

FORMULATION OF BEHAVIORAL OBJECTIVES  
FOR TRAINING IN SELECTED ORNAMENTAL  
HORTICULTURE JOBS

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for the Degree of  
DOCTOR OF EDUCATION  
July, 1971

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## PREFACE

In a continuing search for improved curriculum design and more productive teaching methods, many researchers have turned to innovative techniques to root out improvements needed in all kinds of education. One technique, the formation of educational objectives around desired student behaviors, is becoming a useful source of guidance for curriculum planners. Most important for this study, it is producing a new way to organize student learning experiences around the skills they need for their life in the world of work. Curricula which employ the use of behavioral objectives provide encouraging evidence that they can more precisely direct career education in the occupations and professions toward the demands to be made upon the student in his future work.

This thesis is concerned with formulating behavioral objectives which will provide just such precise direction to ornamental horticulture programs at the post-secondary level. For a group of selected ornamental horticulture occupations, a comprehensive list of job competencies was derived from a detailed task analysis. These competencies provided the source data from which to formulate behavioral objectives appropriate for sound ornamental horticulture occupational training programs. An industry-wide concurrence with these competencies gives assurance that the objectives formulated are aimed directly at developing abilities in students most desired by their future employers.

The bank of behavioral objectives developed in this study provides a first step toward improved curricula in ornamental horticulture educa-

tion. Considerable evaluation of actual programs employing them and of student performance on the job remains.

My most sincere appreciation is extended to Dr. Robert R. Price for his masterful guidance and perennial encouragement which contributed greatly to bringing this study to a successful end. My gratitude is also given to Dr. William Stevenson, Professor W.R. Kays and Dr. Richard M. Payne for their generous assistance and sincere interest.

I am especially indebted to my wife, Arvilla, and my children at home, Kathy, Patty and John, for their enduring patience and personal sacrifice so generously and lovingly given. Their confidences are the pillars of my achievement. I should like also to thank Mrs. Sue Lark not only for her fine editing and typing but also for so generously helping with the final processing.

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## CHAPTER I

### INTRODUCTION

#### Problem Statement

The problem to be solved in this study is: What instructional outcomes (behavioral objectives) should be specified for vocational training in an ornamental horticulture curriculum at the post-secondary level which prepare students for jobs in nursery, garden center, and landscaping firms?

#### Need for this Study

Any individual in order to be proficient on the job must have the knowledge and skills that are essential for the full performance of those tasks that will be required of him. Training programs adequate enough to prepare individuals for skilled work must contain sufficient information, motivating instruction, and repetitive practice to assure that minimum levels of cognitive, affective, and psychomotor capability directly transferable to job tasks will be acquired.

Considerable progress has been made toward identifying the ornamental horticulture subject matter in which students should be at least conversant, or without which they cannot perform the minimum demands of the job. Among the studies contributing significant research results are those of Dillon (1), Bass (2), Johnson (3), and Virta (4). Although the information acquired has added considerably to subject matter verifica-

tion of present curricula, difficulties involved in specifying precise instructional outcomes have not been overcome. Further research of ornamental horticulture occupations using the job analysis method is sorely needed. It is from the analysis of tasks actually performed on the job that the best promise exists for developing these precise instructional objectives. Such objectives should represent accurately the skills and knowledge required of workers to qualify for job entry at the technician level.

Recently the techniques used in task analysis for deriving performance objectives have been applied to a wide range of jobs, particularly by governmental agencies (5) (6). This procedure holds real promise for adding a needed preciseness to the formulation of behavioral objectives for ornamental horticulture vocational programs. For this reason the basic practices used in the task analysis approach for identifying job competencies have been employed in this study.

Few persons enter the ornamental horticulture occupations in Oklahoma with prior training. This is a result of the shortage of vocational programs for these occupations in both secondary and post-secondary schools. (7) By examining Figure 1, which compares student and worker proficiency levels, it will be noted that job entrants presently hired in ornamental horticulture occupations probably fall at the lowest stage of occupational development. Employers thus carry employees for an extended period of time while they acquire, through experience, sufficient skill to be productive workers beyond the level of common unskilled labor. This method of skills acquisition is expensive to both employer and employee. Still, there is no assurance that such training efforts result in optimally skilled employees. It is doubtful as well that many indi-

viduals realize a development in the higher levels of their capacities. In all probability such training provides for little job mobility.

Thus, aside from the in-migration to Oklahoma of skilled workers in ornamental horticulture, it could be speculated that there are relatively few well-rounded, skilled employees in Oklahoma. Some employers report low wage scales for beginning workers (8). This, they claim to be basically the result of low productivity per worker. Mechanization, high skill, and other improved technology could very well increase worker productivity significantly. This would require the expenditure of additional resources for education and research, but pre-entry vocational training and adult programs are urgently needed if improved employee performance is to be attained.

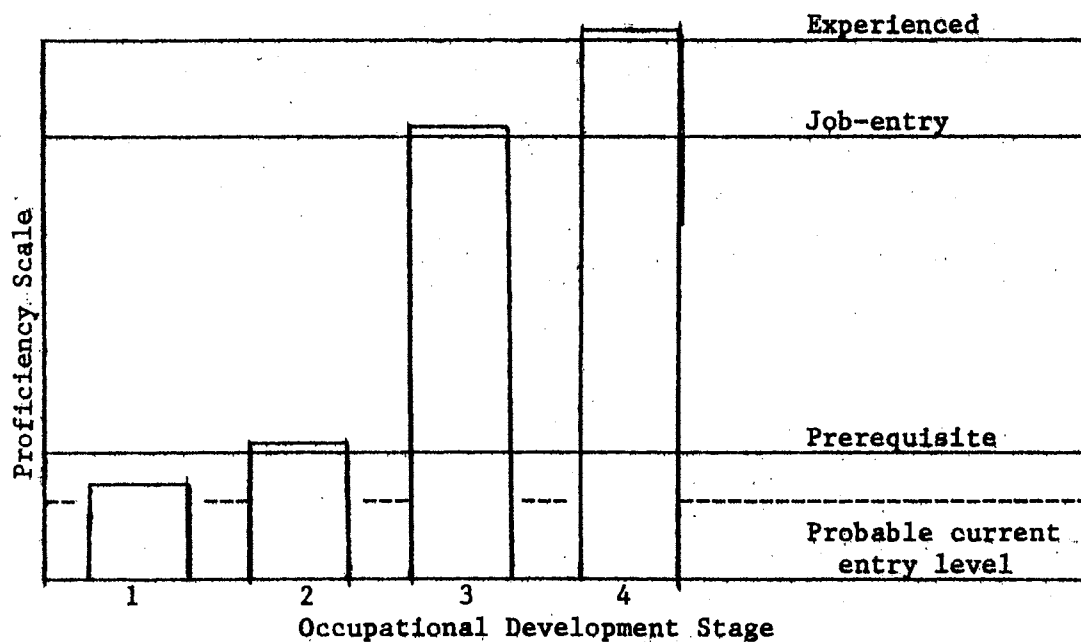


Figure 1. Student Proficiency Scale

As illustrated in Figure 1, vocational training programs lift the individual from a position below the prerequisite level line to as high a position as reasonable time and dollar economy will allow. A post-secondary program founded on a prerequisite level well supported by secondary education is an obvious need. Currently such post-secondary programs would have to include units of preparatory training for the many students disadvantaged by lack of appropriate educational background for entry into vocational training programs in ornamental horticulture.

As previously stated the present burden of training is left with employers. For all practical purposes this constitutes the entire job preparation endeavor. With the implementation of a post-secondary technical program, employers, then able to hire well-trained employees, would be able to concentrate their training efforts on experiences to raise employees from the job entry proficiency level to the experienced worker proficiency level to the experienced worker proficiency level.

#### Scope of the Study

This study, as a means to specify and analyze behavioral objectives, accumulates and verifies job competencies which on the basis of detailed job analysis are shown to exist within one or more jobs of nursery, garden center, and landscaping businesses in Oklahoma. The competencies studied have been those requiring a skill proficiency above that expected of common unskilled laborers. The initial step was to identify job tasks by observation and interview with skilled workers on the job in a variety of firms and jobs. These tasks were each broken down into component skill elements constituting competencies. Once the separate competencies were extracted, they were verified by a representative sample

of owners and managers of the businesses studied. By specifying the behavior required and citing conditions and restrictions for satisfactory performance, behavioral objectives were formulated.

The formulation of behavioral objectives is characterized by procedures employed by Mager (9), and Popham (10). The behavioral objectives should state acceptable overt behaviors, psychomotor responses or products to be elicited from the student which would give evidence that desired learning has taken place (11). This study leaves the additional steps of grouping and sequencing behavioral objectives to the curriculum planner. Such steps need to be developed with full consideration given to the training needs of workers in the locale, the instructional techniques best suited to the implementing teacher, and the separate learning practices used by individual students.

In the analysis an attempt has been made to select common objectives around which a core curriculum can be established for group instruction. Also, those objectives best adapted to individualized occupational experiences or programmed instruction techniques have been identified.

#### Purpose and Objectives

The purpose of this study is to formulate, by identifying and specifying, those behavioral objectives which best describe desired outcomes for a post-secondary ornamental horticulture curriculum and develop vocational skills to bring students up to a job entry proficiency level for occupations in nursery, garden center, and landscaping firms. The study was intended to be a search for terminal behaviors and significant specific objectives that specify the level of proficiency trainees should

reach, i.e. the minimum permissible course completion requirements. Much attention has been given to stating behavioral outcomes in terms of desired overt responses. Concern with such outcomes is not intended to depreciate the value of the lower cognitive and affective aspects of learning. Such learning outcomes were considered to be structured in the student's psychomotor responses and in the enabling prior training which make the final performance successful.

The three objectives of this research may be grouped in a step arrangement with the first objective leading to the second and the second to the third. Reaching each higher objective has been dependent upon results obtained in reaching intermediate objectives.

The first objective was to identify those skilled tasks performed by skilled workers in nurseries, garden centers, and landscaping businesses. The tasks derived may be found in varying degrees among the different jobs studied.

The second objective was to identify with industry concurrence all skilled job competencies inclusive of all job tasks found to exist in the selected occupational areas studied. As with tasks, these competencies are found in varying degrees among the jobs in the selected areas.

The third objective was to specify behavioral objectives that clearly describe desired behavior outcomes, using job competencies as the basic data for their derivation. The desired behavior outcomes here infer a response which, when given, will evidence acceptable proficiency for a job entry performance.

#### Assumptions and Limitations

Two major assumptions have been made that affect the conduct and

outcome of the research undertaken here. These are:

1. Behavioral objectives for guiding instruction in post-secondary ornamental horticulture technology programs can be formulated by the task analysis method, deriving job competencies to be mastered from worker activities in skilled jobs in these occupations.

2. Ornamental horticulture is generally agreed to consist of the three basic areas: floriculture, nursery management, and landscaping (12). With few minor exceptions, Oklahoma nursery and landscaping businesses are involved in the following functions or combination of functions: wholesale nursery, nursery sales, garden center sales, garden center and landscaping, landscaping and nursery, and landscaping.

This research has been limited in significant ways to provide a suitable base for study and permit timely completion of the effort. It is not apparent that these limitations have affected the quality or usefulness of the results. The limitations imposed are:

1. This study is concerned with vocational skill preparation for job proficiency and only incidentally with the broader aspects of general educational development. Skills and knowledge important in job performance, as reflected in precise psychomotor responses, have been examined. The fact that behavior outcomes have incidental relationship to cognitive and affective responses has not been pursued.

2. The job tasks analyzed are those demanding considerable skill - not common labor tasks. Jobs requiring an extensive background in horticulture science, business, or engineering such as those for which the bachelor of science degree would normally be prerequisite have not been included. Those jobs at the technician or para-professional skill levels for which training is usually provided in post-secondary vocational in-

stitutions are the ones that have been studied.

3. Job tasks peculiar to only a single enterprise or those outside of the selected ornamental horticulture occupational areas have not been studied. The major areas of knowledge and skills with which the study has been concerned are horticulture, business and marketing, and agricultural mechanics.

4. In addition to being limited to selected occupational areas in ornamental horticulture, the study is also limited to the borders of the state of Oklahoma. No attempt has been made to determine the applicability of the results to regions outside of the state.

#### Definition of Terms

1. Task. A set of related actions performed by a worker to complete an activity that is part of the total work of the firm.

2. Job Competency. The skill or knowledge required to perform a single act or other element of a total task.

3. Task Analysis. The identification and describing of all tasks making up a job; the specifying of each job competency found within each task; and the study of relationships existing between various jobs, tasks, and competencies.

4. Behavioral Objective. A stated outcome of training which describes what an individual will be doing, under what conditions, and with what restrictions, when demonstrating an acceptable performance.

5. Job Cluster. Two or more jobs requiring essentially the same or similar knowledge and skill in their performance.

6. Individual Instruction. Training endeavor in which the student assumes a large responsibility for the learning activity. Usually it is



performed on a one-to-one teacher-pupil basis.

7. Occupational Experience Training. Activity performed in a job setting, either on-the-job or in a simulated situation, which permits the student to directly develop job proficiency and acquire a knowledge of work relationships.

## CHAPTER II

### LITERATURE REVIEW

#### Introduction

The writing of behavioral objectives is essentially a subjective judgement. No matter how precisely the competencies supporting the objectives have been delineated, in the final analysis the writer's grasp of the skills to be achieved, his method of formulating the behavior intents, and even the direction of his vocational education philosophy affect the results obtained. This literature review is intended to clarify such major underlying principles, techniques, and philosophy as they relate to this study and the behavioral objectives it develops.

The discussion covers four basic areas. The first concerns the central position of sound curriculum objectives in modern agricultural education. The second examines techniques used in formulating behavioral objectives and their uses in instruction. The third describes the system of task analysis as used in discovering competencies toward which instructional intents should be directed. The fourth is a view of ornamental horticulture training programs, as well as a discussion of job skills needed in this field.

An attempt has been made to faithfully interpret the viewpoint of leading authorities and researchers in the fields of ornamental horticulture education and curriculum development. The hope is that the reader will find it clear and sufficient documentation to support the practices

attempted and the results achieved in this study.

## Curriculum Development in Vocational Education

### Vocational Education Described

The problems of everyday life in the real world simply do not follow subject matter lines as the conventional secondary school curriculum may seem to imply. This conventional secondary school curriculum does not appear to have an adequate grasp on the kinds of job knowledge and the organization of that knowledge needed by our society in this last third of the twentieth century.

According to Wood (13) several major areas of the school curriculum urgently need to be changed. First, there is a need to recognize educational goals associated with the work of the community, described in specific terms of human behavior rather than in lofty terms alluding to the importance of subject matter. The second is the need to integrate educational efforts in all moral, economic, and social aspects. The third is a need for a more practical curriculum to provide a natural transition from school life to life in the community. The fourth is a need for a changed concept of teaching to provide a broader range of experiences to meet learners needs, individualized and humanized. The fifth area of need concerns experimentation in education. A vast expansion in research is needed in order to create a new curriculum tailored to each student's individual needs.

Another author (14) also takes exception to much of the current school curriculum. He feels that it fails to come to grips with the pressing problems of youth. School curriculum should focus on such con-

cerns of youth as being able to adequately cope with the life in which they exist and to find assurance that they will develop into effective adults. The task of achieving adulthood in our competitive, achievement oriented society presses one into developing skills and knowledge to reach his highest possible occupational attainment. A student must see clearly the relationship between his studies and his vocational goals, and he must encounter some scholastic success in reaching his vocational goals. If not, in his frustration he may proceed less than satisfactorily in his endeavor to become educated. It is imperative that steps be taken to incorporate more work orientation into the curriculum. This can best be done by bringing the school curriculum closer to the economic, the commercial, and the social realities of everyday life. Educators must be far better informed in matters of workers' skills and future demands of the world of work upon their students.

"Educational programs that rely on the structural content of a traditional discipline become increasingly out of touch with the world of work." (15) However, vocational education is more than the mere preparation to fit an existing job. To be successful it must receive contributions from both specialized training and general education. However, this combination must give a unifying effect that is meaningful to the world of work.

Goodlad (16) in his demand for a more humanistic centered approach to education pointed out that a large segment of the educational enterprise has not provided a way of life centered upon the interests and values of their clients. It is by associating with students as individual clients that each becomes an individual concern, each striving toward a goal for development of his full potential. However, even though a sound

purpose of education has been to guide the individual to reach his full human potential, it should not be denied that persons need to be equipped with the education and skills that are essential to success in industry and public institutions (17). It is apparent that instead of a conflict in goals of education, what actually exists is a serious imbalance between the academic aspects of education and the occupational aspects.

### Modernizing Agricultural Education

Occupational education must arise from the premise that there is a close logical relationship between it and the problems that society faces. The intensification of cries for relevancy in education mean for educators a real concern for such matters as the nature of the labor market, the changing requirements for jobs, and the educational needs of unique groups of people (18). Training should concentrate on those jobs most likely to be in the student's future. To achieve this, curriculum content must constantly be revised to incorporate new technology as soon as job requirements for them develop. Obsolescence in either curriculum direction or content is intolerable.

Of the eight imperatives which Swanson, et. al. (19) regard as crucial to the interpretation and implementation of a modern concept of the vocational curriculum, three are pertinent to this study. They are:

(2) that the first goal of vocational programs be to equip students with salable skills, intellectual and manipulative, and to give them a base of occupational experience that will add relevance and adaptability to their vocational goal achievement.

(3) that maximum effort be given to curriculum development which can accelerate the rate of skill achievement and retard the rate of skill obsolescence.

(6) that competence to enter a job be held as the mini-

minimum requisite for graduation and that eligibility for placement be regarded as the minimum completion requirement.

Among his principles of quality vocational education Coe (20) describes three additional characteristics toward which the endeavors of this study are directed. Quality vocational education:

(9) is based on an analysis of each occupation to determine what is required to perform as a successful worker in that occupation.

(11) provides for the learning of skills employed in using the tools, machines and materials of the occupation and using them safely with good judgment and with pride in good workmanship.

(13) uses methods, materials and equipment as similar to actual working conditions as is practical in a school situation and schedules a sufficient amount of continuous shop and laboratory time to carry through the learning experience.

Following this line of reasoning, the transition occurring in the agricultural industry today should be sufficient reason for transitions to occur in school curricula of agriculture. An out-of-date agriculture curriculum which trains youth only for return to the farm defies the simplest economic principles for overcoming excess agricultural labor resources. Jobs in agri-businesses often have gone begging while rural poverty has continued to climb. Specialized study in off-farm agriculture specialties have lately been turning this lock-step march toward underemployed farm work to a rally for the agri-business industry. The specialties making up this vast industry are generally grouped as: agricultural supplies, agricultural mechanics, agricultural products, ornamental horticulture, agricultural resources, and forestry. Whatever other directions vocational agriculture may take in the future, its central core must become more agri-business oriented simply because that is where the jobs are for the vast majority of rural youth. (21). This study in curriculum

development addresses itself to a major area of the agri-business industry and to a major element of a forward looking agriculture curriculum.

### Curriculum Objectives

For over half a century some educational objective writers have encouraged the construction of curricula which have the practical goal of fitting out the individual for a useful role in society. This organizing of curriculum with specific ends in view was expressed by Bobbitt in 1918 as the "practical task of defining innumerable specific objectives; and then determining the countless pupil experiences that must be induced by way of bringing the children to attain the objectives." (22) His concept was that life consisted in large part of the performance of specific activities and the education that prepares for life prepares for these activities. (23)

This practical character of education objectives was moved a step closer to modern behavioral objectives by Smith and Tyler in 1942 when they formulated three assumptions about education. (24) First, education is a process which seeks to change the behavior patterns of humans. Next, the kinds of behavioral changes that a school seeks become its educational objectives. The third was that a curriculum is appraised by determining how well the objectives of the program have been reached. These assumptions were later developed into a rationale by Tyler which he presented in 1950:

1. What educational purposes should a school seek to attain?
2. What educational experiences can be provided that are likely to attain these purposes?
3. How can these educational experiences be effectively organized?

4. How can we determine whether these purposes are being attained? (25)

Tyler further clarified his rationale by describing elements of the educational experiences around which to effectively organize the curriculum. These elements consist of concepts, skills, and values. Many concepts are employed in most curricula. They constitute the organizing elements tying the curriculum structure together. Skills assist the curriculum organization through sequencing learning acts from the very simple to the complex combinations. Values have organizing significance in that objectives of attitude, interest, and appreciation strengthen the learning endeavor. (26) With these elements Tyler was actually pointing out the cognitive, affective, and psychomotor domains of behavior. A diagrammatic interpretation of Tyler's rationale thus bears a close resemblance to current behavior oriented instruction models. (Figure 2)

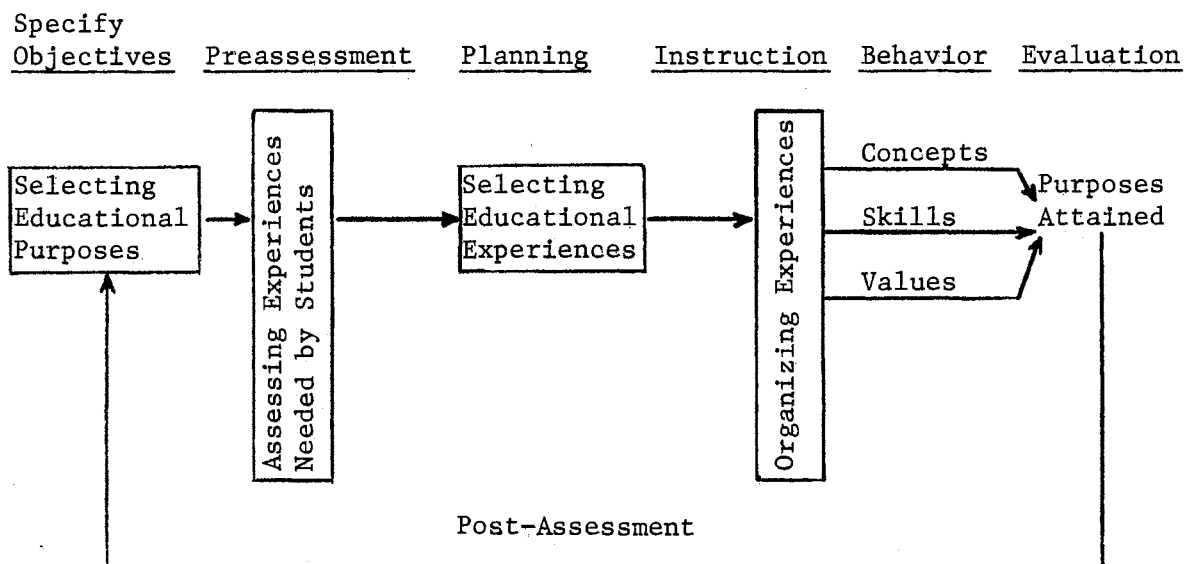


Figure 2. Tyler's Rationale as a behavior oriented instruction model.



Much of what is now called curriculum innovation is in fact the implementation of sound universally accepted theories. From the past has come the challenge for the school curriculum to be involved in the total learning experiences of the student. Educators in vocational education through "practical" curriculum objectives, behaviorally stated, have taken up the challenge and are forging a new involvement of the whole student.

### Formulating Behavioral Objectives

#### Significance of Behavioral Objectives

Behavioral objectives have been defined and described by many authors. One of the most often quoted is that given by Mager (27), to which he assigns the name, instructional objective. He states that it describes an educational intent in terms of what the learner will be doing and under what conditions when demonstrating an acceptable performance. Thus, a behavioral objective specifies a required student behavior, the conditions under which the behavior is to occur, and the performance level of that behavior.

The rationale behind performance objectives is that students upon completing the learning intended will exhibit a behavior (overt) that unmistakably indicates the desired achievement. Most theories concerning learning behavior are complex and difficult to apply to a specific case. However, one theory that is useful and uncomplex is that given by Eiss. (28) He points out that all learning input must initially come through the affective domain at the awareness level. This is evidenced by the turned-on or turned-off student. Next, there is a cognitive response during which the input interacts with what the student already has learn-

ed. Following this the student will exhibit some psychomotor response. This response exhibited by manipulative, perceptual, etc. actions will contain an affective dimension exhibited by interest, appreciation, etc., and a cognitive dimension exhibited by the content of the response. It is upon the overt behavior that the teacher must rely for evidence of any kind of desired learning.

Behaviorally stated objectives have a number of advantages over conventional subject oriented curriculum objectives. It is possible to select an appropriate evaluation method that will be a highly accurate measure of student learning. The choosing of learning activities is made easier. Such objectives can be examined and improved upon because they are specific. For the same reason they can be used effectively by more than one teacher. Additionally both student and teacher devote their time and energy to that which is most relevant for the student. They also provide a useful measure for checking instructor performance.

(29)

In the opinion of Engman (30) correctly writing behavioral objectives constitutes one of four phases which together operationalize behavioral objectives. The writing is followed by the other three phases; designing suitable learning experiences, constructing tests, and analyzing the results achieved. Thus, correct writing is a keystone to the teaching plan, assuring logical and consistent experiences, tests, and teacher evaluation.

The writing of behavioral objectives may be an arduous and time consuming endeavor for the classroom teacher. Popham, (31) however, believes that the task of merely selecting them for use may not be at all difficult. To this end he is directing the efforts of the Instructional

Objectives Exchange at the UCLA Center for the Study of Evaluation to provide a bank of objectives from which a teacher may select those most appropriate for a particular curriculum. The Center also operates as a clearing house for behavioral objectives, reducing duplicate efforts in developing them. Drawing upon such a pool of objectives, any school would have the resources to modify their curriculum to meet the individual needs or special group needs of each student. (19)

### Limitations of Behavioral Objectives

The strongest support for the use of behavioral objectives as a base around which to build curriculum comes from those educators who have implemented them with a high degree of success in training programs such as government job training and vocational-technical school curricula. The loudest opposition seems to come from those academicians whose cognate areas, abstract and heavy in theory, are far distant from the skills of the workaday world.

Cautions from the opposition, however, should not be overlooked by the vocational educator. They should be carefully weighed. There is too much that has not yet been proven about the effects of using behavioral objectives to permit their use with abandon. Unintended consequences have arisen in the past from instructional practices. Behavioral objectives may create their own unintended consequences. Some educators believe that in the long run behavioral objectives may fail to incorporate needed values into the student's value structure. Also, they believe that it is possible for behavioral objectives to limit the development of higher cognitive learning. (32)

Restating the reservations that Atkin (33) has, regarding the use

of behavioral objectives, in the form of precautionary statements provides sobering guidance for all of us who would put them into use:

1. Specified behavioral statements must not inhibit the articulation of the many unspecified curriculum goals. They, of themselves, have potentially worthy outcomes.

2. Behavioral objectives must not be demanded so early in the curriculum planning process as to hamper and frustrate imagination and the development of innovative practices.

3. Achieving stated behavioral objectives must not take instructional priority at the expense of the immediate possibilities of the situation at hand to serve other worthwhile educational purposes.

4. Behavioral objectives must not have as their sole purpose the measuring of prescribed knowledge and skills. They must reflect as well our philosophy which after all determines their educational worth in the first place.

#### Developing Behavioral Objectives

For behavioral objectives to contribute to the instructional process they must provide more than the myriad of curriculum goals already in existence. The shortcomings of other types of objectives are essentially two. They do not call for specific outcomes from learning experiences, and they do not lead to a means of effectively appraising what the student has actually learned from these experiences.

A central purpose for using behavioral objectives, then, is to overcome this vague and non-directional nature of many goals associated with curriculum today. It can be overcome for the most part by composing objectives so that they reflect three criteria: the desired student

performance (behavior); the environment (situation) in which the student will perform; and the quality of perfection of the performance. (34)

The writing of behavioral objectives has been effectively systematized by a number of agencies. One effective procedure which has been tried and proven is in use in the Job Corps Mens' Urban Centers. (35) In this procedure the objective is stated in the form of a short title followed by detailed statements of conditions, behavior, and requirements which indicate a successful performance. The statement concerning conditions may include where appropriate:

- a. what tools, equipment and clothing must be used;
- b. what special job aids or manuals may be used (or not used);
- c. what environmental conditions may affect the performance;  
and
- d. what special physical demands may exist.

The statement which gives in detail the behavior the student must demonstrate indicates just how he is to perform the skill and the results (product) of that performance. A step by step list may be appropriate here. The statement regarding the criteria or requirements for a successful performance should include the following details where needed:

- a. the time allowed to complete the performance;
- b. the number, percentage or proportion of total test items that must be answered correctly to pass;
- c. the actual responses that will be considered acceptable;
- d. the person who will judge or evaluate the performance; and
- e. the distinct point in time at which the performance is considered acceptably completed.

Although there are many ways by which performance objectives can be classified, Harmon (36) divides them into three groups. These are related to the cognitive, psychomotor, and affective domains of learning: verbal performance, physical performance, and attitudinal performance. Verbal performance objectives include recalling a name, explaining an ordered set of actions, responding to statements, solving a specific symbolic

problem, and solving a general symbolic problem. Physical performance objectives include identifying by pointing, performing simple physical acts, performing complex physical acts with direction, performing skilled acts, performing skilled acts in a problem-solving situation, and evaluating quality in products. Attitudinal performance objectives are stating or listing the consequences of an action, giving evidence of remembering a correct social response over an extended period of time, and giving a controlled response to specific social situations.

### Task Analysis and the Curriculum

#### Task Analysis Described

Hilgard (37) states succinctly a research fact and an observation of many vocational teachers: "It has been found enormously difficult to apply laboratory derived principles of learning to the improvement of efficiency in tasks with clear and relatively simple objectives." (He goes on to say it will be even more difficult for complex objectives). This stems from the fact that in training research the limits of experimentation cannot be arbitrarily fixed but are contained in the real life situations under study. That is, the standards of performance on jobs cannot be set by the researcher. They are already specified in terms of what a trained person is expected to do.

The investigator, Hilgard goes on to state, may have no freedom in choosing objectives. He must derive them from the demands placed on the learner in terms of the tasks the learner will have to perform. Thus, for training, the situation that brings about the desired learning constitutes the research goal; not the kinds of results that are yielded by a specific situation. It is the conclusion of a number of educators and

psychologists that it is through task analysis that improved application of learning principles will be made possible in vocational education.

In order to make a vocational course "performance oriented", it is necessary to identify in detail the task steps required in a performance and then teach toward them. (38) It is basic to vocational course construction that the tasks involved in the job be identified accurately. There are many procedures offered to achieve such a task analysis. (39) (40). Certainly among the most useful is the one published by the U.S. Bureau of Employment Security (41). In this pamphlet, job analysis is described as the identification of the tasks which comprise the job, and of the skills, knowledge, abilities and responsibilities required of the worker for successful job performance. A task is one of the distinct major activities of a job. It is comprised of logical and necessary steps in the work performed by the worker. The term element (compared to which, the term job competency is used in this study) is the smallest complete step into which it is practical to subdivide the work activity of a job.

Certain basic practices recommended in the Bureau's Manual have been used in this study. One important practice prescribed is the analysis of jobs where they exist. Another is that each job schedule must faithfully report the job exactly as it exists at the time of the analysis. Another important practice is the observation-interview method because it involves first hand observation. Additionally the level of difficulty of a job, the standards of acceptable performance, and the conditions under which the activity is carried on must be established. Thus, the task analysis is a process for determining the significant tasks and elements of tasks within worker activities, and a process for identifying the re-

quirements and situations in jobs as disclosed by actual observation and interview.

### Using Task Analysis in Curriculum Study

There are two basic approaches to identifying and organizing instructional goals for curriculum. One is the organizing of subject matter content by the subject matter expert into a structure suitable for teaching. The other approach involves a study of behaviors possessed by persons who have reached the sought after goals and convert these behaviors into curriculum objectives. (42) In the second of these approaches stands the best possibility for the successful development of occupational curriculum.

Task analysis is a means of isolating important objectives for training individuals for their jobs. Gagne (43), in his discussion concerning learning structure, points out that in order to make decisions regarding learning, it is necessary to determine the composition of the topic to be learned. This procedure, he states, begins with a statement of terminal objective, a performance that the student will exhibit at the end of training. It is then necessary to specify successively subordinate subtopics that constitute individual learning acts. The curriculum builder starts at the bottom by organizing the subordinate objectives from among the prerequisite capabilities the student must possess in order to achieve the terminal objective. So it is with task analysis. It yields a sequence of possible instructional elements paralleling the breakdown of task elements. The lower elements are described as enabling objectives which lead to higher elements, the terminal objective. Finally these lead to the general course, or curriculum objectives (44).



There are three limitations to this task analysis technique. Provided that the results of instruction will not be seriously impaired by these limitations, task analysis is a highly useful tool for vocational curriculum development. The first of the limitations is the vast amount of time that it takes to complete a task analysis. Second, when the procedures are employed by subject matter experts, it is doubtful that their individual subjective judgements would result in identifiable conclusions for the same analysis. Thirdly, task analysis deals with generally well defined, identifiable psychomotor behavior. Thus, it may well be that only where job activity involves fairly definable psychomotor behavior is task analysis an internally consistent technique for identifying instructional objectives. (45) These limitations generally would not appear to seriously hamper the development of sound instructional objectives for vocational curricula.

Not only does task analysis aid the development of a sound vocational program, but it also provides its own best evaluation mechanism. Specific parts as well as major content are exposed for systematic scrutiny based upon student achievement. In addition the objectives developed represent the performance required for successful employment.

Gagne (46) argues that even though the task analysis method leads to predesigned learning conditions, it still serves as a major contribution to instruction because of its adaptability to many varieties of learners. Pretesting can determine prerequisites already reached by students and they can be sent on to higher objectives. The teaching endeavors can also in truth be adapted to the individual learner.

### Sources of Task Information

The basic source of task information is the actual jobs under study. By observation of workers performing tasks, by interview with workers in the job environment, and by verification of interview results with supervisors and other authorities, task data can be accumulated accurately.

A secondary source of information where much of the costly data accumulation efforts have already been performed by government teams is the Dictionary of Occupational Titles. (47) In the two volumes making up the dictionary are detailed data in the form of job descriptions, occupational groups, and industrial and worker characteristics. Its use can ease the difficulty in compiling the initial job description and expedite the process of task identification and accumulation. In much the same way, the Occupational Outlook Handbook (48) can be used to reveal needed task information.

### The Process of Task Analysis

Task analysis is essential to the proper selection of teaching content in vocational courses. Drawbaugh (49) suggests several steps to follow to obtain a valid list of tasks required of workers in jobs and toward which trainees efforts should be directed. These are:

1. Become acquainted with the D.O.T. and other job analysis publications.
2. Tour businesses, learn operations, determine job relationships.
3. Observe workers and inventory tasks through a complete cycle of work.
4. Verify completed analysis with supervisors and others.
5. Repeat this process at several businesses.

Henrich and Goldsmith (50) in their research used three important steps in task analysis. The first was to develop a task inventory by a search of literature containing job descriptions, existing task inventories, and policy manuals. The next step was to actually survey in the field and, thus, ascertain that the workers were performing the tasks as presupposed in the basic inventory. The third step was to determine the skills and knowledge necessary to perform the tasks, by reducing the tasks down to key skills and knowledge elements. This last step was performed subjectively by subject matter analysts.

Mager (51) groups task analysis effort into two steps. Those described by Drawbaugh he groups together as one and calls them the task listing step. He suggests that in this step each task be weighted by frequency of performance, by importance to the job activity, and by the learning difficulty it presents. From this information the critical nature of each task is identified. The second step corresponds to Henrich and Goldsmith's third step. Here in terms of what the person does in performing a task, are listed the skills making up the task. To make it possible to select out the more difficult elements of tasks to be learned, the type of performance (cognitive or psychomotor level) and learning difficulty are identified.

#### Instructional Methods and Behavioral Objectives

It is imperative that vocational educators accept the responsibility of unifying the bits and pieces of information (as disciplines are organized in response to research results) into a whole which is related generally to life and specifically to a particular arena of work. Vocational education cannot afford the luxury of offering programs based on bits and pieces of information unique to a traditional discipline because the occupational world is not structured on this basis. (52)

The goal of preparing students for their occupational life makes it necessary to be concerned with providing students with "tailor-made" training that meets their own specific needs. Such training can hardly be limited to any single discipline and certainly cannot be patterned after the formal structure of the discipline. Valid programs of occupational education have to be based on the positions of employment that graduates will have available to them. Their performance capability in the final analysis is measured by employers. It is not a graduate's extensive knowledge of facts in a discipline that counts with employers, but it is his ability to perform required operations with an acceptable proficiency. The levels of such proficiency may vary for job entry from a competent performance without supervision down to simply an acceptable performance with constant direction. Thus, success in vocational education is the acquisition of competence at the needed levels of performance required by the job and expressed in specific performance (behavioral) outcomes for the course of training. (53)

Behavioral objectives can be used to guide training programs toward this goal by two instructional methods. One is individualized instruction. The other is job cluster training. Individual instruction permits the student considerable flexibility in the pursuit of his goals. Additionally, when coupled to desired behavioral outcomes, it provides concrete objectives so that the student and teacher both know when he has reached the required performance. It is not necessary to make any form of comparative evaluation with the achievement of others. (54)

Instruction based on behavioral objectives, also, permits the training of common competencies to groups of students regardless of the specific job for which they individually would be preparing. In many cases

the similarity between jobs discovered when identifying behaviors to be acquired show that clusters of jobs can be readily prepared for in a single curriculum. (55) This cluster approach to occupational training eliminates single job skills training, giving the individual a wider (horizontal) mobility.

A program which utilizes these concepts is suggested by Dillon (56) to train workers for licensed ornamental horticulture businesses. Basic courses containing items of knowledge and skills (competencies) needed by two or more job titles would be included in a core curriculum. These would be supplemented by specialized courses containing items unique to the needs of workers in a single job title. Many programs in ornamental horticulture contain a high proportion of individualized and occupational experience training. Clark (57) recommends that as much time as possible should be spent in doing each job. He states that all programs at the Essex Agricultural and Technical Institute include five months of supervised work experience each year to further develop needed skills and abilities.

#### Ornamental Horticulture Technology

##### Ornamental Horticulture Job Opportunities

Studies over a period of several years have revealed that the ornamental horticulture industry has an expanding significance in the economy which indicates increased job opportunities now and in the future. Dillon (58) found a 25 percent increase in licensed retail nursery dealers in Illinois in 1969 over the preceeding five years. Stevenson (59) predicted that the number of persons employed in ornamental horticulture in Oklahoma needing agricultural competencies would increase 46 percent by

1969 over those employed in 1964. Bass (60) singled out ornamental horticulture in 1969 as one of the fastest growing phases of the agriculture industry in Virginia. The expanding occupational opportunities in ornamental horticulture appear to be a nationwide phenomenon.

In Oklahoma a steady progression toward urbanization has been accompanied by an increased demand for landscape services and nursery products for residences, industrial sites, and parks and recreation centers. Many jobs in these expanding businesses require further training after high school. In 112 interviews by Stevenson with ornamental horticulture businesses, approximately 75 percent indicated that post high school or college training was needed for managers. In fifty interviews concerning education needs for nursery and greenhouse growers, it was indicated by over 50 percent that post high school or college training was needed for such jobs. (61)

#### Ornamental Horticulture Technology Programs

Ornamental horticulture is described by many authors as an off-farm agricultural industry. Stevens (62) identifies a number of types of businesses performing ornamental horticulture functions: greenhouse production and sales, nursery production and sales, garden center sales and services, landscaping, groundskeeping, greenskeeping, and arboriculture.

Hendrin (63) described the major units for instruction in ornamental horticulture to be nursery practice, floriculture and landscape gardening. The content of these areas of instruction he says should be:

Nursery Practice: plant propagation, growing and propagating structures, transplanting, grass production, controlling insects and diseases, and the safe use of chemicals.

Floriculture: greenhouse management, greenhouse structures, marketing, floral design, and floriculture crops.

Landscape Gardening: landscape principles, developing areas, plant materials, drawing plans, planting and maintaining.

Members of the Maryland Nurseryman's Association have recommended that trainees in ornamental horticulture programs be given training in a number of comprehensive and general competencies. (64) Their recommendations were:

Comprehensive Training in Competencies:

- Identification of plants
- Identification of plant diseases and insects
- Propagation of plants
- Selection of soils
- Lawn care and maintenance
- Planting and pruning
- Forcing plants to bloom

General Training in Competencies:

- Controlling weed in horticulture crops
- Digging, pruning, and transplanting ornamentals
- Growing house plants in the greenhouse
- Caring for cut flowers, arranging flowers
- Growing bulbs and corms
- Growing annuals and perennials
- Soil sterilization
- Compost and manures
- Mixing soluble fertilizers
- Potting soil mixtures
- Watering plants in the greenhouse and nursery
- Horticulture mechanics
- Basic landscaping
- Business techniques
- Operation and maintenance of engines and machinery
- Interest in one's work

Abilities Needed by Ornamental Horticulture Workers

Much research has been done to identify competencies that are important to successful performance in ornamental horticulture work. Sources of such information have been vocational agriculture teachers, agricultural education specialists, business managers and workers. One study completed by Bass (65) through interviews with a number of specialists

in education and business involved in ornamental horticulture revealed the following list of 38 competencies as essential for teachers of high school ornamental horticulture courses:

1. Identifying the kinds of ornamental plants
2. Taking soil samples
3. Reading and interpreting soil test results
4. Selecting soil for specific plants: effects of soil structure and texture on plants
5. Planning the use of lime to correct soil acidity
6. Planning the use of phosphorus and potassium for specific plants
7. Planning the use of nitrogen for specific plants
8. Planning the use of compost and manure
9. Planning the use of mulches
10. Planning the use of trace elements
11. Explaining the function of soil bacteria
12. Explaining how plant nutrients become available in the soil
13. Making fertilizer recommendations for specific plants
14. Planning soil fertility buildup programs
15. Applying fertilizer, including lime and nitrogen materials
16. Identifying nutrient deficiencies in plants
17. Planning soil fertility programs to maintain organic matter.
18. Planting seeds
19. Planting seedlings, bulbs, corms, sod, etc.: determining correct time to plant and/or transplant specific plants.
20. Cultivating plants: working the soil
21. Identifying weed seeds and plants
22. Planning weed control programs using and handling agricultural chemicals
23. Identifying name and function of specific agricultural chemicals
24. Determining proper use of pre-emergence agricultural chemicals
25. Determining proper use of post-emergence agricultural chemicals
26. Determining most effective use of new agricultural chemicals
27. Determining use of granular vs liquid agricultural chemicals
28. Identifying toxic effects of specific chemicals on specific plants
29. Selecting proper weedicides
30. Mixing agricultural chemicals for specific jobs
31. Identifying and controlling insects affecting ornamental plants
32. Identifying and controlling diseases, viruses, etc., that affect ornamental plants.
33. Maintaining sanitary conditions.



34. Buying needed seed, plants, supplies, materials, etc.
35. Horticultural mechanics; maintaining, adjusting, and caring for mechanical equipment
36. Horticultural mechanics: maintaining application equipment
37. Horticultural mechanics: operating tractor or power driven equipment
38. Horticultural mechanics: operating hand powered equipment

In summary, this literature review has concerned itself with pertinent aspects of behaviorally-oriented curriculum and ornamental horticulture training as they relate to this study. As was noted, there is considerable need for change in the traditionally organized school curriculum. The basic direction of such change should be toward the individual needs of the student, to equip him to achieve social and economic success in a real and demanding world. One way to obtain this desired curriculum change would be by improving curriculum objectives. For ornamental horticulture, behavioral objectives directly related to the occupational future of the student may very well provide just such improved curriculum objectives. Studying the formulation of behavioral objectives basically should be the next significant step in ornamental horticulture curriculum research.

## CHAPTER III

### RESEARCH METHODOLOGY

#### Task Identification

A first step in task analysis is to describe the characteristics of a job or jobs under study. Generally this involves identifying the tasks performed in completing the work of which the job consists. In this study a search of the Dictionary of Occupational Titles was made. The search examined job descriptions for all job titles specifically associated with the selected horticultural occupations studied as well as related job titles. Other references such as the Occupational Outlook Handbook were reviewed and discussions were held with resource persons.

From these sources of information a comprehensive list of tasks was compiled which could be expected to be found among the jobs in the occupations with which this study is concerned. Many of the tasks were inferred. Some were simply restated from the job descriptions. Key descriptions from which tasks were developed included those for the job titles of:

- Nurseryman
- Nursery Worker
- Laborer, Nursery
- Landscape Gardener
- Laborer, Landscape
- Groundskeeper
- Tree Surgeon
- Tree Surgeon, Helper
- Tree Girdler
- Tree Pruner
- Tree Planter

Bagger and Burlap Man  
 Sprayer  
 Sprayer, Hand  
 Lawn-mower Repairman  
 Farm-equipment Operator  
 Sales person, Lawn and Garden Equipment and Supplies  
 Salesman, Farm and Garden Equipment and Supplies  
 Irrigator, Sprinkling System

Closely associated with these were other job titles covering work of a similar nature or referred to in the key job description. These related descriptions were also used to identify tasks.

Park Foreman  
 Park Worker  
 Manager, Farm  
 Farm Foreman  
 Farm Hand, Fruit  
 Farm Hand, Vegetables  
 Horticultural Products Specialist  
 Packer, Agricultural Produce  
 Manager, Store  
 Manager, Service Establishment  
 Spray Foreman  
 Irrigator, Head  
 Foreman  
 Salesman  
 Sales Person  
 Sales Clerk

Another group of job titles were used as references for clarifying the tasks inferred from the key and related descriptions. Generally these jobs were beyond the limits of skill levels established for this study or were more remote from the specific jobs to be studied:

Horticulturist  
 Ornamental Horticulturist  
 Landscape Architect  
 Orchardist  
 Tree Remover  
 Tree Climber  
 Sales Person, Flowers  
 Farm Equipment Mechanic  
 Packing-House Foreman  
 Laborer, irrigation  
 Irrigator  
 Fumigator, Orchard  
 Spraygun Repairman

Upon completion of this examination of literature, interviews with skilled workers at six firms were scheduled and completed. The six firms consisted of two wholesale nurseries, two retail nurseries, and two garden centers. The retail nurseries and garden centers each performed landscaping services. The six firms were selected from dispersed locations to permit a wide diversity of viewpoints, if such is affected by regional differences. With consideration given to type of firm, they were selected from Durant, Lawton, Muskogee, Oklahoma City, Shawnee, and Tahlequah.

In all, sixteen workers skilled in landscaping, growing, salesmanship, and the supervising of these activities were interviewed. Their work areas and activities were observed as they existed on the job during the day of the interview. A task identification list, containing sixty-seven tasks, which had been developed from the study of job descriptions was used as the basic reference to expedite the interview and standardize task statements where appropriate. (See Appendix A)

The tasks, as identified for each job, were listed on a separate task list for each job. The task list form used is illustrated in Figure 3. The original plan included an evaluation of the difficulty of each task to be provided by the worker. However, it was soon found that the difficulty of tasks varied so greatly with the situation in which it was performed that workers could not give a reliable difficulty evaluation for most tasks. Thus, this difficulty evaluation was abandoned.

As each task list was completed and agreed upon by the worker on the job, it was reviewed with the manager of the firm, or with the worker's immediate supervisor. This provided additional perspective and accuracy in the identification and stating of tasks.

When all task lists were completed, the tasks were catalogued and statements standardized. Each separate task was associated with a task group. It was found that all tasks could be included within seven task groups: plant production, landscape maintenance, management, sales, equipment operation, and equipment maintenance. After grouping the tasks, they were assigned a task number associated with the task group. The appropriate number was then entered on the task list forms wherever that task appeared.

### TASK LIST

Job Title: \_\_\_\_\_ Occupational Area: \_\_\_\_\_

Name: \_\_\_\_\_

Firm: \_\_\_\_\_

Task No.	Task Description	Diff. Index	Task Anal.

Figure 3. Task List Form

### Deriving Competencies

Each task was carefully analyzed for major skill and knowledge elements described as competencies. Generally it was found that tasks were composed of three to six of these competencies. Care was taken not to just fragment the task but instead find substantial meaningful elements consisting of a skilled effort or using an important principle or concept.

Competencies were separated from their task of origin, assembled by task group and catalogued. Duplicate competencies were eliminated and minor descriptive differences were resolved by rewording or by grouping into a more inclusive competency statement. Competencies as finally expressed and grouped were each given a separate code number for control.

For the most part deriving competencies consisted of a subjective analysis of the tasks involved. Doubts were resolved by referring to resource people, educators, and nurserymen having expertise in the area in question. The competency statements were written concisely yet as clearly as possible to assure readability and ease of evaluation by those who were to respond to the questionnaire into which the competencies were assembled.

### Questionnaire Preparation

The questionnaire was composed of the distilled list of ninety-eight competencies assembled by task group and each given a rating scale for use by the respondent. (See Appendix B). The rating scale of 4,3,2,1,0 was employed as a means of giving a value to the importance of a particular competency to the business operated by the respondent. As will be noted on the instruction sheet accompanying the questionnaire (See Appendix A), a value of 4 indicated a highly important competency to the

business, and a zero indicated one of no significance, with the numbers in between reflecting significance between these two extremes.

It should also be noted that the respondents were permitted complete anonymity. It was asked though that they identify their type of business. This was to obtain needed information to correlate responses with types of businesses if the information would prove of value to the study later. Additional competency statements were requested if they were included in the work of the respondent's business.

The questionnaires were given a trial test on students and two businesses before being mailed out for the survey. No difficulty was experienced except for the oversight of one trial respondent who failed to enter a rating for one of the competencies. To assure as large a percentage of returns as possible, two follow up notices were sent out, one three weeks after the original mailing and the other after six weeks.

#### Survey Procedure

The credibility of this study hinges much upon the businessmen in the selected horticultural occupations chosen to assist in evaluating the competencies. The most reliable source of information about nursery production, landscaping, and sales of nursery and garden supplies and equipment was considered to be the licensed nurseryman. Turning to the latest available Directory of Licensed Oklahoma Nurserymen, 146 registrants were selected based on their functions in production, landscaping or sales as related to this study. Those not identified within these functions such as fruit and nut stock producers, berry stock producers, and greenhouse stock and house plant producers were not selected. The identification of the functions of firms and the selection of firms was

achieved with the assistance of the advisory committee and other resource persons having knowledge of these firms.

Because of the large size of the population, it was determined that a manageable sample should be taken to assure completion of the study within the time frame available. A large sample of sixty was agreed upon by the advisory committee as adequate to provide valid results for the competency importance measure.

To obtain a representative sample, the characteristics of the population was described in terms of functions performed: retail nursery, wholesale nursery, landscaping, and garden center sales. Also, the geographic distribution of the functions and the firms they represent were identified. The geographic distribution was arrived at by dividing the state into quadrants. The upper and lower halves were divided by a line following Interstate Highway 40 from Fort Smith to the Oklahoma City limits, then north the the north city limits of Edmond; then westward by a line parallel to Interstate Highway 40 to the Oklahoma-Texas border. The east-west halves were divided by a line that fell roughly halfway between Interstate Highway 35 and Highway 177 from the Oklahoma-Kansas border south to the east city limits of Oklahoma City; then on south, east of Ardmore to the Oklahoma-Texas border.

The number of firms and the functions they represented in the total population by quadrant are shown in Table I. The total 146 firms represented 239 functions. Two quadrants, I (Northeast) and III (Southwest), included the vast majority of firms and functions.

Applying the percentage of firms and the percentage of functions in each quadrant to the chosen sample size, the number of firms and their related functions for the sample were computed. This stratified sample,



TABLE I  
POPULATION DESCRIPTION

Quadrant	Firms Total	% Total	Functions Total	Functions and Percent*							
				RN Total	%	LS Total	%	GC Total	%	WN Total	%
I (NE)	61	43	94	50	53	32	34	9	10	3	3
II (SE)	11	7	22	11	50	7	28	2	11	2	11
III (SW)	55	37	89	46	52	34	38	8	9	1	1
IV (NW)	19	13	36	18	50	17	48	1	2	0	0
TOTAL	146	100	239	125	51	90	38	20	8	6	2

\*RN - Retail Nursery; LS - Landscaping; GC - Garden Center; WN-Wholesale.

TABLE II  
SAMPLE DESCRIPTION

Quadrant	Firms Total	% Total	Functions Total	Functions and Percent*							
				RN Total	%	LS Total	%	GC Total	%	WN Total	%
I (NE)	26	43	40	21	53	13	34	4	10	2	3
II (SE)	4	7	8	4	50	2	28	1	11	1	11
III (SW)	22	37	37	19	52	14	38	3	9	1	1
IV (NW)	8	13	13	7	50	6	48	0	2	0	0
TOTAL	60	100	98	51	51	35	38	8	9	4	2

\*RN - Retail Nursery; LS - Landscape; GC - Garden Center; WN-Wholesale.

thus, was composed of the same characteristics as the total population for the purposes of this study. It has served the same purpose as would have a survey of the total population. (See Table II).

In the selection of individual firms to survey within each quadrant, a dispersion which accounted for both geographic distribution of firms as well as functions was attempted. Thus, firms were selected from Oklahoma City and Tulsa in considerably larger numbers than from other cities and rural communities. But, in all quadrants firms were selected so as to give as much geographic dispersion as possible.

#### Data Tabulation and Analysis

Each respondent identified an importance value for each competency as it related to his firm. These values from the returned questionnaires were accumulated on tally sheets by competency. Then an arithmetic mean was computed for each competency by totaling all values given and dividing by the number of responses received. This mean value became the importance value for that competency, while one of a standard deviation below the mean was considered to indicate little or no importance. (See Table V)

To determine the degree of industry concurrence with the mean value, a standard deviation was computed for each competency. A small standard deviation gave a measure of considerable concurrence. A wide standard deviation showed little agreement. Both a high mean and a narrow standard deviation were thought to show a significant cluster value for the competency and indicated a universal need for that skill or knowledge in the selected occupations.

In order to more clearly identify those competencies which the in-

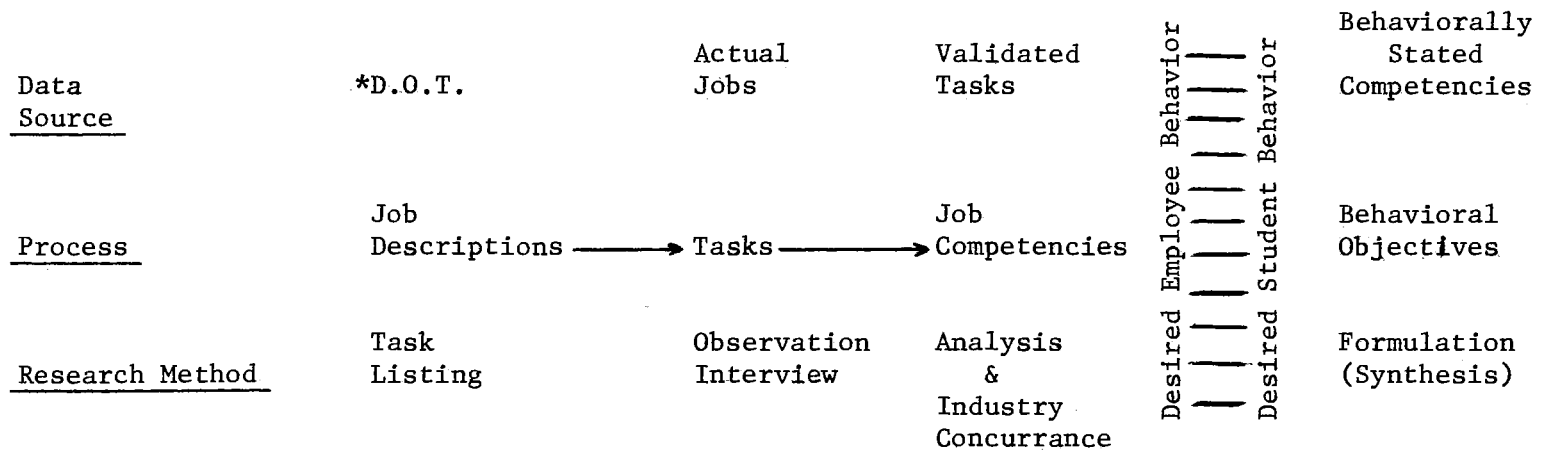
dustry in Oklahoma considers as having some significant importance for their workers to know, a further statistical measure was applied. By averaging the means of all competencies (competency mean totals divided by total number of competencies) a grand mean was computed. The standard deviation of the grand mean, computed from the deviation of individual means from the grand mean, provided a cut-off point in the lower values below which competencies were considered as suspect. To determine if these competencies with lower arithmetic means were outside of the competencies actually demanded of workers in the selected jobs, an evaluation of this individual standard deviation was made. A narrow individual standard deviation in this group showed general industry concurrence and gave reason for eliminating it from the study. Although this is but a simple statistical measure, it had real utility by assuring that no competency was eliminated that could reasonably be expected to be useful to a job entrant.

The behavioral objectives as written were based upon the inferred performance and knowledge required of a skilled worker when demonstrating a validated competency. Thus, objectives are supported by the competencies and in the main are terminal objectives, to be achieved by the student usually after considerable learning and practice.

Each objective has a five part format. The first part is a brief statement of title identifying the objective. The second part is the statement of the competency toward which the behavioral objective is aimed. The third part is a concise but complete statement of the expected student behavior or product, where appropriate, including a step by step performance sequence. The fourth part is a statement of conditions under which a student would be expected to achieve the desired perform-

ance. Such conditions consist of locations, tools, materials, references, safety devices, and special aids or restrictions bearing on the student's performance. The last part is a statement of requirements which must be met to achieve a satisfactory performance. These requirements include the degree of accuracy demanded, performance time limitations, and who will evaluate if other than the instructor. Conditions and requirements were often written in general terms to permit greater flexibility in application to specific training situations.

In summary the research methodology prescribed in this study includes a process which can best be described as the development of a student to employee interface illustrated in Figure 4. Task lists were prepared from such sources as the Dictionary of Occupational Titles. These tasks were then validated by the observation-interview method applied to a variety of jobs. Job competencies were derived by breaking down validated tasks (analysis) and by obtaining a concurrence from businesses in the industry. These job competencies stated in terms of desired employee behavior formed the basic source of data from which behavioral objectives, that described desired student behavior, were synthesized. This process developed an interface between the school experience and the world of work, equating the developing student behavior to future behavior as an employee.



\*Dictionary of Occupational Titles

Figure 4. Interface of Student and Employee Behavior

## CHAPTER IV

### PRESENTATION AND ANALYSIS OF DATA

#### Summary of Data

As a result of the job interviews and the task analysis, several changes were made in the original task identification list (See Appendix A). These changes were:

1. The task, "lays and adjusts irrigation pipe and attaches sprinkler heads," was transferred from the plant production category to equipment preparation.

2. Added to the equipment maintenance category was the task, "performs maintenance on lath houses, sheds and other buildings."

3. The task, "supervises workers in the performance of their duties," was added to the management category.

4. "Conducts inventories, prepares merchandise orders and restocks shelves" was transferred from record keeping to management.

5. That portion of the task which states, "keeps customer service records," was transferred from sales to record keeping.

6. The task, "arranges for transportation, directs loading and prepares documentation," was added to sales.

These changes incorporated into the original task identification list formed the final task listing from which the job competencies were developed.

Of the 60 firms to whom questionnaires were mailed, responses were received from 35, or a 58.3 percent return. Five of these responses

were not useable, and an occasional incomplete entry occurred on a few questionnaires. This resulted in useable returns for items on the questionnaire varying from 27 to 30. The final composition of the sample is not known precisely since most firms preferred to remain anonymous. However, there are indications that it was quite representative. All respondents identified their functions, showing that returns were received from each of the four categories: wholesale nurseries, retail nurseries, garden centers, and landscaping firms.

It would be expected that an infinite number of firms responding to a large number of competencies covering the area under study would result in data that would form a normal curve. The data from the sample is skewed slightly toward the high values with a close proximity between the mean and the median. The standard deviation includes 42 percent of the items above the mean and 25 percent below. This gives some evidence that the sample may be representative of the total population.

Most of the competencies derived from the task analysis were validated in the survey of businesses. As is described in detail under the section of competency evaluation in this chapter, those competencies with a mean within one standard deviation below a grand mean were considered validated. Only those below one standard deviation and having a narrow competency standard deviation (which showed a considerable agreement by the firms surveyed) were eliminated. Those with a wide standard deviation, even though they were below one standard deviation, were included because of lack of sufficient evidence to justify eliminating them. All competencies evaluated in the survey are listed by competency code sequence in Table III. The competency codes will be useful in referring to other tables throughout this chapter.

TABLE III  
VALIDATED COMPETENCIES  
(Listed in Competency Code Sequence)

Competency Code	Competency Statement
<u>PLANT PRODUCTION</u>	
PP-1	Operates propagation or production unit; i.e., lath house, greenhouse, to control environment.
PP-2	Prepares stock plants, plant material and seed for propagation, storage or other treatment.
PP-3	Propagates by cuttings, layerage, and graftage in large quantities.
PP-4	Prepares soil mixes for stockpiles and planting beds using synthetic additives, fertilizers and organic materials.
PP-5	Prepares soil for planting by sterilizing or fumigating, and adding a correct amount of moisture.
PP-6	Plants in nursery row, garden beds, or containers, distributing roots and setting at correct depth and distances.
PP-7	Evaluates watering needs and irrigates by hand or through irrigating system.
PP-8	Evaluates fertilizer needs by stage of growth, symptoms, or testing and applies fertilizer by various methods.
PP-9	Inspects plants, identifies symptoms, determines causes, and decides on corrective measures.
PP-10	Prepares plant specimens and collects samples of soil and water, tests and makes trial treatments, or sends to a testing agency.
PP-11	Performs common cultural practices, such as cultivating, weeding, mulching and cleaning up debris.
PP-12	Applies chemicals by spray or dust to control diseases, pests, and weeds.
PP-13	Mixes insecticides, fungicides, herbicides, fertilizers and other chemicals in correct proportions and strengths for specific treatments and plants.
PP-14	Safely disposes of spray chemicals and residues preventing contamination.
PP-15	Identifies plants by cultivar, grade and quality; separates large quantities rapidly.
PP-16	Assembles plant material and packs individually, in bunches, in containers and in palletized loads for shipment.
PP-17	Carries or conveys large numbers of transplants, handling without damage, and spaces correctly in beds or on storage dunnage.
PP-18	Organizes materials and equipment in work areas for efficient transplanting, propagating and other operations.
PP-19	Prepares plants for transport: tags and ties tops, burlaps and twines root ball, and/or places in bags, boxes, or other containers.



TABLE VII - Continued

Competency Code	Competency Statement
PP-20	Digs plants either bare-root or with soil ball, removing adequate root system and burlapping for protection.
PP-21	Prunes tops of plants when transplanting if root/top balance requires.
<u>LANDSCAPE MAINTENANCE</u>	
LS-1	Improves surface and subsoil drainage; installs tile, ditches and culverts.
LS-2	Removes top soil, improves land contour, drainage, and appearance; replaces top soil uniformly.
LS-3	Constructs and repairs walks, patios, borders, fences, etc. from materials such as wood, concrete, brick and stone.
LS-4	Climbs trees to prune and repair at high elevations; uses ropes, slings and ladders.
LS-5	Repairs damaged and diseased trees and shrubs by cutting out, painting, injecting preservatives and fillers, and bracing.
LS-6	Removes branches and fells trees; removes stumps and main roots; may treat with herbicides to kill.
LS-7	Performs seasonal landscape maintenance; determines tools, supply and labor needs for each job.
LS-8	Plants trees and other plants, using sound horticultural practices.
LS-9	Prepares soil for beds and gardens adding fertilizer, organic matter, and other additives as needed.
LS-10	Prepares soil mix and seedbed for lawn area; seeds, sods, plugs, or sprigs.
LS-11	Covers planted lawn with mulch and protective materials until established.
LS-12	Makes braces and supports for trees and shrubs using guy wires, poles, and stakes.
LS-13	Checks soil in lawns and gardens for water requirements; waters uniformly by irrigating systems or by hand.
LS-14	Prunes and trims trees and shrubs to improve growth or to achieve natural or artistic effects.
<u>SALES</u>	
SA-1	Offers customers products and services; discusses problems and aids customers using horticultural knowledge.
SA-2	Discusses horticultural methods with customers and recommends procedures; may give or sell books, bulletins or leaflets.
SA-3	Gives customers instruction and demonstrations on use and maintenance of lawn and garden equipment.
SA-4	Prepares written instructions or provides leaflets to customers on planting and care of plants and supplies purchased.
SA-5	Answers customers inquiries; arranges for appointments.

TABLE-III (Continued)

Competency Code	Competency Statement
SA-6	Displays plants, garden supplies and equipment to encourage sales.
SA-7	Assists customers in making landscaping decisions; advises on plants for desired use.
SA-8	Prepares landscape planting and construction cost estimates for customers.
SA-9	Draws landscape planting and construction plans to detail specification.
SA-10	Sketches artistic illustrations interpreting mature landscape appearances.
SA-11	Writes up landscape contract specifications to include planting and construction materials, labor and services.
SA-12	Writes up sales slips and sales contracts, recording sales transactions.
SA-13	Receives and records cash and check receipts through the cash register or cash drawer.
SA-14	Handles credit transactions according to policies of the firm.
<u>MANAGEMENT</u>	
MA-1	Solves problems, selecting alternatives based on efficiency and economy and drawing on past training and experience.
MA-2	Evaluates capability and capacity to produce; introduces mechanization and other labor saving methods.
MA-3	Establishes procedures and steps to implement approved plans.
MA-4	Establishes priorities to carry out operations and produce output as needed to meet established schedules.
MA-5	Establishes work schedules to make efficient use of labor and facilities.
MA-6	Analyzes actual costs from operations and budgets for future costs.
MA-7	Computes labor needs for various operations and prepares estimates of man-hour requirements.
MA-8	Computes consumption data for materials from inventory records; computes future requirements and orders with sufficient lead times.
MA-9	Studies cultural practices for improved efficiency; tests and implements new methods.
MA-10	Studies processing and handling methods for efficient sequencing and reduced costs.
MA-11	Directs the unloading, inspecting and counting of receipts; verifies documentation; stores properly.
MA-12	Moves supplies from bulk storerooms and restocks shelves in sales store or in processing areas.
MA-13	Estimates transportation requirements; contracts with shipping firms; plans consolidated shipments.

TABLE III (Continued)

Competency Code	Competency Statement
MA-14	Interviews and helps make hiring decisions; evaluates workers performance and recommends personnel actions.
MA-15	Instructs employees in their work and clarifies procedures.
MA-16	Assigns duties; leads work crews; coordinates work to achieve company goals.
MA-17	Hears worker problems and assists to enhance morale and efficiency.
<u>RECORD KEEPING</u>	
RK-1	Accumulates production, sales, and operating expense data by department; reports or has recorded.
RK-2	Accumulates time and performance data for workers to assure accurate payroll records.
RK-3	Keeps records of results of inventory of plant material and merchandise.
RK-4	Records and files contracts and work orders, cumulatively, for customers, including guarantees and service.
RK-5	Maintains cumulative crop records; uses in planning and preparing future production.
RK-6	Keeps records of plant symptoms, causes, and corrective measures.
RK-7	Maintains data on application and use of fertilizer, insecticides, and other chemicals.
RK-8	Prepares bills of lading and packing lists for use in assembling, loading, and shipping.
<u>EQUIPMENT OPERATION</u>	
EQ-1	Operates tractors and attachments skillfully in performing such tasks as tilling, planting, cultivating, and digging.
EQ-2	Operates heavy equipment for grading, ditching, and digging.
EQ-3	Operates forklifts, hand trucks, and conveyors to handle and stack supplies.
EQ-4	Checks condition of equipment before operation, secures attachments to power unit, fuels, and lubricates.
EQ-5	Performs in-operation checks on equipment to assure proper operation.
EQ-6	Shuts down equipment after use, performing cleaning and adjustment tasks, and stows correctly.
EQ-7	Exercises proper safety precautions when using hand tools, garden tools, carpentry tools, and masonry tools.
EQ-8	When operating tools and equipment, uses appropriate protective clothing, masks, gloves, goggles, etc.
EQ-9	Observes correct safety rules when operating tractors, attachments, and other power equipment.
EQ-10	Selects and uses correctly the appropriate hand, garden, carpentry, or masonry tools for the job to be performed.
EQ-11	Operates power mowers, edgers, trimmers, and attachments skillfully.

TABLE III (Continued)

Competency Code	Competency Statement
EQ-12	Uses hand and powered pruning and trimming tools skillfully as well as climbing hooks, belts, slings, and ropes.
EQ-13	Uses pipe fitting and plumbing tools to thread, connect, adjust, dismantle, and join.
EQ-14	Carries irrigation pipe, lays in pattern, and connects with valves and sprinkler heads.
EQ-15	Controls water flow through irrigation system, adjusting valves, changing pressure, assuring uniform water distribution.
EQ-16	Inspects sprayer, fills tank, starts agitator, checks filter, assures proper operation.
<u>EQUIPMENT MAINTENANCE</u>	
EM-1	Services lawn and garden power equipment, fueling, lubricating, adjusting, replacing warranty units and parts.
EM-2	Sharpens and adjusts cutting blades on lawn and garden equipment.
EM-3	Performs minor repair on tractors and similar heavy equipment, replacing parts such as points and plugs, and cleaning and adjusting.
EM-4	Cleans sprayer after use; i.e., tank, hose, tubes, nozzle, filter, etc.
EM-5	Constructs braces, guy wires, poles and dead man anchors to support lath houses and cloth houses.
EM-6	Repairs structures by replacing damaged timber, siding, and roofing; constructs footings; replaces screens and glass.
EM-7	Cleans clogged sprinkler heads and lines, repacks water valves, and repairs coupling devices on irrigating systems.
EM-8	Lubricates, adjusts, and sharpens hand tools and garden and pruning tools.

As a first step in writing the behavioral objectives, each competency validated by the survey was closely examined to determine the kinds of behavior which best indicated acceptable proficiency for a job entry performance. This constituted a highly subjective study. The derivation of these objectives is explained in detail elsewhere in this chapter. A total of 90 competencies were validated. The titles of the behavioral objectives derived from these competencies are listed by the related

competency code in Table IV.

TABLE IV  
BEHAVIORAL OBJECTIVE TITLES  
(By Related Competency Code)

Competency Code	Behavioral Objective Title
<u>Plant Production</u>	
PP-1	Operating a Production Structure
PP-3	Vegetative Production
PP-4	Soil Preparation
PP-5	Soil Sterilization
PP-6	Transplanting
PP-7	Watering
PP-8	Soil Testing
"	Fertilizer Application
PP-9	Identifying Plant Nutrient Deficiencies
"	Identifying Insect, Disease and Pest Symptoms
"	Correcting Nutrient Deficiencies and Disease and Pest Infestation
PP-11	Grounds Maintenance
PP-12	Disease and Pest Control
PP-13	Mixing Chemicals for Plant Treatment
PP-14	Disposal of Excess Chemicals and Residues
PP-15	Plant Identification
"	Plant Grading
PP-17	Materials Handling
PP-18	Production Planning
PP-19 & 20	Balling and Burlapping for Shipment
"	Preparing Bare-root Plants for Shipment
PP-21	Pruning for Transplanting
<u>Landscape Maintenance</u>	
LS-1	Drainage Installation
LS-2	Improving Land Contour
LS-4	Tree Pruning
LS-5	Tree Repair and Surgery
LS-6	Tree Removal
LS-7	Landscape Maintenance Planning
LS-8	Planting Trees and Shrubs
LS-9	Preparation of Gardens for Planting
LS-10	Establishing a Lawn
LS-12	Bracing and Supporting Trees and Shrubs
LS-13	Estimating Water Requirements
LS-14	Pruning

TABLE IV (Continued)

Competency Code	Behavioral Objective Title
<u>Sales</u>	
SA-1	Assisting Customers
SA-2	Advising Customers
SA-3	Demonstrating Lawn and Garden Equipment
SA-4	Writing Cultural Instructions
SA-5	Landscaping Services
SA-6	Garden Center and Nursery Merchandise Display
SA-7	Landscape Advice
SA-8	Landscape Cost Estimate
SA-9	Landscape Planning
SA-10	Landscape Design Drawing
SA-11	Landscape Contracts
SA-12	Making Sales Transactions
SA-13	Making Cash Register Sales
SA-14	Credit Transactions
<u>Management</u>	
MA-1	Management Problem Solving
MA-2	Planning Production Methods
MA-3	Developing Procedures
MA-4	Production Scheduling
MA-5	Work Scheduling
MA-6	Budget Planning
MA-7	Manhour Planning
MA-8	Ordering Plant Materials
MA-9	Scientific Method
MA-10	Operations Analysis
MA-11	Receipt of Supplies
MA-12	Stocking Shelves
MA-13	Shipment Planning
MA-14	Hiring Procedures
MA-15	Supervising
MA-16	Leadership
MA-17	Employee Relations
<u>Record Keeping</u>	
RK-1	Cost Data Accumulation
RK-2	Manhour Data Accumulation
RK-3	Recording Inventory Data
RK-4	Customer Service Records
RK-5	Crop Records
RK-7	Pesticide and Fertilizer Treatment Records
<u>Equipment Operation</u>	
EO-1	Tractor Operation
EO-2	Grading Equipment
EO-4	Before Operation Equipment Check
EO-5	In-Operation Equipment Check

TABLE IV (Continued)

Competency Code	Behavioral Objective Title
EO-6	After Operation Equipment Check
EO-7	Safety with Hand Tools
EO-8	Protective Clothing and Devices
EO-9	Safety with Power Equipment
EO-10	Hand Tool Selection and Use
EO-11	Operating Powered Garden Tools
EO-12	Operating Pruning and Trimming Tools
EO-13	Pipe Fitting and Plumbing
EO-14	Setting Up Irrigation Lines
EO-15	Operating an Irrigation System
EO-16	Sprayer Inspection
<u>Equipment Maintenance</u>	
EM-1	Lawn and Garden Equipment Repair
EM-2	Sharpening Cutting Blades
EM-3	Motor Tune-up and Repair
EM-4	Sprayer Clean-up
EM-5	Bracing and Supporting Protective Shelters
EM-6	Building Repair
EM-7	Irrigating System Repair
EM-8	Servicing Garden and Hand Tools

#### Competency Evaluation

As described in Chapter III, each firm that was sent a questionnaire was asked to rate the competencies according to the importance that these competencies had to job performance in their business. These ratings in numerical form permitted a statistical evaluation of competencies to more readily identify uniformity or differences of importance that these competencies had among the businesses involved. By computing from the survey data a mean and a standard deviation for each competency, a relative measure of industry wide importance was obtained (mean) and the extent of industry concurrence (standard deviation) was described. The arithmetic mean was computed by dividing the total value of all ratings

given for the competency by the total useable responses submitted. The standard deviation of this individual mean measured the uniformity of importance that respondents gave to the competency. A listing of the mean and standard deviation for each competency by competency code is given in Table V.

TABLE V  
ARITHMETIC MEAN AND STANDARD DEVIATION FOR EACH VALIDATED COMPETENCY  
(By Competency Code)

*Arithmetic Mean	Standard Deviation	Competency Code
<u>Highly Important</u>		
3.827	0.45	SA-1
3.678	0.71	EO-9
3.633	0.72	EO-7
3.589	0.88	MA-1
3.586	0.67	EO-10
3.551	0.72	EM-4
3.517	1.12	SA-7
3.482	1.24	LS-8
3.448	1.29	SA-12
3.448	0.92	SA-14
3.428	1.12	MA-17
3.400	0.92	PP-12
3.400	1.14	PP-20
3.379	1.05	EO-5
3.379	0.95	EO-8
<u>Important</u>		
3.357	1.10	LS-14
3.344	1.35	SA-9
3.344	0.95	SA-13
3.344	0.95	MA-5
3.275	1.28	EO-4
3.266	1.27	PP-21
3.250	1.15	LS-9
3.250	0.86	MA-2
3.250	1.01	MA-16
3.241	1.22	SA-8
3.241	1.14	EM-8
3.241	1.30	SA-5



TABLE V (Continued)

*Arithmetic Mean	Standard Deviation	Competency Code
3.222	1.09	EO-6
3.206	0.76	MA-3
3.206	1.43	EO-16
3.200	0.94	PP-14
3.178	1.10	MA-15
3.172	1.04	MA-11
3.133	0.98	PP-11
3.133	1.08	PP-13
3.074	0.94	MA-4
3.068	1.31	EO-12
3.066	0.94	PP-7
3.035	1.13	SA-6
3.033	1.11	PP-9
3.000	1.64	LS-7
3.000	1.33	LS-12
3.000	1.22	EM-3
2.962	1.54	EO-11
2.856	1.40	MA-12
2.833	1.06	PP-8
2.821	1.26	EO-1
2.800	1.11	PP-6
2.750	1.45	RK-4
2.750	1.26	EM-5
2.733	1.12	PP-4
2.724	1.48	SA-2
2.724	1.20	LS-5
2.689	1.18	EM-6
2.678	1.24	MA-7
2.620	1.53	SA-11
<u>Significant</u>		
2.588	1.09	MA-6
2.552	1.45	LS-6
2.535	1.23	RK-2
2.517	1.40	LS-10
2.517	1.24	MA-8
2.464	1.39	LS-13
2.428	1.08	RK-7
2.392	1.14	RK-3
2.321	1.22	MA-14
2.275	1.45	SA-10
2.275	1.35	MA-10
2.241	1.59	SA-3
2.200	1.37	PP-5
2.178	1.03	RK-1
2.137	1.52	PP-15
2.103	1.47	PP-1
2.103	1.26	LS-4
2.034	1.49	LS-2

TABLE V (Continued)

*Arithmetic Mean	Standard Deviation	Competency Code
2.034	1.21	MA-9
2.000	1.39	PP-18
1.896	1.36	SA-4
1.892	1.39	EM-1
	<u>Questionable</u>	
1.724	1.63	PP-3
1.689	1.23	EM-2
1.633	1.73	PP-19
1.607	1.65	MA-13
1.607	1.31	RK-5
1.551	1.71	EO-13
1.500	1.51	PP-2
1.482	1.53	LS-1
1.413	1.66	EO-2
1.344	1.58	PP-17
1.333	1.38	RK-8
1.298	1.35	RK-6
1.275	1.59	EO-15
1.266	1.27	PP-10
1.241	1.64	EM-7
1.233	1.51	PP-16
1.062	1.56	EO-14
1.035	1.55	EO-3
0.931	1.10	LS-3
0.741	1.04	LS-11

\*Individual rating values on importance scale of 4,3,2,1,0, with 4 the highest and 0 of no importance.

Further reflections will reveal that those competencies with both high arithmetic means and narrow standard deviations are of uniformly high importance to all types of businesses in this segment of the ornamental horticulture industry studied. Thus, the mean and standard deviation together constitute a rating of cluster value. Students preparing for skilled jobs in this industry would do well to train in those competencies with high means and narrow standard deviations. A listing of such competencies having a high cluster training potential are listed in Table VI by competency code.

TABLE VI  
COMPETENCIES WITH HIGH CLUSTER  
TRAINING POTENTIAL

Competency Code	Arithmetic Mean	Standard Deviation
PP-7	3.066	0.94
PP-9	3.033	1.11
PP-11	3.133	0.98
PP-12	3.400	0.92
PP-13	3.133	1.08
PP-14	3.200	0.94
PP-20	3.400	1.14
PP-21	3.266	1.27
LS-8	3.482	1.24
LS-9	3.250	1.15
LS-14	3.357	1.10
SA-1	3.827	0.45
SA-6	3.035	1.13
SA-7	3.517	1.12
SA-8	3.241	1.22
SA-12	3.448	1.29
SA-13	3.344	0.95
SA-14	3.448	0.92
MA-1	3.589	0.88
MA-2	3.250	0.86
MA-3	3.206	0.76
MA-4	3.074	0.94
MA-5	3.344	0.95
MA-11	3.172	1.04
MA-15	3.178	1.10
MA-16	3.250	1.01
MA-17	3.428	1.12
EO-4	3.275	1.28
EO-5	3.379	1.05
EO-6	3.222	1.09
EO-7	3.633	0.71
EO-8	3.379	0.95
EO-9	3.678	0.71
EO-10	3.586	0.67
EM-3	3.000	1.22
EM-4	3.551	0.72
EM-8	3.241	1.14

Low arithmetic mean ratings resulted from the computations for a number of competencies. For some of these competencies there were con-

siderable differences in the importance ratings received, a few receiving several very high ratings. Other competencies received uniformly low ratings. As was discussed in Chapter III, the method for determining industry concurrence for the inclusion of a competency was its relation to the grand mean and the size of its own standard deviation. The grand mean was computed to be 2.596 and its standard deviation .778. One standard deviation above and below the grand mean included competency means from 1.818 to 3.374.

Those competency means falling one standard deviation or more below the grand mean were considered questionable, possibly not used in the industry. Those greater than one standard deviation above the grand mean were considered to be highly important to the industry. These categories are separated in Table V.

A competency whose mean was more than one standard deviation below the grand mean was further tested for industry concurrence with its lack of importance. These low arithmetic mean competencies with individual standard deviations of 1.55 or less were considered to show a high industry concurrence in their lack of importance. Therefore, they were withdrawn from the competency listing and were not used in the formulation of behavioral objectives. They are listed in Table VII by competency code with the deviation from the grand mean as well as the competency standard deviation.

TABLE VII  
COMPETENCIES WITHDRAWN  
(Not Validated by the Survey)

Competency Code	Deviation from Grand Mean	Competency Standard Deviation
PP-2	1.096	1.51
PP-10	1.330	1.27
PP-16	1.363	1.51
LS-3	1.665	1.10
LS-11	1.955	1.04
RK-6	1.298	1.35
RK-8	1.236	1.38
EO-3	1.561	1.55

#### Derivation of Behavioral Objectives

The competency statement as validated by the industry provided exceptionally good guidance for the writing of a behavior statement for the behavioral objectives. It also assured that the objective conformed to the performance the student would be expected to make on the job. Using this guidance restricted the amount of attention given to conventional subject matter approaches, enhancing possibilities for achieving innovative practices when implemented by the instructor. The conditions and requirement portions of the objective statement were written for either classroom, laboratory, or training station performances. The performance required is intended to test the student's job entry level skill. Thus, the behavioral objectives tend to fit available training situations and still conform to the entry level proficiency requirement.

As described in Chapter III, each behavioral objective is written in five parts: the title, the competency statement, the behavior statement, the test conditions, and the performance requirements. The detail

in the conditions and requirements vary according to the restrictions needed to assure an acceptable performance, but still provide brief, yet descriptive statements. For the most part each objective concerns a separate skill or group of closely related skills. However, a few of the behavioral objectives have been interrelated as they are essentially additional aspects of the same activity, such as before, during, and after operation servicing of power equipment.

A total of 94 behavioral objectives were derived from the 90 competencies validated in the survey. For the most part these objectives call for complex behaviors or products which prove the student's proficiency. This should not preclude the use of cognitive tests to identify the progress that a student is making toward the objective. Here, though, the attempt is to derive behavioral objectives which clearly show the student performing as he would on the job and with a proficiency needed for successful job entry.

#### Discussion of Results

The relation of behavioral objectives to tasks becomes more remote as the research progresses from task analysis through competency validation. It becomes obvious that the concern in development of behavioral objectives is with the skills of the individual in a task performance and not with the tasks themselves. Also, throughout the task analysis it was observed that many tasks were interrelated by the similarity of skills required in their performance. Training in a single skill or a few skills may equip a student with capacity to perform in more than a single task. Expanding on this reasoning, the student succeeding in performing the behavioral objectives developed herein is most likely equipped to perform well in jobs and occupations outside of the ones specifically examined in this study.

Even a cursory observation of the standard deviations computed from the competency ratings reveals the wide differences existing in the importance of skills among the businesses studied. For most jobs in the industry, the validated competencies would be sufficient for successful job entry capability. However, for at least a few businesses a small amount of additional specific training or experience may be necessary. For instance, in a business where one of the eliminated competencies holds some importance in a firm, that skill would have to be developed on-the-job. In the same way a student would acquire some skill from the composite of behavioral objectives that would possibly not be needed on his first job. However, the unused training would not be lost. It would give him valuable breadth of training, which would provide him mobility among the range of skilled jobs represented in the businesses surveyed in this study.

#### Behavioral Objectives

The behavioral objectives that follow are listed in competency code sequence. This makes it possible to trace each objective back through competency and task data from which it arises.

1. Title: Operating a Production Structure (PP-1)

Competency: operates propagating or production unit, i.e., lath house, greenhouse, cloth house, etc. to control environment,

Behavior Statement: adjusts the environmental conditions of a production structure to meet the needs of crops being produced, i.e., heating, cooling, humidity, light intensity, and water.

Conditions: performs acceptably in more than one type structure. May use references, diagrams or other job aids but without any direct super-

vision.

Requirements: Under the observation of the training station supervisor or the instructor, regulates environment under conditions specified during normal work training periods for several days in each type of structure.

2. Title: Vegetative Propagation. (PP-3)

Competency: propagates by cuttings, layerage, and graftage in large quantities.

Behavior Statement: (1) demonstration phase: apply correct method of propagating to a number of different cuttings, layers, grafts and buds on demonstration material; (2) production phase: performs two or more propagation procedures on the job producing large quantities rapidly and accurately.

Conditions: performs using tools and materials as provided by the instructor. Work must be accomplished without references or other aids. The production phase is under actual work conditions, on the job at the training station.

Requirements: performance is evaluated by the instructor or training station supervisor. Production phase should be sustained over a period of several hours and results measured by supervisor's estimate of probable success of plant growth. Demonstration phase is evaluated by proper sequence and precision of steps performed.

3. Title: Soil Preparation. (PP-4)

Competency: prepares soil mixes for stock piles and planting beds, using synthetic additives, fertilizers, and organic materials.

Behavior Statement: determines needs, assembles substances to produce required media, locates stock pile for efficiency in operation. Loads



and operates mixer, or hand mixes in proper proportions to get uniform results, producing in considerable quantities in an on-the-job situation.

Conditions: performs under work conditions in nursery seedbed, work shed or garden; provided with hand and garden tools or power mixer as needed. May use references.

Requirements: performance is evaluated by training station supervisor; performance is completed when required components are thoroughly mixed and ready for use.

4. Title: Soil Sterilization. (PP-5)

Competency: prepares soil for planting by sterilizing or fumigating and adding correct amount of moisture.

Behavior Statement: (1) assembles soil mix in planting bed or stockpile; (2) moistens soil lightly and uniformly; (3) inserts and assembles steam-pipe network, or operates electrical soil sterilizing equipment; (5) places cover snugly over stockpile or bed; (6) sterilizes at temperature specified for required time, or fumigates for required time period; (7) removes cover and designates when ready for use.

Conditions: performs on the job or in training facilities under normal work conditions without references. Uses pipe fitting tools and other hand tools.

Requirements: performs intermittently as needed over a period of time sufficient to achieve soil sterilization. Satisfactory performance is determined by instructor or supervisor observing, using temperature guages, and by timing.

5. Title: Transplanting. (PP-6)

Competency: plants in nursery row, garden beds, or containers, distributing roots and setting at correct depth and distances.

Behavior Statement: (1) assembles plants at work location and provides adequate protection from wilting or cold exposure; (2) digs ditches or holes of required dimension; (3) sets out plants at required depth and distances; (4) applies soil additives to enhance growth, improve drainage, etc.; for bare-root, distributes roots uniformly as fills; (7) when filling containers, sets out in growing area at proper distances.

Conditions: performs in training facility or on the job without references. Student selects and uses tools correctly. Instructor designates plant materials, planting locations, and containers.

Requirements: preciseness of performance is essential. Instructor observes technique closely and measures depth and distances as required.

6. Title: Watering. (PP-7)

Competency: evaluates watering needs and irrigates by hand or through an irrigating system.

Behavior Statement: when presented with six or more samples of soil, the student checks by feel and crumbling, determining according to the structure of the sample whether it should be watered.

Conditions: student performs in laboratory or work location; may use trowel, knife or other hand tool in making the evaluation.

Requirements: student moves progressively from one sample or soil location to another, judging samples and gives verbal or written response to the instructor. Must correctly judge each sample tested.

7. Title: Soil Testing. (PP-8)

Competency: evaluates fertilizer needs by stage of growth, symptoms, or by testing, and applies fertilizer by various methods. (First part only)

Behavior Statement: employing simple soil test method, determines nitrate nitrogen, phosphorus, potassium, and pH levels of the soil samples

under laboratory conditions. (1) properly selects a soil sample from a designated plot; (2) completes test; (3) computes fertilizer requirements, considering cultivars involved.

Conditions: instructor provides soil test kit and other needed tools and equipment. References may be used.

Requirements: student selects and arranges appropriate materials, performs sample selection, and obtains accurate test results when compared against instructor pretest sample. Results are written on a soil test form and submitted to the instructor.

#### 8. Title: Fertilizer Application. (PP-8)

Competency: the last part of competency under 7.

Behavior Statement: demonstrates correct methods for applying solid fertilizers; demonstrates correct mixing and application of liquid fertilizers.

Conditions: instructor provides fertilizer, applicator equipment, and measuring devices; student may use reference.

Requirements: student selects appropriate fertilizer materials, computes correct amount to apply; and distributes uniformly to meet requirements indicated by soil test or standard recommendations.

#### 9. Title: Identifying Plant Nutrient Deficiencies. (PP-9)

Competency: inspects plants, identifies symptoms, determines causes, and decides on corrective measures.

Behavior Statement: examines plant specimens and pictures which illustrate common nutrient deficiencies and chemical damage; names these deficiencies and damage symptoms.

Conditions: student performs without references, but may use instruments such as magnifying glass, dissecting probes and foliar test equipment.

Works in the laboratory.

Requirements: performance may vary as to time limit and problem-solving approach; satisfactory performance is the correct identification of the causes of the symptoms.

10. Title: Identifying Insect, Disease, and Pest Symptoms. (PP-9)

Competency: refer to competency in 9.

Behavior Statement: identifies causes of symptoms and damage by examining plant specimens and pictures which illustrate common disease, insect, and pest damage.

Conditions: performs without references but uses laboratory instruments as needed.

Requirements: performance may vary as to time limit and problem-solving approach; satisfactory performance is measured by the correct identification of the causes of the symptoms or damage.

11. Title: Correcting Nutrient Deficiencies and Disease and Pest Infestation. (PP-9)

Competency: refer to competency in 9.

Behavior Statement: prescribes orally or in writing the treatment procedure for each designated diagnosed disorder.

Conditions: student proceeds without references but has specimens available to observe.

Requirements: workable procedures should be prescribed; response should include precautions in the use of chemicals and equipment where important. Student states or submits written solution to the instructor.

12. Title: Grounds Maintenance. (PP-11)

Competency: performs common cultural practices such as cultivating, weeding, mulching, and cleaning up debris.

Behavior Statement: (1) cultivates soil surface in the nursery row or

seedbeds to increase water absorption and reduce evaporation and runoff; (2) cuts weeds not destroyed by herbicides; (3) applies mulches to reduce water loss and control soil temperature; (4) cleans up plant materials debris to reduce sources of contamination.

Conditions: uses common garden hand tools at training station or in school garden.

Requirements: performs at the same pace as trained nursery workers; work observed and evaluated by training station supervisor or the instructor.

13. Title: Disease and Pest Control. (PP-12)

Competency: applies chemicals by spray or dust to control diseases, pests, and weeds.

Behavior Statement: operates a power sprayer, fogger, duster, or another applicator when spraying or dusting infested plants; obtains thorough coverage by manipulation of spray nozzle and duster.

Conditions: uses commercial power sprayer, fogger, or other applicator designated by instructor; performs on the job. May use references.

Requirements: selects proper climate conditions for successful application and is evaluated by the training station supervisor according to techniques employed and results obtained.

14. Title: Mixing Chemicals for Plant Treatment. (PP-13)

Competency: mixes insecticides, fungicides, herbicides, fertilizers and other chemicals in required proportions and strengths for specific treatments and plants.

Behavior Statement: assembles containers, supplies and tools for mixing chemicals for each of several treatments. Measures and mixes correct proportions for the treatments assigned.

Conditions: interprets published manufacturers instructions. Instructor

provides instruments, containers, and supplies. Performance is in the laboratory or work area.

Requirements: instructor evaluates by close observation; each mixture must be properly mixed to the correct proportions for the intended use.

15. Title: Disposal of Excess Chemicals and Residues. (PP-14)

Competency: safely disposes of spray chemicals and residues preventing contamination.

Behavior Statement: explains in writing or orally to the instructor the procedures for the safe disposal of chemicals commonly used in nurseries.

Conditions: exercise conducted in classroom or laboratory with samples of test chemicals available for observation, but no other references available.

Requirements: correctly describes disposal procedures for all items; at least five families of substances should be considered: non-persistent insecticides, systemic pesticides and fungicides, fertilizers, persistent herbicides, and growth regulators.

16. Title: Plant Identification. (PP-15)

Competency: identifies plants by cultivar, grade and quality, separates large quantities rapidly.

Behavior Statement: identifies plant materials in general use by nurseries in the locale from plant parts of growing specimens by writing out the name on a test answer sheet.

Conditions: performs out-of-doors without references. Where growing specimens are inaccessible, plant parts are displayed in the laboratory or work area.

Requirements: student must accurately identify by commercially accepted name 90 percent of the samples, making a positive identification of each

in a 30-second time period.

17. Title: Plant Grading. (PP-15)

Competency: refer to competency in 16.

Behavior Statement: separates by grade and quality a large number of specimens of a common cultivar.

Conditions: performs at the training station with commercially acceptable materials or at a location where materials are available.

Requirements: performs at a rate of speed common for skilled graders with an 80 percent accuracy; performance evaluated by the supervisor.

18. Title. Materials Handling. (PP-17)

Competency: carries or conveys large numbers of transplants, handling without damage, and spaces correctly in beds or on storage dunnage.

Behavior Statement: moves a large number of transplants by a plan devised by the student himself.

Conditions: student has a selection of handling devices and equipment to employ with his plan; test is performed in the training station.

Requirements: performance successful when materials have been moved by the student's plan with minimum damage and stored as specified by the instructor. Plan should result in a rapid, direct move of transplants.

19. Title: Production Planning. (PP-18)

Competency: organizes materials and equipment in work areas for efficient transplanting, propagating or other operation.

Behavior Statement: writes out the procedural steps to be followed to accomplish an assigned transplanting, propagating or similar operation.

Conditions: the instructor specifies the work operation to be performed and the materials and facilities to be made available for its accomplishment.

Requirements: student must submit in writing a procedure in step by step form that would produce acceptable results in terms of time and volume of production as evaluated by the instructor.

20. Title: Balling and Burlapping for Shipment. (PP-19 & 20)

Competency: prepares plants for transport: tags and ties tops, burlaps and twines root ball, and/or places in bags, boxes, or other containers.

Behavior Statement: student tags and ties the tops of selected plants; digs plants with root ball intact and burlaps, secures, and twines the root ball.

Conditions: supplies and tools such as spades and knife are provided; work performed in the nursery row at the training station; plants for digging are selected by the supervisor.

Requirements: student must remove plant from the soil within one to several minutes depending on the size of the plant dug; plant must be lifted and burlapped without injury to the rootball or the plant tops.

21. Title: Preparing Bare-root Plants for Shipment. (PP-19 & 20)

Competency: refer to competency in 20.

Behavior Statement: student tags and ties tops of selected plants; digs plants, lifting main root system structure; bags roots and/or bundles and boxes for shipment.

Conditions: student provided with garden hand tools and needed supplies. Work performed in the nursery row and at the work shed of the training station.

Requirements: student must remove an adequate amount of root system to assure early recovery and growth of the transplants; and bag or bundle compactly and uniformly.

22. Title: Pruning for Transplanting. (PP-21)



Competency: prunes tops of plants when transplanting to achieve root/top balance.

Behavior Statement: after replanting selected plants, student prunes top skillfully to form desired shape and growth, achieving root/top balance.

Conditions: student provided with tools for digging and pruning; work performed in the nursery row on plants selected by supervisor.

Requirements: work performance and results must be acceptable in form as well as root/top balance.

23. Title: Drainage Installation. (LS-1)

Competency: improves surface and subsoil drainage; installs tile, ditches, and culverts.

Behavior Statement: given a drainage problem student draws a labeled diagram illustrating his recommended drainage improvement including location of installed tile, ditches, and culverts; student writes out the steps to be followed in the work of installing drainage improvement.

Conditions: student performs at unimproved landscape site; obtains needed information on request or by measuring and digging soil samples.

Requirements: an acceptable performance is a commercially workable plan described in sufficient detail so that it could be implemented.

24. Title: Improving Land Contour. (LS-2)

Competency: removes top soil; improves land contour, surface drainage, and appearance; replaces top soil uniformly.

Behavior Statement: in conjunction with LS-1 describes in writing, including a labeled diagram, a procedure for improving the contour of the landscape.

Conditions: student develops procedure at unimproved landscape site and

in the laboratory; necessary information obtained by inspecting and measuring at the site.

Requirements: the submitted plan should provide improved drainage, desirable appearance, uniform top soil replacement, and be commercially feasible.

25. Title: Tree Pruning. (LS-4)

Competency: climbs trees to high elevations to prune and repair; uses ropes, slings and ladders.

Behavior Statement: student climbs tree, prunes and repairs by using pruning tools and equipment, rope and ladders.

Conditions: performed on the job with required materials, supplies and equipment provided. Not performed in inclement weather.

Requirements: performance is acceptable when: the tree is pruned to proper form for cultivar, repairs are made that will result in early recovery, and work has been efficiently and safely performed.

26. Title: Tree Repair and Surgery. (LS-5)

Competency: repairs damaged or diseased trees and shrubs by cutting out, painting, or injecting preservative and fillers, and bracing.

Behavior Statement: student repairs major damage to a tree by: cutting away broken limbs, cutting out and smoothing splintered areas; installing braces and supports, making grafts, applying filler and preservatives, and trimming and applying pruning paint.

Conditions: instructor designates the tree on which to perform and provides the student with the materials, supplies and tools as needed.

Requirements: student performs under the close observation of the instructor without supervision. Techniques must be employed skillfully and results indicate that recovery can be anticipated.

27. Title: Tree Removal. (LS-6)

Competency: removes branches and fells trees; removes stumps and main roots; may treat with herbicides to kill.

Behavior Statement: Part A: provided with an example, either pictures or an actual tree, student analyzes the tree removal problem and describes step by step in writing the procedure he would follow without the use of herbicides. Part B. provided with another example student describes in writing the procedure to be followed to kill with herbicides.

Conditions: student performs either at site with specimen or in class-room with pictures provided by instructor; performs without references.

Requirements: description of removal must be in sufficient detail for the instructor to be able to evaluate safety precautions as well as how damage to electrical lines, buildings or other property is to be avoided.

28. Title: Landscape Maintenance Planning. (LS-7)

Competency: performs seasonal landscape maintenance; determines tools, supplies, and labor needed for each job.

Behavior Statement: student writes up a job estimate to complete the landscape maintenance tasks on a residence by:

- (1) estimating the labor hours and costs required.
- (2) computing costs and quantities of supplies.
- (3) compiling a list of tools and equipment needed.

Conditions: student prepares preliminary job estimate at site of residence and completes estimate at the training station or in the classroom, verifying costs and quantities by reference to manuals, price lists, etc.

Requirements: a completed estimate must be submitted with not more than a 15 percent deviation from the instructor's or the supervisor's solution.

29. Title: Planting Trees and Shrubs. (LS-8)

Competency: plants trees and other plants, using sound horticultural practices.

Behavior Statement: student plants one balled and burlapped shrub and one bare-root shrub by:

- (1) digging a hole of proper dimension.
- (2) preparing soil for planting, mixing peat, gypsum, and other additives.
- (3) setting root ball at proper level; or distributing bare roots symmetrically.
- (4) filling in with prepared soil to previous ground level.
- (5) watering thoroughly.

Conditions: student performs at training station, or on the school grounds or garden site; instructor provides shrubs, tools and supplies needed.

Requirements: performance is watched closely by instructor or supervisor to observe technique. Correct use of tools and supplies, proper planting depths, and careful handling of plants are essential.

30. Title: Preparation of Gardens for Planting. (LS-9)

Competency: prepares soil for beds and gardens, adding fertilizer, organic matter, and other additives.

Behavior Statement: at a designated small garden plot the student: (1) evaluates soil conditions and probable drainage slope; (2) determines fertilizer and other needs, if any; (3) assembles materials and tools; (4) spreads and rototills additives into top soil; (5) levels to obtain desired drainage.

Conditions: tools, supplies and garden plot provided by the instructor; performed at a time when soil is suitable for working.

Requirements: kinds and quantities of substances added are in agreement with the instructor estimates; uniform distribution and thorough mixing of materials is obtained; ground line is graded and ready for planting.

31. Title: Establishing a Lawn. (LS-10)

Competency: prepares soil mix and seedbed for lawn area; seeds, sods, plugs, or sprigs.

Behavior Statement: prepares seedbed as in item 30; seeds designated area and sods, plugs, or sprigs remainder where designated.

Conditions: performance to occur on a small plot of ground designated by the instructor; supplies and equipment provided by instructor.

Requirements: student performs seeding and other planting operation designated by the instructor, cares for plot during period of establishment to include proper watering and maintaining of a protective cover.

32. Title: Bracing and Supporting Trees and Shrubs. (LS-12)

Competency: makes brace and supports for trees and shrubs using guy wires, poles, and stakes.

Behavior Statement: constructs required mechanical braces and supports for designated trees suitable for the tree conditions involved.

Conditions: tools, materials, and supplies are provided by the instructor; student performs without supervision, on instructor designated trees and shrubs.

Requirements: the supports and braces constructed must provide required support and be sufficiently durable to last until the tree is established or recovers.

33. Title: Estimating Water Requirements. (LS-13)

Competency: checks soil in lawn and garden for water requirements; waters uniformly through irrigating system or by hand.

Behavior Statement: student estimates water content of soil by digging with spade or trowel and observing physical conditions in crumbling, leafing, and adherence to the trowel or space, checking a number of samples according to the size of the area evaluated; submits recommendation verbally or in writing.

Conditions: student evaluates the water requirement at a lawn or garden site and gives his recommendations to the instructor or supervisor.

Requirements: student must be thorough, obtaining a sound estimate for all parts of the area and in close agreement with instructor's estimate.

34. Title: Pruning. (LS-14)

Competency: prunes and trims trees and shrubs to improve growth or to achieve natural or artistic effects.

Behavior Statement: student prunes four to six trees and shrubs of different species to achieve natural effects.

Conditions: instructor provides tools and materials but no references are permitted; instructor designates trees and shrubs.

Requirements: pruning must be done according to accepted cultural practices for each separate cultivar designated. Instructor evaluates by close observation.

35. Title: Assisting Customers. (SA-1)

Competency: offers customers products and services; discusses problems and aids customers using horticultural knowledge.

Behavior Statement: describes verbally to the instructor the various products and services available to customers at the training station; explains their uses, advantages, and precautions in their use; discusses solutions to common customer problems as introduced by the instructor.

Conditions: student interacts with the instructor who acts as a role-

playing customer at the training station; student performs without references.

Requirements: student should accurately answer all questions about major items sold, plants, equipment and supplies, and know how to obtain items not stocked. Student should give sound horticultural solutions for instructor posed problems and questions.

36. Title: Advising Customers. (SA-2)

Competency: discusses horticultural methods with customers and recommends procedures; may give or sell books, bulletins, or leaflets.

Behavior Statement: discusses horticultural methods and recommends practices to solve common customer problems; recommends suitable USDA bulletins, extension leaflets, commercial pamphlets, etc.

Conditions: student interacts with the instructor who acts as a role-playing customer at the training station; performs without references.

Requirements: student discusses problems logically and makes sound recommendations and/or identifies helpful references.

37. Title: Demonstrating Lawn and Garden Equipment. (SA-3)

Competency: gives customers instructions and demonstrates the use and maintenance of lawn and garden equipment.

Behavior Statement: states to the instructor the operating instructions for several designated items of lawn and garden equipment; discusses the proper procedures for care and maintenance; demonstrates the operation and maintenance of equipment.

Conditions: performs in a role-playing situation at the training station without references; instructor plays the customer role.

Requirements: student should show that he knows how to give operating instructions clearly and accurately, and can instructively demonstrate

the use and maintenance of designated equipment.

38. Title: Writing Cultural Instructions. (SA-4)

Competency: prepares written instructions or provides leaflets to customers on planting and care of plants and supplies purchase.

Behavior Statement: composes brief instruction statements about the planting and care of designated trees, shrubs, and bedding plants.

Conditions: using library, text materials, and other sources available; performs as a course assignment out-of-class.

Requirements: student accumulates information and composes statements of a quality suitable to be attached to plants or to be distributed to customers.

39. Title: Landscaping Services.(SA-5)

Competency: answers customer landscaping inquiries; arranges for appointments.

Behavior Statement: receiving customer in the sales yard or the store student answers inquiries and discusses landscaping services available; arranges for appointment with the landscape specialist.

Conditions: performance is under actual conditions with instructor role-playing as the customer; references limited to those normally available in the sales area.

Requirements: satisfactory performance includes: confident bearing, correct answers, and good report. Arranging appointment should include accurate recording\*on the appointment schedule.

40. Title: Garden Center and Nursery Merchandise Display. (SA-6)

Competency: displays plants, garden supplies, and equipment to encourage sales.

Behavior Statement: construct a commercially acceptable outdoor display,



using nursery plants, garden supplies, and lawn and garden equipment:

(1) clear area for the display and arrange background; (2) construct or otherwise prepare a stage or props; (3) assemble materials and equipment in an aesthetically pleasing way; (4) attach price tags, signs, and labels prominently.

Conditions: using common carpentry tools and materials and merchandise provided by the instructor, performs out-of-doors in a sales yard or similar area.

Requirements: student completes an acceptable commercial display within a flexible time limit depending upon the extent of materials provided.

41. Title: Landscaping Advice. (SA-7)

Competency: assists customer in making landscape decisions; advises on plants for desired uses.

Behavior Statement: given a simulated customer landscaping problem, the student writes a description of the landscape work to be done, plant materials to be used, and the overall design concept recommended to meet the customer's desires.

Conditions: problem presented and performance initiated at a residential site; performance continued in laboratory; references permitted.

Requirements: performance is complete when student submits a written description of his recommendations to the instructor; no sketches or diagrams required.

42. Title: Landscape Cost Estimate. (SA-6)

Competency: prepares landscape planting and construction cost estimates.

Behavior Statement: given a list of materials for plants and supplies and a landscape plan, student writes up a cost estimate for landscape job including cost of labor.

Conditions: performs in the classroom with catalogs, price lists and other references, in addition to the list of materials and landscape plan.

Requirements: complete a cost estimate within 10 percent of overall estimate and 20 percent on individual costs compared with instructor's solution.

43. Title: Landscape Planning. (SA-9)

Competency: draws up landscape planting and construction plans to detailed specifications.

Behavior Statement: takes measurements, inspects grounds and soil at a residential site; draws up landscape planting and construction plans with detailed specifications.

Conditions: measurements taken and data obtained at the residential site designated by the instructor; drawing and specification details prepared in laboratory with equipment and materials provided by the instructor.

Requirements: develop an accurate detail plan suitable for commercial use, as evaluated by instructor.

44. Title: Landscape Design Drawing. (SA-10)

Competency: sketches artistic illustrations interpreting mature landscape.

Behavior Statement: using the landscape plan in item 43, student draws an elevation sketch and any supplemental illustrations needed to interpret complex planting or construction areas.

Conditions: performed in the laboratory with materials and equipment and references provided.

Requirements: complete, attractive, and authentic interpretations illustrating the mature development of the landscape, suitable for commercial use as evaluated by the instructor.

45. Title: Landscape Contracts. (SA-11)

Competency: writes up landscape contracts to include planting and construction materials and specifications, labor requirements, and services to be rendered.

Behavior Statement: in conjunction with items 42, 43, 44, and 45 assembles data and materials and writes up a landscaping contract.

Conditions: performed in the laboratory; references permitted, plus all problem data presented by the instructor and student materials developed for items, 42, 43, 44, and 45.

Requirements: performance is satisfactory with completion of accurate written statements describing the work to be performed and materials and labor to be provided, plus needed attachments and illustrations.

46. Title: Making Sales Transactions. (SA-12)

Competency: writes up sales slips and sales contracts recording sales transactions.

Behavior Statement: prepares sales slips and/or conditional sales contracts for several sales situations, recording the transactions on the cash register or on a customer account record.

Conditions: students, as role-playing participants, test a student's ability to correctly perform the required tasks; materials provided by the instructor in the classroom or laboratory.

Requirements: correct recording of each transaction is required. Instructor observes student performance and evaluates recorded data.

47. Title: Making Cash Register Sales. (SA-13)

Competency: receives and records cash and check receipts through the cash register or cash drawer.

Behavior Statement: receives cash or checks from customer role-player,

rings up the receipt on the cash register, and gives correct change to the customer role-player.

Conditions: performs in a role-playing situation with other students participating as customers; materials and equipment provided by the instructor in the laboratory.

Requirements: record the transactions correctly on the cash register and make correct change to the customer.

48. Title: Credit Transactions. (SA-14)

Competency: handles credit transactions according to policies of the firm.

Behavior Statement: student writes answers to the following test items:

- (1) What are the requirements for a sound credit policy?
- (2) How can you find out about a customer as a credit risk?
- (3) How would the credit policy of a garden center sales store and a landscape construction firm differ?

Conditions: student performs in the classroom in a test situation.

Requirements: correctly answered test items, including the following:

- (1) Requirements listed as given in class discussion and references.
- (2) Statement identifies credit bureau, banks and businesses as well as procedures to follow.
- (3) Student states suitable credit terms and methods of transferring credit risk.

49. Title: Management Problem-solving. (MA-1)

Competency: solves problems, selecting alternatives based on efficiency and economy, and drawing upon past training and experience.

Behavior Statement: student writes his solution to test items that require: (1) Description in writing of the elements of a problem solving

procedure for a supervisor. (2) the student is to identify from several local problem solving situations in case studies the problem solving sequences involved and the alternatives available, and to derive from these case studies suitable solutions in terms of efficiency and economy.

Conditions: performance is in the classroom with test and materials provided by the instructor.

Requirements: (1) a clear statement indicating a sound understanding of the problem solving procedure; (2) solutions which show an ability to use problem solving methods as evaluated by the instructor.

50. Title: Planning Production Methods. (MA-2)

Competency: evaluates capability and capacity to produce; introduces mechanization and other labor saving methods.

Behavior Statement: student analyzes a production problem at the training station involving a number of processing and handling operations and develops a solution in writing including mechanization and labor-saving techniques.

Conditions: instructor, or supervisor at the training station, presents an existing production problem to the student; student may use any equipment available at the training station or may supplement (with justification) with commercially developed equipment, materials, or devices.

Requirements: student solution should be innovative and sound, supported with evidence of improvements in costs and efficiency over alternatives.

51. Title: Developing Procedures. (MA-3)

Competency: establishes procedures and steps to implement approved plans.

Behavior Statement: the student develops in writing a detailed procedure that will accomplish the production effort needed to reach a production goal.

Conditions: the production decision (goal) is presented by the training station supervisor and the student develops a procedure within the capabilities of the training station that will achieve this goal.

Requirements: the quality of the procedure the student develops will be measured by practicality, efficiency, and economy in the use of resources in relation to other activities being carried on.

52. Title: Production Scheduling. (MA-4)

Competency: establishes priorities to carry out operations and produce output as needed to meet established schedules.

Behavior Statement: presented with a schedule of forecasted sales, the student in writing develops a schedule of production that will provide the required output to meet shipment dates.

Conditions: the instructor issues the sales forecast to the student in the classroom or laboratory. References permitted.

Requirements: student solution must consider the production time needs for each crop involved. All planning must be within the capacity of the facility described by the instructor's test item.

53. Title: Work Scheduling. (MA-5)

Competency: establishes work schedules to make efficient use of labor and facilities.

Behavior Statement: given data from a typical production day, the student examines the labor and facilities available and the work to be accomplished; recommends a work schedule for that day.

Conditions: performed at the training station; recommendations may be given verbally to the training station supervisor.

Requirements: recommended work schedule must assure reasonable possibility of the work being performed proficiently and make efficient use of

labor and facilities.

54. Title: Budget Planning. (MA-6)

Competency: analyzes costs from operations and budgets for future costs.

Behavior Statement: student analyzes costs of past operations in relation to future production plans and computes and submits in writing a budget for future operations.

Conditions: performed in the classroom or laboratory; cost data from past operating periods including labor, materials, equipment rental, depreciation, land, etc. provided by the instructor; references permitted.

Requirements: budget must be realistic and arise from records of past cost experience; changes for costs of proposed operations must be justified.

55. Title: Manhour Planning. (MA-7)

Competency: computes labor needs for various operations and prepares estimates of manhour requirements.

Behavior Statement: student computes and presents in writing manhour estimates for the performance of operations actually existing at the training station.

Conditions: performance required in the laboratory or training station; references permitted; instructor identifies operations with situation test items.

Requirements: students compute daily and/or weekly labor needs as appropriate by each separate element in the operation and presents results in terms of manhours to be consumed.

56. Title: Ordering Plant Materials. (MA-8)

Competency: computes consumption data for materials from inventory records; computes future requirements and orders with sufficient lead times.

Behavior Statement: provided with simulated inventory records and planning data student: (1) compiles consumption data; (2) computes the requirements for five common nursery plants; (3) prepares orders and assigns shipping dates.

Conditions: work performed in the classroom; instructor provides a packet of records, consumption data, catalogs, price lists, and forms.

Requirements: orders should be accurate and neatly prepared and shipping dates assigned that assure timely arrival, yet minimum storage costs; figures should be within 10 percent of instructor's solution.

57. Title: Scientific Method. (Ma-9)

Competency: studies cultural practices for improved efficiency; tests and implements new methods.

Behavior Statement: student evaluates cultural practices; recommends an improved method or practice for one; tests this proposed improvement on a sample test plot.

Conditions: student evaluation occurs at the training station; recommendation approved by the instructor before proceeding with testing; experiment performed at training station or in school facilities.

Requirements: student proceeds scientifically, identifying variables and establishing controls; performance evaluated mainly on the technique and the adequacy of the methods used.

58. Title: Operations Analysis.(MA-10)

Competency: studies processing and handling methods for efficient sequencing and reduced costs.

Behavior Statement: student writes an evaluation of an assigned processing operation; makes recommendations for improvements with justification based on costs or reduced costs.



Conditions: instructor assigns processing operation at training station; student studies operation as it progresses over time.

Requirements: student recommendations evaluated on thoroughness of observations, practicality, and cost reduction possibilities.

59. Title: Receipt of Supplies. (MA-11)

Competency: directs the unloading, inspecting, and counting of receipts; verifies documentation, stores properly.

Behavior Statement: student unloads, inspects, and counts receipt of a truck load shipment; stores receipts properly and verifies shipment documentation.

Conditions: student performs on a mixed truck shipment at the training station.

Requirements: proper safety and handling practices must be followed; items are inspected for damage and accuracy; shipment documentation is verified and completed; and receipts are stored in the proper location for items involved; supervisor evaluates by closely observing operation.

60. Title: Stocking Shelves. (MA-12)

Competency: moves supplies from bulk storeroom and restocks shelves in sales store or processing area.

Behavior Statement: student inspects shelves and computes restockage needs; breaks down bulk stocks in store room and carries to sales room to restock shelves; changes inventory or stockage records.

Conditions: student performs at training station according to training station stockage procedures.

Requirements: student restocks shelves with required quantities; labels and prices items correctly; posts records accurately; cleans up store-room and sales area at completion of work.

61. Title: Shipment Planning. (MA-13)

Competency: estimates transportation requirements; contacts shipping firms; plans consolidated shipments.

Behavior Statement: student computes in writing the truck transportation needs for both a single destination shipment and a consolidated shipment using weight and cube data from a shipping document; computes costs.

Conditions: instructor provides shipping document with weight and cube data to the student in the classroom; student permitted freight classification and other references.

Requirements: student uses transportation space efficiently and computes costs accurately.

62. Title: Hiring Procedures. (MA-14)

Competency: interviews and helps make hiring decisions; evaluates worker performance; recommends personnel actions.

Behavior Statement: student interviews a prospect, accumulates needed personnel data, and recommends hiring decision.

Conditions: prospects are role-playing students instructed regarding their qualifications and other personnel information; performance occurs in the classroom or laboratory.

Requirements: student performance requires accumulation of sufficient data and information to justify his employment recommendation to the instructor; final recommendation may be submitted verbally or in writing.

63. Title: Supervising. (MA-15)

Competency: instructs employees in their work and clarifies procedures.

Behavior Statement: student instructs employees in the work they are to perform and describes the procedures to be followed:

Conditions: student receives work information beforehand for study; he

gives instruction in front of class and observing instructor.

Requirements: acceptable student performance requires clear instructions, easily understood as evaluated by observing instructor.

64. Title: Leadership. (MA-16)

Competency: assigns duties, leads work crew, coordinates work to achieve company goals.

Behavior Statement: criticizes, in writing, a case study of a local problem concerning the assignment of duties and leading of a work crew in a retail nursery and the relating of this work to company goals.

Conditions: at the close of considerable leadership and supervision training, student writes his critique in the classroom (having had some experience with the case study method).

Requirements: performance is acceptable when student's critique of case study demonstrates a thorough grasp of the principles of leadership and techniques involved in leading.

65. Title: Employee Relations. (MA-17)

Competency: hears worker problems and assists to enhance morale and efficiency.

Behavior Statement: student, presented in writing with a worker's problem, writes out a solution.

Conditions: student solves the problem as a classroom test item by using company policy data provided by the instructor and prior training received.

Requirements: solution must be one with a high probability of enhancing morale and efficiency, but stays within the limits of company policy and responsibilities.

66. Title: Cost Data Accumulation. (RK-1)

Competency: accumulates production, sales, and operating expense data by department; reports or has it recorded.

Behavior Statement: student sorts documents and lists income, expenditures, obligations by department when given a packet of sales slips, bills, purchase orders, receipts, and similar documents.

Conditions: performance in the laboratory; instructor issues a packet of documents similar to those received in a week's operation in a nursery business. Student may use references.

Requirements: student must return documents to instructor with cost and income data categorized and consolidated and any document discrepancies corrected.

67. Title: Manhour Data Accumulation. (RK-2)

Competency: accumulates time and performance data for workers to assure accurate payroll records.

Behavior Statement: accumulates and categorizes manhour and piecework data by employee from data received and submits a manhour data report.

Conditions: instructor issues a packet of manhour and performance information in the classroom or laboratory.

Requirements: student correctly sorts information and submits in writing accumulated manhour and performance information recorded accurately by employee with an analysis of data and an itemized list of corrected discrepancies.

68. Title: Recording Inventory Data. (RK-3)

Competency: keeps records of results of inventory of plant materials and merchandise.

Behavior Statement: prepares inventory records; posts inventory data to the records; writes an analysis of inventory status from records and in-

formation received.

Conditions: student works in the laboratory with a packet of inventory records, receipts, sales slips, purchase orders, etc. issued by the instructor. May use references.

Requirements: must accurately post and balance inventory records and give in writing an analysis of the status of all items in the inventory records.

69. Title: Customer Service Records. (RK-4)

Competency: records and files contracts and work orders, cumulatively, for customers, including guarantees and services.

Behavior Statement: posts file folders and makes record forms; posts records with customer data; files papers, contracts, and warranties.

Conditions: from a packet issued by the instructor in the laboratory, sorts and assembles data and posts records.

Requirements: must submit a correctly prepared and accurately posted and filed set of customer service records.

70. Title: Crop Records. (RK-5)

Competency: maintains cumulative crop records; uses in planning and preparing future production.

Behavior Statement: prepares crop records and posts cumulative data for an assigned crop.

Conditions: instructor provides data sheets and materials; data accumulated from assigned crop at training station.

Requirements: student accumulates crop data from assigned crop on written record as it occurs over entire production period. At completion, records should reflect all important data needed for future planning. Performance evaluated by training station supervisor.

71. Title: Pesticide and Fertilizer Treatment Records. (RK-7)

Competency: maintains data on application and use of fertilizer, insecticides, and other chemicals.

Behavior Statement: prepare in writing a detailed report covering the preparation, application, purpose and results obtained in the use of five fertilizers and a combination of ten insecticides and/or fungicides.

Conditions: prepare data sheets from actual experiences at the training station and laboratory practice.

Requirements: data sheets must be complete enough to be able to reproduce the treatments and know results to anticipate.

72. Title: Tractor Operation. (EO-1)

Competency: operates tractors and attachments skillfully in performing such tasks as tilling, planting, cultivating, and digging.

Behavior Statement: operates a small to medium tractor with attachments to demonstrate in a field or nursery row the tasks of tilling, planting, cultivating, and digging in conjunction with items 74, 75, and 76.

Conditions: at the school garden or the training station, student performs with equipment provided by the instructor.

Requirements: operates equipment and attachments skillfully, safely, and with preciseness in each operation; operations may be performed at separate times.

73. Title: Grading Equipment. (EO-2)

Competency: operates heavy equipment for grading, ditching, and digging.

Behavior Statement: operates specialized heavy equipment to perform grading, ditching, and/or digging operations.

Conditions: equipment provided by instructor or training station supervisor.

Requirements: performs each of the operations skillfully, safely, and with preciseness; instructor or supervisor evaluates by observing.

74. Title: Before Operation Equipment Check. (EO-4)

Competency: checks condition of equipment before operation, secures attachments to power unit, fuels, and lubricates.

Behavior Statement: checks equipment over before operation, starting and testing to assure proper performance; attaches securely the equipment train; fuels and adds lubricant as needed; performs in conjunction with items 72, 75, and 76.

Conditions: performs on equipment with defects known by the instructor.

Requirements: makes check in accordance with checklist; corrects defects and prepares equipment for safe and efficient operation.

75. Title: In-operation Equipment Check. (EO-5)

Competency: performs in-operation check on equipment to assure continued proper operation.

Behavior Statement: performs in-operation checks to insure continued and safe operation of equipment and attachments; i.e., checks fuel, tightens parts, checks latches and other connections.

Conditions: performs under close observation of the instructor or the training station supervisor; performs in conjunction with items 72, 74, and 76.

Requirements: completes checks during operation in accordance with the instructor checklist.

76. Title: After Operation Equipment Check. (EO-6)

Competency: shuts down equipment after use, performs cleaning and adjustment tasks, and stows correctly.

Behavior Statement: shuts down power unit; detaches attachments; cleans

and adjusts; and stows and parks in assigned locations.

Conditions: performs under close observation of instructor or training station supervisor; in conjunction with performance of items 72, 74, and 75.

Requirements: completes after operation checks in accordance with instructor's checklist.

77. Title: Safety with Hand Tools. (EO-7)

Competency: exercises proper safety precautions when using hand tools, garden tools, carpentry tools, and masonry tools.

Behavior Statement: uses safely and takes necessary safety precautions for himself and others when using and handling hand tools, garden tools, carpentry tools, and masonry tools.

Conditions: performs under close observation of training station supervisor; in conjunction with item 80.

Requirements: prudently exercises safety precautions, employing safety methods, safety guards and other devices habitually; evaluation over an extended period of time.

78. Title: Protective Clothing and Devices. (EO-8)

Competency: when operating tools and equipment uses appropriate protective clothing, masks, gloves, goggles, etc.

Behavior Statement: uses appropriate protective clothing and other protective devices; i.e., masks, gloves, goggles, etc. when operating tools and equipment.

Conditions: performs under the extended close observation of the training station supervisor or instructor; in conjunction with item 81 and 82.

Requirements: habitually uses the correct protective clothing or devices for the tools and equipment used; evaluation over an extended period of



time.

79. Title: Safety with Power Equipment. (EO-9)

Competency: observes correct safety rules when operating tractors, attachments, and other power equipment.

Behavior Statement: operates tractors, attachments and other power equipment safely, taking necessary precautions for himself and others.

Conditions: performs under the extended close observation of the training station supervisor or instructor; in conjunction with items 72 and 73.

Requirements: habitually exercises the proper safety precautions when using equipment; evaluation covers an extended period of time.

80. Title: Hand Tool Selection and Use. (EO-10)

Competency: selects and uses correctly the appropriate hand, garden, carpentry, or masonry tools for the job to be performed.

Behavior Statement: evaluates tasks to be performed; determines and selects the appropriate tools for the work; uses the hand, garden, carpentry, or masonry tools in the approved manner for the tasks to be performed.

Conditions: performs under the extended observation of the training station supervisor or instructor; in conjunction with item 77.

Requirements: consistently selects the proper tools and uses them skillfully and safely; evaluation covers several task performances sampling a major portion of the tools he has been trained to use.

81. Title: Operating Powered Garden Tools. (EO-11)

Competency: operates power mowers, edgers, trimmers, and attachments skillfully.

Behavior Statement: student skillfully operates power mowers, edgers,

trimmers, sprayers, and attachments in appropriate tasks for landscaping and nursery work.

Conditions: performs under the close observation of the instructor or the training station supervisors.

Requirements: operates equipment skillfully; evaluation covers a number of tasks to permit sufficient opportunity to observe student capability.

82. Title: Operating Pruning and Trimming Tools. (EO-12)

Competency: uses hand and powered pruning and trimming tools skillfully, as well as climbing hooks, belts, slings, and ropes.

Behavior Statement: student skillfully operates and uses pruning and trimming tools and devices such as climbing hooks, belts, slings, and ropes when performing tasks in landscaping and nurseries.

Conditions: performs at training station or school grounds under close observation of instructor.

Requirements: operates equipment skillfully; evaluation covers a number of tasks to permit the instructor to observe student ability closely.

83. Title. Pipe Fitting and Plumbing. (EO-13)

Competency: uses pipe fitting and plumbing tools to thread, connect, adjust, dismantle, and join.

Behavior Statement: makes a project that requires the procedures of threading, connecting, adjusting, joining with common irrigating valves, and other plumbing hardware.

Conditions: performs in school workshop on student project which demonstrates skills in all procedures; instructor evaluates performance and project.

Requirements: project should show that procedures have been used properly; results obtained in project must satisfy minimum standards for

plumbing in nurseries.

84. Title: Setting up Irrigation Lines. (EO-14)

Competency: carries irrigation pipe; lays in a pattern and connects valves and sprinkler head.

Behavior Statement: (1) writing in class and with drawings describes a workable layout for a temporary pipe irrigation pattern; lists all parts and illustrates where used; (2) in shop project connects valves and sprinkler heads to an irrigation line.

Conditions: writes up irrigation problem solution in the classroom; demonstrates the connecting of valves and sprinkler heads in the laboratory.

Requirements: solution to irrigation problem must be workable and efficient as judged by the instructor. The connecting project must pass inspection and testing by the instructor.

85. Title: Operating an Irrigation System. (EO-15)

Competency: controls water flow through irrigation system, adjusting valves, changing pressure, assuring uniform water distribution.

Behavior Statement: operates irrigation system, effectively controlling water flow by adjusting valves and water pressure.

Conditions: performs at the training station or school garden observed by instructor or supervisor.

Requirements: obtains uniform water distribution for irrigated plot as checked by instructor or supervisor.

86. Title: Sprayer Inspection. (EO-16)

Competency: inspects sprayer, fills tank, starts agitator, checks filter, assures proper operation.

Behavior Statement: in preparation for use, student inspects a power

sprayer, filling tank, operating agitator, examining filter, and operating sprayer attachments to assure sprayer is in operating condition; cleans and unclogs parts when needed.

Conditions: performs in school laboratory or training station; may refer to operating manual.

Requirements: puts sprayer into operation by correcting deficiencies through dismantling, cleaning and adjusting.

87. Title: Lawn and Garden Equipment Repair. (EM-1)

Competency: services lawn and garden powered equipment, fueling, lubricating, adjusting, replacing warranty units and parts.

Behavior Statement: student fuels, lubricates, adjusts and replaces parts on an item of lawn or garden equipment to place in serviceable working condition.

Conditions: instructor controls defects in items to be serviced; students may use operator manuals.

Requirements: performance is successful when required items have been replaced, servicing has been accomplished, and unit is in working condition.

88. Title: Sharpening Cutting Blades. (EM-2)

Competency: sharpens and adjusts cutting blades on lawn and garden equipment.

Behavior Statement: student removes blades from lawn and garden power equipment, sharpens, replaces, and adjusts.

Conditions: Performs operation on equipment specified by instructor; may use operator manual.

Requirements: blades must be sharpened with proper bevel, replaced, and adjusted for efficient equipment performance.

89. Title: Motor Tune-up and Repair. (EM-3)

Competency: performs minor repair on tractors and similar heavy equipment, replacing such parts as points and plugs, and cleaning and adjusting.

Behavior Statement: student performs minor motor tune-up to achieve smooth efficient motor operation to include such tasks as replacing and adjusting points and plugs, and replacing filters.

Conditions: instructor assigns equipment with known defects to the students in the workshop; operating manual references may be used.

Requirements: defects must be corrected and motor tuned to smooth efficient operation.

90. Title: Sprayer Clean-up. (EM-4)

Competency: cleans sprayer after use, i.e., tank, hose, tubes, nozzles, filters, etc.

Behavior Statement: student thoroughly cleans out the residues or spray substances from tank, hoses, nozzles and other parts of sprayer.

Conditions: performance is on a sprayer either in the workshop or at the training station; operating manual references may be used.

Requirements: instructor inspects for cleanliness of the tank and filters, and clear unobstructed tubes, nozzles, etc.

91. Title: Bracing and Supporting Protective Shelters. (EM-5)

Competency: constructs braces, guy wires, poles, and dead men anchors to support lath houses and cloth houses.

Behavior Statement: construct supports and braces including guy wires, anchors, and poles to support protective shelter.

Conditions: performs on school garden shelters or at training station on shelters as directed by the supervisor.

Requirements: construct one support consisting of guy wires, poles, and dead man anchors or similar support.

92. Title: Building Repair. (EM-6)

Competency: repairs structures by replacing damaged timbers, siding and roofing; constructs footings, replaces screens and glass.

Behavior Statement: repairs defects or damage; i.e., siding, roofing, footings, screens, windows, etc.

Conditions: performs repairs as directed by instructor or supervisor with materials and tools provided.

Requirements: performs several repair tasks, each of a different nature to demonstrate building repair ability.

93. Title: Irrigating System Repair. (EM-7)

Competency: cleans clogged sprinkler heads and lines, repacks water valves, repairs coupling devices on irrigating pipe.

Behavior Statement: cleans a clogged sprinkler head and repacks a water valve, and repairs a coupling device.

Conditions: irrigating system parts in need of cleaning and/or repair are provided by instructor in workshop.

Requirements: performance is complete when sprinkler heads are thoroughly cleaned and water valves and coupling devices repaired serviceably.

94. Title: Servicing Garden and Hand Tools. (EM-8)

Competency: lubricates, adjusts, and sharpens hand tools and garden and pruning tools.

Behavior Statement: student lubricates, adjusts, and sharpens as appropriate, a number of hand tools and garden and pruning tools.

Conditions: in laboratory or workshop instructor designates several hand tools and garden tools for the student to service.

Requirements: student must adjust, sharpen, clean, and lubricate tools so that they operate efficiently by actual test after repair has been completed.

## CHAPTER V

### SUMMARY AND CONCLUSIONS

#### Introductory Discussion

There is a diversity of topics covered by the conclusions to this study. Because of this diversity appropriate discussion has been included with each conclusion statement. However, one general comment may be useful. Much of what has been undertaken in this research has not been previously attempted in relation to ornamental horticulture training programs. Although the principles applied and the practices employed have been well established in other research, the results of this application here requires cautious interpretation. Behavioral objectives have been derived from a study of jobs in Oklahoma. Thus, similar studies outside of this area need to be accomplished before the results can be generalized to other regions.

As a first endeavor in behavioral objective writing for ornamental horticulture, the research results have clearly shown a productiveness and ease in construction from task analysis procedures. They may prove to be a valuable tool for curriculum improvement in all facets of ornamental horticulture vocational training.

#### Conclusions

1. In this study, task analysis has proven to be a useful tool for isolating competency data. The observation-interview method employed



proved to be both expeditious and thorough. It is essential in this procedure that all related jobs in an occupational area be examined at each skill level. However, success in extracting competencies from the tasks still depends largely upon the familiarity of the researcher with what the tasks entail and with stating the competency clearly in behavior terms.

2. There is indication that an ornamental horticulture curriculum paralleling the competencies found in jobs in the segment of the industry studied should be divided into the seven major organizing areas of: plant production, landscape maintenance, sales, management, record keeping, equipment operation, and equipment maintenance. The bank of behavioral objectives derived in this study also separate well into these categories, indicating a possible organizing structure on which to build enabling objectives. Such subordinate objectives would contain facts, principles, motivational training, and other aids to the attainment of behavioral objectives. Such a curriculum structure might be organized as shown in Figure 5.

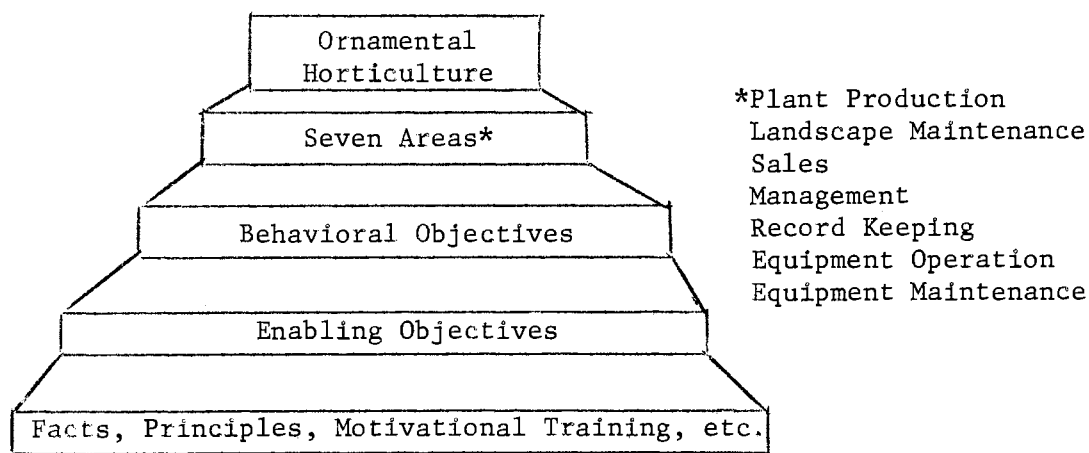


Figure 5. Curriculum Organizing Structure.

3. The bank of behavioral objectives which have been developed in this study are aimed directly at job proficiency, requiring the student to reach job entry proficiency in each job skill. They would not be easily attained through conventional discipline organized subject matter format. As depicted in Figure 4, the subject matter and student activities may demand considerable revision with innovative and inter-disciplinary approaches to assist the student to successfully reach these goals.

4. It is reasonable to expect that as written in this bank of behavioral objectives such objectives should provide the instructor with suitable criteria for evaluating student achievement. It is also expected that these objectives will add an important dimension to student learning by providing him with concrete statements of the exact goals he is expected to reach. Such statements will provide useful guidance to the student when organizing his own learning strategies. Some objectives are likely to include skills learned or partially learned elsewhere. When this information is known, the student can direct his energies toward other objectives in which he needs more development. Effective use of these objectives by the instructor may, thus, permit a considerable reduction in formal classroom training, since the student will be able to accept more responsibility for his own learning.

5. The cluster training potential of a job competency was revealed in this study through the concurrence survey with the industry. This potential provides a useful measure for separating out those objectives that can be reached efficiently in group training. It was isolated by having the characteristics of a high arithmetic mean and a narrow standard deviation as computed from statistically analyzed responses. In

much the same way a concurrence survey of industry tends to indicate for the remaining competencies an adaptability to individualized instruction or self-teaching techniques.

6. An often heard complaint against conventional discipline-oriented curriculum is lack of relevance. In vocational training organized around job competencies, such complaints can be greatly reduced by identifying those competencies which with industry concurrence do not constitute a significant skill for workers to acquire. Such a measure can be obtained through statistical analysis of industry concurrence survey responses. Responses resulting in a low mean and a narrow standard deviation would indicate that the competency could not be defended for inclusion in the curriculum.

7. A conclusion readily drawn from this study is that behavioral objectives for ornamental horticulture vocational training programs can be written with considerable ease directly from job competency statements. Certain cautions must be considered to do this successfully: (1) the broadening of competency statements to incorporate closely similar expressions may sometimes be necessary to prevent the fragmentation of behavior statements; also, (2) the measuring of the student performance and the instructor's activities must be adapted to a training situation, yet must still result in student acquisition of the identical job skill expressed in the original competency statement.

#### Recommendations

Some recommendations appear to be appropriate regarding the use of the results of this study and the direction that future research should take to expand upon what has been achieved. Three such recommendations

come to mind and are suggested here.

1. Although the behavioral objectives have been drawn from reliable industry sources and their applicability to training programs in Oklahoma is apparent, prior to use they should be tested. Preferably this should be accomplished side by side with conventional curricula to measure such aspects as improvement in student job performance, reduced training time, ease of student learning, and adaptability to the training situation, teaching methods, and resources available.

2. The successful implementation of the behavioral objectives developed in this study will depend heavily upon the quality of enabling objectives which must now be developed to guide student learning up to these terminal objectives. Pertinent facts, principles, motivational training, and other aids must be incorporated appropriately to lead the student through a series of learning experiences preparing him for the final terminal objective performance.

3. This study has covered those aspects of ornamental horticulture training concerned with nurseries, garden centers, and landscaping firms. It should prove productive to make a task analysis of the two remaining areas: greenhouse production of flowers and other ornamental plants, and flower shop sales and design. Probably the competencies in sales and management would be similar to the type of businesses already studied. In greenhouse production the plant production, equipment maintenance, and equipment operation competencies also may be similar.

Some additional comments may be appropriate as regards the implications of results derived from this study. One such comment concerns the statement made by industry participants on numerous occasions. They have stated that an urgent need exists for skilled workers in ornamental horti-

culture businesses. It was their concensus that post-secondary school training in ornamental horticulture as envisioned in this study could provide the needed skilled workers. Apparently new employees seldom possess the desired skills, and this was attributed by some in the industry to a lack of appropriate skills training in horticulture programs. Although this may in part occur, a more probable cause is the lack of programs to teach horticulture in the first place. The behavioral objective approach to skills training may provide a way to establish small programs for one or a few individuals wherever student-worker needs for such training is indicated.

Another comment also concerns the demand for skilled workers. The largest demand for these workers in the selected occupations studied is apparently for those highly skilled in production methods and in performing business functions. Achieving the behaviors in the behavioral objective bank in this study will assure the achievement of those skills (See Figure 4). Plans to expand horticultural training in Oklahoma, certainly long overdue, should aim directly at preparation of persons for entry into the industry at the skilled technician level. This is the very level in which no training currently exists. Those behavioral objectives can serve as a ready data source for developing such a curriculum. In fact it would now be appropriate to develop immediately an innovative behaviorally-oriented curriculum in this field. There are strong indications that such a program will prepare students more directly and efficiently for their work.

In practice by associating behavioral objectives with the skills which workers must have for a successful employment experience, it is hoped that they will provide a proper base for occupational training.

Without concrete empirical evidence to prove that these objectives will achieve what it is purported that they should achieve, it is questionable that full reliance should be placed on them. Useful measures derived from industry concurrence surveys, as pursued in this study, indicate possible directions for developing mathematical validating models. Probably just as important are measures that would provide a quality evaluation of behavioral objectives, pointing up the learning potential that an objective has for a particular student. Also a hierarchy relationship between objectives for a curriculum could provide a means for sequencing learning experiences. Such a model might well be based on the taxonomies of learning, where higher levels of cognitive and psychomotor learning would produce higher quality values.

Much has been said about the need for great specificity in writing behavioral objectives. The purposes served in skill development certainly justify the application of this axiom to the minutiae of enabling objectives. However, in the formation of a bank of terminal objectives, little purpose is served in such a limiting practice. It would appear to be far more valuable to write behavioral objectives carefully so that they might be readily implemented in many regions and diverse situations. There is little enough time now for the agriculture teacher to get his present tasks accomplished without adding behavioral objective construction studies to his workload. Instead, the dilemma of tight schedules and heavy workloads may well be eased considerably by providing him with a bank of ready-to-use behaviorally structured modules of instruction. This would greatly reduce the time now spent in preparation for formal instruction, as well as open new avenues for individually paced learning experiences for each student.

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## APPENDIX A

## TASK IDENTIFICATION LIST

## PLANT PRODUCTION

- \_\_\_ Propagates plants by seed, cuttings, layerage or grafts.
- \_\_\_ Plants and cares for nursery stock in greenhouses, hotbeds, etc.
- \_\_\_ Digs trees and shrubs and prepares for storage or shipment.
- \_\_\_ Pots young plants in containers & balls and burlaps for shipment.
- \_\_\_ Transplants trees and shrubs bare-root for growing on.
- \_\_\_ Cares for trees, shrubs and other plants in nursery or sales
- \_\_\_ Sprays and dusts plants using both hand and power equipment
- \_\_\_ Sprays foliar fertilizer to improve growth.
- \_\_\_ Lays and adjusts irrigation pipe & attach sprinkler heads.
- \_\_\_ Insures a uniform distribution of water through irrigation system.
- \_\_\_ Analyzes plant symptoms and soil & water conditions or has made.
- \_\_\_ Investigates effects of spray, fertilizer or other chemicals.
- \_\_\_ Tags plants with proper names & prices.
- \_\_\_ Assembles, grades and bunches plants for shipment or storage.
- \_\_\_ Wraps and packs plant material in boxes, cartons, barrels & crates.
- \_\_\_
- \_\_\_
- \_\_\_
- \_\_\_

## LANDSCAPE MAINTENANCE

- \_\_\_ Constructs landscapes to contract specifications.
- \_\_\_ Grades land, installs drainage and prepares soil for planting.
- \_\_\_ Digs holes and trenches for plantings, drainage and culverts.
- \_\_\_ Prepares soil mixes and applies fertilizers and mulches.
- \_\_\_ Seeds, sods, plugs and sprigs lawns.
- \_\_\_ Plants according to individual depth, soil mix & fertilizer needs.
- \_\_\_ Cultivates, fertilizes and sprays trees, shrubs and gardens.
- \_\_\_ Mows, trims, fertilizes, sprays and cleans lawns.
- \_\_\_ Waters & irrigates lawns, gardens, shrubs and trees.
- \_\_\_ Builds and repairs garden borders, fences, gates and walls.
- \_\_\_ Installs and repairs walks, patios, and driveways.
- \_\_\_ Prunes and trims shrubs and trees.
- \_\_\_ Repairs and treats damaged and diseased trees and shrubs.
- \_\_\_ Climbs trees for pruning and repairing; uses climbing hooks and belts.
- \_\_\_ Braces and supports trees and shrubs with guy wires and poles as needed.
- \_\_\_ Injects herbicides into trees and shrubs to kill them.
- \_\_\_ Fells and removes trees & shrubs.
- \_\_\_
- \_\_\_
- \_\_\_
- \_\_\_

## EQUIPMENT OPERATION

- \_\_\_ Uses garden hand tools skillfully.
- \_\_\_ Uses hand tools for connecting adjusting and dismantling.
- \_\_\_ Uses powered lawn, garden and pruning equipment and tools.
- \_\_\_ Uses some carpentry and masonry tools.

## EQUIPMENT MAINTENANCE

- \_\_\_ Services and does minor repair on tractors and similar equipment.
- \_\_\_ Services and repairs gasoline or electric powered lawn and garden power tools and equipment.
- \_\_\_ Cleans and adjusts power sprayer; checks and fills sprayer tank.
- \_\_\_ Sets up, operates, adjusts and

## TASK IDENTIFICATION LIST (Continued)

## EQUIPMENT OPERATION-cont'd

Operates garden tractors, attachments and towed equipment.  
 Operates farm equipment for tilling, cultivating and digging.  
 Operates materials handling equipment and devices.

## EQUIPMENT MAINTENANCE-cont'd

repairs sprinkler irrigating system

## MANAGEMENT

Participates in planning production of nursery stock.  
 Motivates workers, resolves worker problems and recommends personnel action.  
 Plans operations, estimates man-hour requirements and establishes procedures  
 Receives and stores supplies and materials.  
 Solves problems in production, storage, processing & shipping.  
 Evaluates practices and handling methods for efficiency & economy.  
 Plans work schedules, assigns duties, and  
 Plans packing, storing & shipping operations.  
 Makes estimates and prepares orders for seed, bulbs, plants, fertilizer, pesticides and other supplies.  
 Participates in hiring & training of employees.

## SALES

Sells lawn and garden plants, supplies and equipment.  
 Prepares sales slips or sales contracts and records sale, receives payment or credit authorization.  
 Schedules customer appointments, makes job estimates and keeps customer service records.  
 Sets up displays of plants and garden supplies & equipment.  
 Advises customers on landscaping plans and in use of plant material.  
 Displays, instructs customers of garden tools and equipment  
 Consults with customers advising them proper horticultural practices.  
 Prepares landscape designs and cost estimates.  
 Prepares and provides customers with instructions on planting and care of trees, shrubs and other plants.

## RECORD KEEPING

Keeps worker time & production records.  
 Keeps records of operating expenses: labor, materials repairs, parts, etc.  
 Keeps records of spray, fertilizer, and other applications &

## ADDITIONAL DUTIES AND TASKS

## TASK IDENTIFICATION LIST (Continued)

## RECORD KEEPING-cont'd

## ADDITIONAL DUTIES-cont'd

treatments to include quantity,  
dates and kinds.

Computes costs and profits from  
operations and budgets future  
operations.

Conducts inventories, prepares  
merchandise orders and restocks  
shelves.

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## APPENDIX B



## INSTRUCTION SHEET

## Ornamental Horticulture Technician

Job Competency Evaluation

Several pages are attached containing statements describing the work skilled employees perform in nursery, garden center and landscaping firms. These Statements are called job competencies. Their importance to individual jobs and the work of the firm varies from business to business. A few can readily be identified as important in all jobs and others only with one or few jobs.

In order to develop valid course objectives for training ornamental horticulture technicians, all the important competencies need to be identified to insure inclusion. You will note that a rating scale 4 3 2 1 0 is prefixed to each job competency. If the statement identifies a highly important competency in your business, you should circle the number 4. If it identifies one of no significance in the work performed in your business, you should circle the zero. The numbers in between provide a graduation by which you can reflect the significance of competencies which fall between the extreme points as far as the work in your business is concerned.

If, as you proceed with rating the job competencies, you find that one of some importance to your business has not been included, please enter it at the end of the listing where you will find blank spaces set aside for this purpose.

Before proceeding further would you please circle the basic function that most nearly describes your business in the following list:

Wholesale Nursery  
Nursery Sales  
Garden Center Sales  
Garden Center and Landscaping  
Landscaping  
Nursery and Landscaping

Every effort has been made to assure complete security in the handling of this information. After you have completed the questionnaire, if you will kindly place it in the self-addressed postage paid envelope, it will return to us without your identification. However, if you should like to identify your business with us, it may prove helpful in further communications. In any case please be assured that the information you provide us will be held in the strictest confidence.

At the end of the questionnaire you will find space to write us your comments, opinions, suggestions, or criticisms regarding our study. We sincerely urge you to share your thoughts with us.

# JOB COMPETENCIES

## PLANT PRODUCTION

- 4 3 2 1 0 Operates propagation or production unit, i.e., lath house, greenhouse, to control environment.
- 4 3 2 1 0 Prepares stock plants, plant material and seed for propagation, storage or other treatment.
- 4 3 2 1 0 Propagates by cuttings, layerage, and graftage in large quantities.
- 4 3 2 1 0 Prepares soil mixes for stockpiles and planting beds using synthetic additives, fertilizers and organic materials.
- 4 3 2 1 0 Prepares soil for planting by sterilizing or fumigating, and adding a correct amount of moisture.
- 4 3 2 1 0 Plants in nursery row, garden beds, or containers, distributing roots and setting at correct depth and distances.
- 4 3 2 1 0 Evaluates watering needs and irrigates by hand or through irrigating system.
- 4 3 2 1 0 Evaluates fertilizer needs by stage of growth, symptoms, or testing and applies fertilizer by various methods.
- 4 3 2 1 0 Inspects plants, identifies symptoms, determines causes, and decides on corrective measures.
- 4 3 2 1 0 Prepares plant specimens and collects samples of soil and water, tests and makes trial treatments, or sends to a testing agency.
- 4 3 2 1 0 Performs common cultural practices, such as cultivating, weeding, mulching, and cleaning up debris.
- 4 3 2 1 0 Applies chemicals by spray or dust to control diseases, pests and weeds.
- 4 3 2 1 0 Mixes insecticides, fungicides, herbicides, fertilizers and other chemicals in correct proportions and strengths for specific treatments and plants.
- 4 3 2 1 0 Safely disposes of spray chemicals and residues preventing contamination.
- 4 3 2 1 0 Identifies plants by cultivar, grade and quality; separates large quantities rapidly.
- 4 3 2 1 0 Assembles plant material and packs individually, in bunches, in containers, and in palletized loads for shipment.
- 4 3 2 1 0 Carries or conveys large numbers of transplants, handling without damage, and spaces correctly in beds or on storage dunnage.
- 4 3 2 1 0 Organizes materials and equipment in work areas for efficient transplanting, propagating and other operations.
- 4 3 2 1 0 Prepares plants for transport: tags and ties tops, burlaps and twines root ball, and/or places in bags, boxes, or other containers.
- 4 3 2 1 0 Digs plants either bare-root or with soil ball, removing adequate root system and burlapping for protection.
- 4 3 2 1 0 Prunes tops of plants when transplanting if root/top balance requires.

## LANDSCAPE MAINTENANCE

- 4 3 2 1 0 Improves surface and subsoil drainage; installs tile, ditches and culverts.
- 4 3 2 1 0 Removes top soil, improves land contour, drainage, and appearance; replaces top soil uniformly.

- 4 3 2 1 0 Constructs and repairs walks, patios, borders, fences, etc. from materials such as wood, concrete, brick, and stone.
- 4 3 2 1 0 Climbs trees to prune and repair at high elevations; uses ropes, slings and ladders.
- 4 3 2 1 0 Repairs damaged and diseased trees and shrubs by cutting out, painting, injecting preservatives and fillers, and bracing.
- 4 3 2 1 0 Removes branches and fells trees; removes stumps and main roots; may treat with herbicides to kill.
- 4 3 2 1 0 Performs seasonal landscape maintenance; determines tools, supply and labor needs for each job.
- 4 3 2 1 0 Plants trees and other plants, using sound horticultural practices.
- 4 3 2 1 0 Prepares soil for beds and gardens adding fertilizer, organic matter, and other additives as needed.
- 4 3 2 1 0 Prepares soil mix and seedbed for lawn area; seeds, sods, plugs, or sprigs.
- 4 3 2 1 0 Covers planted lawn with mulch and protective materials until established.
- 4 3 2 1 0 Makes braces and supports for trees and shrubs using guy wires, poles, and stakes.
- 4 3 2 1 0 Checks soil in lawns and gardens for water requirements; waters uniformly by irrigating systems or by hand.
- 4 3 2 1 0 Prunes and trims trees and shrubs to improve growth or to achieve natural or artistic effects.

#### SALES

- 4 3 2 1 0 Offers customers products and services; discusses problems and aids customers using horticultural knowledge.
- 4 3 2 1 0 Discusses horticultural methods with customers and recommends procedures; may give or sell books, bulletins or leaflets.
- 4 3 2 1 0 Gives customers instruction and demonstrations on use and maintenance of lawn and garden equipment.
- 4 3 2 1 0 Prepares written instructions or provides leaflets to customers on planting and care of plants and supplies purchased.
- 4 3 2 1 0 Answers customers inquiries; arranges for appointments.
- 4 3 2 1 0 Displays plants, garden supplies and equipment to encourage sales.
- 4 3 2 1 0 Assists customers in making landscaping decisions; advises on plants for desired use.
- 4 3 2 1 0 Prepares landscape planting and construction cost estimates for customers.
- 4 3 2 1 0 Draws landscape planting and construction plans to detail specification.
- 4 3 2 1 0 Sketches artistic illustrations interpreting mature landscape appearance.
- 4 3 2 1 0 Writes up landscape contract specifications to include planting and construction materials, labor and services.
- 4 3 2 1 0 Writes up sales slips and sales contracts, recording sales transaction.

- 4 3 2 1 0 Receives and records cash and check receipts through the cash drawer.
- 4 3 2 1 0 Handles credit transactions according to policies of firm.

#### MANAGEMENT

- 4 3 2 1 0 Solves problems, selecting alternatives based on efficiency and economy and drawing on past training and experience.
- 4 3 2 1 0 Evaluates capability and capacity to produce; introduces mechanization and other labor saving methods.
- 4 3 2 1 0 Establishes procedures and steps to implement approved plans.
- 4 3 2 1 0 Establishes priorities to carry out operations and produce output as needed to meet established schedules.
- 4 3 2 1 0 Establishes work schedules to make efficient use of labor and facilities.
- 4 3 2 1 0 Analyzes actual costs from operations and budgets for future costs.
- 4 3 2 1 0 Computes labor needs for various operations and prepares estimates of manhour requirements.
- 4 3 2 1 0 Computes consumption data for materials from inventory records; computes future requirements and orders with sufficient lead times.
- 4 3 2 1 0 Studies cultural practices for improved efficiency; tests and implements new methods.
- 4 3 2 1 0 Studies processing and handling methods for efficient sequencing and reduced costs.
- 4 3 2 1 0 Directs the unloading, inspecting and counting of receipts; verifies documentation; stores properly.
- 4 3 2 1 0 Moves supplies from bulk storerooms and restocks shelves in sales store or in processing areas.
- 4 3 2 1 0 Estimates transportation requirements; contracts with shipping firms; plans consolidated shipments.
- 4 3 2 1 0 Interviews and helps make hiring decisions; evaluates worker performance and recommends personnel actions.
- 4 3 2 1 0 Instructs employees in their work and clarifies procedures.
- 4 3 2 1 0 Assigns duties; leads work crews; coordinates work to achieve company goals.
- 4 3 2 1 0 Hears worker problems and assists to enhance morale and efficiency.

#### RECORD KEEPING

- 4 3 2 1 0 Accumulates production, sales and operating expense data by department; reports or has recorded.
- 4 3 2 1 0 Accumulates time and performance data for workers to assure accurate payroll records.
- 4 3 2 1 0 Keeps records of results of inventory of plant material and merchandise.
- 4 3 2 1 0 Records and files contracts and work orders, cumulatively for customers, including guarantees and services.
- 4 3 2 1 0 Maintains cumulative crop records; uses in planning and preparing future production.
- 4 3 2 1 0 Keeps records of plant symptoms, causes, and corrective measures.

- 4 3 2 1 0 Maintains data on application and use of fertilizer, insecticides and other chemicals.
- 4 3 2 1 0 Prepares bills of lading and packing lists for use in assembling, loading, and shipping.

#### EQUIPMENT OPERATION

- 4 3 2 1 0 Operates tractors and attachments skillfully in performing such tasks as tilling, planting, cultivating and digging.
- 4 3 2 1 0 Operates heavy equipment for grading, ditching and digging.
- 4 3 2 1 0 Operates forklifts, hand trucks and conveyors to handle and stack supplies.
- 4 3 2 1 0 Checks condition of equipment before operation, secures attachments to power unit, fuels and lubricates.
- 4 3 2 1 0 Performs in-operation checks on equipment to assure proper operation.
- 4 3 2 1 0 Shuts down equipment after use; performing cleaning and adjustment tasks and stows correctly.
- 4 3 2 1 0 Exercises proper safety precautions when using hand tools, garden tools, carpentry tools and masonry tools.
- 4 3 2 1 0 When operating tools and equipment uses appropriate protective clothing, masks, gloves, goggles, etc.
- 4 3 2 1 0 Observes correct safety rules when operating tractors, attachments and other power equipment.
- 4 3 2 1 0 Selects and uses correctly the appropriate hand, garden, carpentry, or masonry tools for the job to be performed.
- 4 3 2 1 0 Operates power mowers, edgers, trimmers and attachments skillfully.
- 4 3 2 1 0 Uses hand and powered pruning and trimming tools skillfully as well as climbing hooks, belts, slings and ropes.
- 4 3 2 1 0 Uses pipe fitting and plumbing tools to thread, connect, adjust, dismantle and join.
- 4 3 2 1 0 Carries irrigation pipe, lays in pattern, and connects with vales and sprinkler heads.
- 4 3 2 1 0 Controls water flow through irrigation system, adjusting valves, changing pressure, assuring uniform water distribution.
- 4 3 2 1 0 Inspects sprayer, fills tank, starts agitator, checks filter, assures proper operation.

#### EQUIPMENT MAINTENANCE

- 4 3 2 1 0 Services lawn and garden power equipment, fueling, lubricating, adjusting, replacing warranty units and parts.
- 4 3 2 1 0 Sharpens and adjusts cutting blades on lawn and garden equipment.
- 4 3 2 1 0 Performs minor repair on tractors and similar heavy equipment, replacing parts such as points and plugs, and cleaning and adjusting.
- 4 3 2 1 0 Cleans sprayer after use, i.e., tank, hose, tubes, nozzle, filter, etc.
- 4 3 2 1 0 Constructs braces, guy wires, poles and dead man anchors to support lath houses and cloth houses.
- 4 3 2 1 0 Repairs structures by replacing damaged timbers, siding,

- and roofing; constructs footings; replaces screens and glass.
- 4 3 2 1 0 Cleans clogged sprinkler heads and lines, repacks water valves, and repairs coupling devices on irrigating systems.
- 4 3 2 1 0 Lubricates, adjusts, and sharpens hand tools and garden pruning tools.

ADDITIONAL COMPETENCIES NOT INCLUDED:

- 4 3 2 1 0 \_\_\_\_\_
- \_\_\_\_\_
- 4 3 2 1 0 \_\_\_\_\_
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- 4 3 2 1 0 \_\_\_\_\_
- \_\_\_\_\_
- 4 3 2 1 0 \_\_\_\_\_
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- 4 3 2 1 0 \_\_\_\_\_
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COMMENTS

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VITA<sup>3</sup>

Henry Vieth Griffith

Candidate for the Degree of

Doctor of Education

Thesis: FORMULATION OF BEHAVIORAL OBJECTIVES FOR TRAINING IN SELECTED  
ORNAMENTAL HORTICULTURE JOBS

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