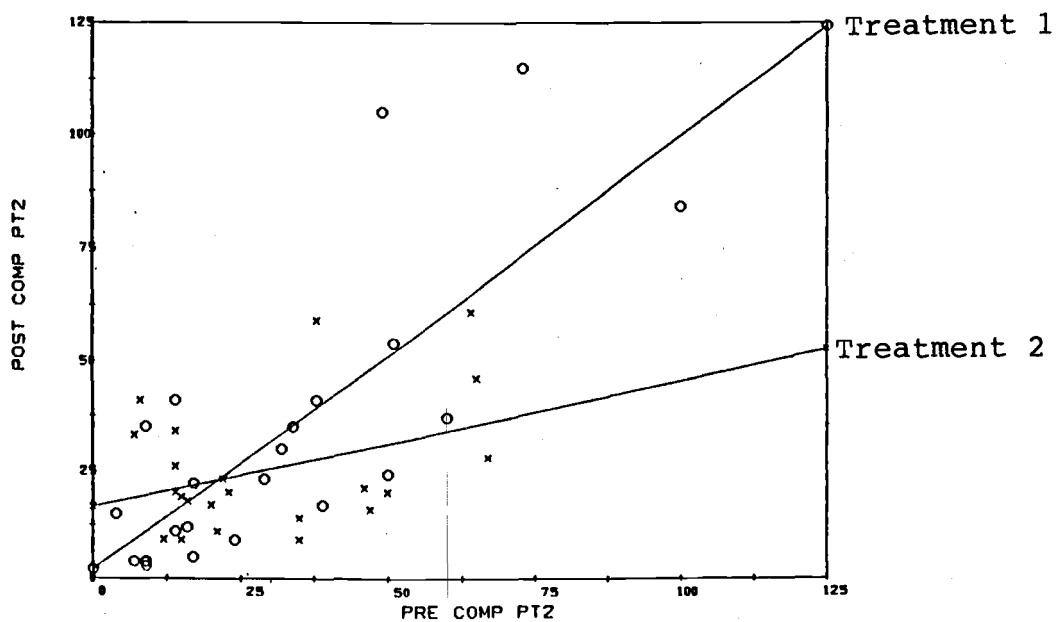


FIGURE 2. Nonparallel Slopes of the Part II  
Pretest-Posttest Regression Equations  
for the Treatment and Control Groups

Therefore, the analysis of covariance was not used on the Part II composite scores and null hypothesis II could not be meaningfully tested.

The analysis of covariance procedure was applied to the Part I AAMD Adaptive Behavior Scale and adjusted the posttest means as shown on TABLE 1:

TABLE 1: Adjustment of Posttest Means  
Based on Covariance Procedure Pretest Results

GROUP	RAW MEAN	ADJUSTED MEAN
	POSTTEST SCORE	POSTTEST SCORE
Control	140.68	142.16
Treatment	146.36	144.88

The analysis of covariance summary indicated that there was no significant difference between the treatment and control groups as shown on TABLE 2:

TABLE 2: Analysis of Covariance Summary for Part I

SOURCE	SUM OF	DF	MEAN	F	PROBABILITY
	SQUARES		SQUARE		
Covariate	87853.164	1	87853.164	98.520	0.001
Treatment	80.893	1	80.893	0.091	0.765
Explained	87934.056	2	43967.028	49.305	0.001
Residual	36560.921	41	891.730		
TOTAL	124494.977	43	2895.232		

The Covariate entry shows the relationship between the pretest and posttest scores and resulted in an F value of 98.52 which was significant at the 0.001 probability level, thus indicating that the pretest scores are

accounting for much of the significant variability ( $R_2 = 0.706$ ).

The Treatment entry shows the statistical difference between the group posttest means after the effect of the pretest scores was removed statistically and, therefore, reflects the amount of variance in the group posttest scores that we can attribute to the difference between treatment and control groups. The nonsignificant F probability of 0.765 indicates that since the study accepted the 0.05 probability level as the measure of statistical significance, null hypothesis I was retained.

### Discussion

The result of the analysis of covariance procedure on Part I of the AAMD Adaptive Behavior Scale composite scores confirmed the null hypothesis that there would be no significant difference between the mean composite scores of the treatment and control groups.

The failure of the Part II portion of the AAMD Adaptive Behavior Scale to meet the analysis of covariance assumption of parallelism was possibly a result of the test reliability figures cited in the AAMD Adaptive Behavior Scale test manual (Nihira, 1974) for Part II of 0.67 and 0.57. Other studies have indicated the need for further refinements of the Part II portion of the AAMD

Adaptive Behavior Scale (McDevitt, 1977; Isett, 1979; Roszkowski, 1980) and have cautioned against its full utilization.

## IV. SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

Summary of Findings

A group of test and control subjects with cerebral palsy was randomly selected from a medical residential institution specializing in the care and rehabilitation of crippled children. A pretest measure of adaptive behavior, the AAMD Adaptive Behavior Scale, was administered. The treatment group was exposed to an adjunct horticultural therapy program. A control group received no horticultural therapy and continued their normal therapeutic program. Both groups were posttested using the AAMD Adaptive Behavior Scale. Composite pretest and posttest scores for Part I and Part II of the AAMD Adaptive Behavior Scale were tabulated and the treatment and control group posttest composite scores were statistically analyzed for significant differences using an analysis of covariance procedure to compensate for pretest score inequities.

Part I AAMD Adaptive Behavior Scale scores showed no significant difference between the mean posttest scores of the treatment and control groups after adjusting for the covariate.

Part II AAMD Adaptive Behavior Scores were disqualified from the analysis for failing to meet the

assumption of parallelism, which must be met in order to use the analysis of covariance procedure.

### Conclusion

The adjunct horticultural therapy program designed and administered in this study had no measurable effect on the treatment children which was distinguishable from the normal ongoing activities of the control group children at Angel View Crippled Children's Hospital as measured by the AAMD Adaptive Behavior Scale-Part I.

### Implications

The results of this study indicate that a horticultural therapy program which is adjunct in nature, of short duration and applied by a volunteer teacher on a part-time basis cannot be expected to make a significant improvement in the AAMD Adaptive Behavior Scale performance of cerebral palsied children. Horticultural therapy programs as time fillers may be a waste of instructor time, finances and resources if they are faced with the limitations of this study. The claim that horticultural therapy is applicable to any sized budget, any type of facility, and any degree of staff expertise

and involvement does not seem to be true. The implication is that a major effort utilizing full-time staff, coordination with other therapies, and a considerable investment in equipment and facilities may be required. An expenditure for a full-time program requires justification and the effect of a horticultural therapy program under these circumstances has yet to be established. One might ask, however, if there is value in having these students involved in horticultural activities as compared to having to organize and structure their own time. The pure time element involved in the horticultural activity may have been valued individually by the student and the supervising staff members of the institution. This study made no attempt to measure the time involvement factor.

#### Recommendations for Further Research

The effect of an adjunct horticultural therapy program on cerebral palsied children is still not clearly established. A volunteer program of short duration with limited facilities and resources does not produce measurable differences. A full-time program administered by a staff horticultural therapist in close coordination with other professional therapists has not been adequately tested (a necessary prerequisite if horticultural therapy



is to justify the time, staff and resources that such a program may require). Such a study would constitute an operational replication with the following refinements:

1. The sample should be drawn from a population of more than one institution to be more representative of cerebral palsied institutionalized children.
2. The number of experimental subjects should be expanded to 100 subjects or more to allow for statistical analysis of domain as well as composite AAMD Adaptive Behavior Scores.
3. The AAMD Adaptive Behavior Scale-Part II reliability needs to be improved or an alternative measure of maladaptive behavior found.
4. The treatment duration should be lengthened.
5. The horticultural therapist should be a full-time staff member with an established horticultural therapy treatment schedule, access to medical records and continuous involvement with the other therapeutic efforts.

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