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SETTING OBJECTIVES IN A PLANT PROPAGATION COURSE

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One educational principle is that learning is a function of perseverance, time, and teaching. The first component, perseverance is largely a personal characteristic of the learner as modified by his personal experiences and motivation. The second component, time, can be a limiting factor both when there is too little time or when there is too much (procrastination). This factor is elastic in that we can modify it.

The teaching component is complex. Whole curricula are based on the development of teachers. There are many aspects which must be studied, and the application of education theory to educating students is a practical result.

In agriculture, and specifically horticulture, we do not teach in formats designed by professional educators. Our methods follow a basic lecture and laboratory format and only occasionally do we reach out for different ways of doing things. Our clients in industry (= employers), on the other hand, are bombarded with new concepts: zero based budgets, management by objectives, systems analysis, etc. The feedback we receive from them is often contradictory to what we "educators" perceive as necessary in our product, the student.

How should we cope with the multitude of needs as perceived by us, by the employers, or by the student?

Those who have studied the processes of learning tell us, not unreasonably, that people learn best when they know

what they are supposed to learn about. In other words, we ask, what are the objectives in a given learning situation?

Our plant propagation courses function at different levels: What to do; How to do it; Why we do it; not to mention, Where and When. At each of these levels, objectives can be specified to make a task identifiable and the outcomes of performance measurable.

Almost anyone long involved in plant propagation would say that to be both proficient and efficient at making cuttings, for instance, requires a lot of practice. How much practice is enough? Is an appropriate objective that a student make 100, or 600, or 1600 cuttings? Should a time limit be imposed? Do we need to specify just how the cuttings should be collected, handled, and prepared for sticking in the propagation bed? Is it necessary to understand the difference between terminal and stem piece cuttings, or the effects of polarity on rooting?

The more we analyze the task, the more concerns we have about organizing a correct approach to teaching it. Education is notorious for ambiguity, while the "real world" functions by knowing how to measure its product, and the efficiency with which it was produced — the good old "Bottom Line."

Looking back at our instruction problem — teaching the student to make cuttings — we find a greater need to define what we are attempting to do. One very good approach is to ask, "What should the student be able to do after completing the exercise?" The answer to this question can be rephrased as an objective.

Possible statements of objectives:

1. The student shall produce 100 terminal cuttings of oleander.
2. The student will collect and prepare 100 terminal cuttings of oleander.
3. During a two-hour laboratory, the student will collect plant material from stock plants of oleander and prepare 100 terminal cuttings.
4. During a two-hour laboratory, the student will collect plant material from stock plants of white oleander, cut the terminals to 5-inch lengths, remove leaves from the bottom 3 inches, and dip the base into a prepared rooting hormone to produce 100 uniform cuttings.

As we examine the statements, the "Do what?" question is fairly obvious for all 4, increasing in specificity from 1 to 4. However, the conditions under which the student will work are lacking in statements 1 and 2 while we are aware of a time constraint in 3 and 4. Between 1 and 4 there is also a clarifica-

tion of the performance level we are seeking, from "produce 100 cuttings" to a description of which oleander (the white one), how long a cutting (5 inches), what preparation (terminals, basal leaf removal, rooting hormone treatment), and importantly, that the resulting product be 100 uniform cuttings (measurable component of the objective).

The statements could go into greater detail, and statement 4 may be more of a set of directions than an objective. Still, careful statement of an objective based on *outcome* of the exercise should have three elements: The performance required of the student, the conditions under which this performance takes place, and the minimum acceptable level of performance. This last is the measurable component of the task.

This all seems simple enough except that we have really only thought the problems through on one level, the "hands on" level. If all we want is a technician to produce hundreds of uniform cuttings, these statements may suffice in designing a laboratory exercise in plant propagation by means of cuttings.

The choice of verb is important to the wording of the objective and to our understanding of how "deep" we want to go.

Mechanical aptitude can be expressed by verbs such as cut, strip, remove, trim, prepare, collect, etc. Some of these require sub-skills. Basically, however, they do not require much more than *doing*. One has to be careful at this level not to put in an excessive amount of time developing instructional units for simple manipulative tasks.

Do we really want to teach only HOW to make cuttings? At our university level we do not have the facilities and the time to turn out efficient practitioners of the art of making cuttings. Thus, a major part of our effort is devoted to giving the students an understanding of why certain tasks are performed. For this, objectives are established which require *knowledge*, and these objectives will use verbs which reflect the complexity of use of this knowledge.

Some objectives may relate to memory and recall: to *know* and be able to *label* the parts of a plant, to *identify* the cambial zone, to *list* the procedures for making cuttings, to *recognize* an axillary bud.

More advanced objectives require comprehension and the ability to inter-relate concepts: to *distinguish* between wounding and scarifying, to *explain* polarity of shoots, to *give examples* of practices which minimize desiccation, to *compare* mist and high humidity systems.

When students begin to associate complex ideas and to analyze and synthesize new patterns of ideas, high level objectives can be constructed: to *interpret* the results of a rooting experiment, to *relate* a plant's physiological status to its ability to root, to *integrate* principles and practices into a system for pathogen-free production.

This last part overlaps with skills which we would like to see our students develop in the area of organization. The emphasis is on comparing, relating, and synthesizing concepts, resolving conflicts, and organizing or developing systems. For example, objectives might require that the student *develop* year around schedules for propagation to keep a propagation area full, or *create* a flow chart for nursery operations or *identify* the bottlenecks to maximum productivity.

Whether we are setting forth tasks for students or for employees in a nursery, we can do a better job by asking ourselves whether our objectives are clearly stated and if they are formulated at the appropriate level of generality. Careful wording is necessary, and it is helpful to have others read the statements we prepare as a check on the meanings we think we have tried to communicate.

A checklist for evaluating objective statements may include the following points:

1. Select and state the desired learning outcome while taking into account such questions as:
   a. What is the importance of students possessing this skill or knowledge?
   b. What does the student know already about this task? Or, what does he have to learn for entry at this level?
   c. What are the desired competencies in this area?
2. In your statement, is the desired outcome clear and unambiguous?
3. Is the minimum acceptable performance required of the student stated?
4. Is there a means for measuring accomplishment of the goal?
5. Limitations which may be imposed are stated.
   a. If time or space limits attainment of the goal, can the task be sub-divided into logical major parts and reworked as separate objectives?
   b. If the task is too small or too simple, can it be fitted into a larger concept and associated with related ideas?