AN ABSTRACT OF THE THESIS OF

ARTHUR BARRY NOONAN for the degree of DOCTOR OF PHILOSOPHY

in EDUCATION presented on March 26, 1979.

Title: DEVELOPMENT OF A MODEL FOR CONTEXT EVALUATION OF COMMUNITY COLLEGE COMPETENCY-BASED CURRICULA

Abstract approved: Redacted for privacy

E. Wayne Courtney

Purpose of the Study

The purpose of this study was to develop and field test a model for context evaluation of objectives used in competency-based curricula at the community college level.

The study:

1. Developed a decision and information matrix that identified objectives which should be considered for deletion from the given curriculum.
2. Determined whether each objective in the revised curriculum was an improvement over its counterpart in the original curriculum.
3. Determined, for each objective in the original curriculum as well as the revised curriculum, whether there were significant differences in ratings given by the five juries.

Procedure

An overview of the procedure is as follows:

1. The research instrument was developed and then refined via field tests.
2. A competency-based community college course was selected for the study. The selected course was "Soils and Drainage," which was a three-credit hour course in the first year of the Landscape Technology program at Portland Community College.
3. Five juries were used in this study. The juries were:
   a. Students' Jury
   b. Program Completers' Jury
   c. Non-Advisory Committee Experts' Jury
   d. Advisory Committee Jury
   e. Instructors' Jury
4. In April 1978, all five juries met at the College for a luncheon or dinner meeting to evaluate the 109 objectives in the Soils and Drainage course.
5. The following statistical data was computed on the Statistical Package for the Social Sciences at Oregon State University:
   a. 218 Paired "t" Tests
   b. 218 One-Way Analysis of Variance Tests

c. Five Least Significant Difference Tests (LSD Test)

d. Five Student-Newman-Keuls Tests

6. Based on the statistical data and written comments made by the jury members, some objectives were added, deleted, or modified. The title of the course was also changed.
7. In October 1978, the revised curriculum was evaluated by the same juries.
8. The same statistical tests were run on the revised curriculum as were run on the original curriculum. In addition, the Wilcoxon Matched-Pairs Signed-Ranks Test was used to compare the original curriculum and the revised curriculum.
9. The study report was written.

Conclusions

The conclusions listed below are based upon findings of the study. Such conclusions may, or may not, have applicability beyond this study. The conclusions of this study are:

1. Use of the context evaluation model developed in this study can identify objectives which are not appropriate for the stated purposes of a given curriculum. Elimination of such objectives has

implications for all levels of education because errors in the selection of objectives can be costly in terms of staffing, facilities, equipment, materials, and can be a poor investment for the taxpayer as well as a waste of time and money for the students.

2. Knowledgeable individuals from outside the educational institution will reject few, if any, of the objectives for a given curriculum if the development and evaluation model presented in this study is utilized.
3. With respect to objectives developed by the model presented in this study, there will be no significant difference in the ratings given by instructors as compared to ratings given by other juries representing students and knowledgeable individuals from outside the educational institution.
4. Students' and instructors' ratings of the revised curriculum will be much closer to each other than were their ratings of the original curriculum.
5. The Matrix for Analysis of Rated Competencies (MARC) is an effective tool for organizing and displaying the statistical information regarding

each objective, as well as for assisting the instructional team in making decisions regarding the objectives.

DEVELOPMENT OF A MODEL FOR CONTEXT EVALUATION OF COMMUNITY COLLEGE COMPETENCY-BASED CURRICULA

by

Arthur Barry Noonan

A THESIS

submitted to

Oregon State University

in partial fulfillment of
the requirements for the
degree of

Doctor of Philosophy

Commencement June 1979

APPROVED:

Redacted for privacy

Professor of Education
in charge of major

Redacted for privacy

Dean of School of Education

Redacted for privacy

Dean of Graduate School

Date thesis is presented March 26, 1979

Typed by Marcia Dier for Arthur Barry Noonan

ACKNOWLEDGEMENTS

"A teacher affects eternity; he can never tell where his influence stops" (The Education of Henry Adams). Many teachers have influenced me; some of them have graduate degrees and have taught me at the universities; some are like my five children, who have no degrees, but have taught me many beautiful lessons about what is real, true, and good in life.

I would like to acknowledge my Portland Community College colleagues who have shared their expertise and have encouraged me throughout the years: Dr. Leonard Garmire, John Wirth, Dick Hollenbeck, Ken Knapp, and my secretary Win Jacob. I reserve special mention for Jerry Talent, who is the instructor who has worked so diligently with me since 1972 in the development and refinement of the curriculum evaluated in this research study.

Each member of my doctoral committee was supportive in helping make this study a meaningful learning experience. I am deeply thankful for the pleasure of having Dr. Wayne Courtney as my major professor and for being such a fine example of professional and personal excellence in higher education. Dr. Joel Galloway was one of the main forces behind my decision to do my year of residency. Dr. Amo De Bernardis has been my daily teacher as I have worked as a member of his Office for the last

seven years. His philosophy of education and concern for meeting the needs of all students have become an integral part of my own philosophy of education. Dr. Fred Klopfer's research expertise and interest in the study provided an exciting learning opportunity for this student. Dr. Michael Colbert and Dr. Leonard Weber provided encouragement, direction, and stimulating questions.

One's family has a great influence on what one is able to achieve in life. It is impossible to express my gratefullness to my mother, Ermine L. Noonan, and my father, Arthur John Noonan (1902-1964). Over many years they have unselfishly given of themselves in so many ways. Inspiration, encouragement, patience, understanding, and love have been freely given me by my wonderful wife Linda and our blessed children: Rick (17), Steve (14), Keven (10), Kirk (8), and Sherilynn (6). The children had their own ways of encouraging me when the hours were long and it seemed as if this study would never come to an end. Steve made little posters and attached them to the wall next to my desk. Sherilynn drew a picture of me at my desk and then printed a caption saying, "My dad works in the ben to get his chapture bun." Keven and Kirk often popped into the study to sit on my lap and tell me of their wonderous world of discovery. Rick was supportive in so many ways; Linda and

I are thankful for such a positive and mature eldest son. I can summarize Linda's contribution by saying that for 23 years she has been nothing but a blessing to me.

All of the individuals mentioned in this Acknowledgement have been my teachers. They have made an indelible mark upon my life and future.

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DEVELOPMENT OF A MODEL FOR CONTEXT EVALUATION OF COMMUNITY COLLEGE COMPETENCY-BASED CURRICULA

I. INTRODUCTION

The objectives for community college competency-based curricula should be subjected to context evaluation wherein the objectives are evaluated by (a) individuals who are practitioners of the subject matter and who are not on the staff of the institution writing the objectives, (b) students who have recently completed the given set of objectives, if the context evaluation is for a curriculum which is being evaluated for possible revision, and (c) instructors from the department writing the objectives. Such an evaluation would assist educators to gain insight about how other knowledgeable individuals view the objectives. This insight can lead to changes in the quantity and quality of the objectives and thus have an impact on the students' education. The process of how such an evaluation might be conducted is the focus of this study.

This study was designed to develop and field test a context evaluation model which could be used in assessing the objectives for any given competency-based curriculum. "Soils and Drainage" (LA 8.106) was the title of the course selected for this study. The course applies toward the Associate of Applied Science Degree in Landscape Technology

at Portland Community College. The College is located in Portland, Oregon.

Statement of the Problem

A computer search of the literature did not locate a context evaluation model which provided definitive information upon which instructional and administrative staff could evaluate objectives which are part of the foundation for the development and implementation of competency-based curricula. This is a problem if one is to determine the appropriateness of objectives for a given curriculum.

The central purpose of this research was to develop and field test a model for context evaluation of objectives used in competency based curricula at the community college level.

Rationale for the Study

In competency-based curricula, the objectives define what is to be learned and also influence the selection of instructional materials and instructional strategies. Errors in the selection of objectives can be costly in terms of staffing, facilities, equipment, materials, and can be a poor investment for the taxpayer as well as a waste of time and money for the student. However, just

having objectives per se is not necessarily going to increase the likelihood that the objectives are, in fact, what a student should know and be able to do by the end of a given curriculum.

The need to develop and field test a model for context evaluation of competency-based curricula is seen in the fact that a computer search of the literature did not locate any information on how one would statistically determine which objectives should be retained or rejected for a given curriculum.

The literature contains many statements regarding the need for context evaluation of objectives. However, the reported processes for such evaluation do not address the specific information needs of educators who are interested in having precise information to make precise changes in the objectives. The study reported herein provides a field tested model which will provide the context evaluation information needed to make decisions regarding objectives for a given curriculum.

The following paragraphs in this section review some of the literature regarding the definition of evaluation, reason for educational evaluation, evaluation of objectives, and elements which the literature suggests should be in curriculum evaluation but often are not present.

The need for a relevant curriculum was well expressed by Van Doren when he wrote:

> The college is meaningless without a curriculum, but it is more so when it has one that is meaningless. . . . Whatever the limitations of Herbert Spencer may have been, no one can sensibly disagree with him concerning 'the enormous importance of determining in some rational way what things are really most worth learning." (1943:108)

Monroe asks:

> What things, then are 'most worth learning?' Unless the courses taught in a college yield useful materials for the fulfillment of a student's personal and vocational needs, and for the solution of problems related to his moral and value systems, and problems of the nation and the world, then the curriculum lacks value and relevance for the student. If a curriculum is to remain relevant, it must be subjected to periodic examination and revision. . . . For many courses, even five years without change have brought obsolescence and irrelevance. Curriculum study should be a permanent, on-going process as life itself is in a state of perpetual change. (48)

Monroe's statement is an applied example of Wenrich and Wenrich's definition of evaluation: "We define evaluation as a continuing systematic review of institutional objectives and performance which will provide organized information on which to base educational decisions." (262) According to Wenrich and Wenrich, the major purpose of evaluation ". . . is to improve institutional performance. It must assist the decision maker in ascertaining whether or not program objectives have

been achieved, and even whether or not they should be changed." (262) The model presented in this study does "provide organized information on which to base educational decisions" and does assist the decision maker in ascertaining whether or not program objectives should be changed.

In 1969, Arthur M. Cohen wrote a book entitled Dateline '79: Heretical Concepts for the Community College. In this book he set forth the kinds of changes which he thought needed to take place in the community colleges by 1979. It is now 1979. Some of the concepts are still heresy in the opinion of some educators. One of the heresies is the subject of this study: the heresy of defining what it is that a student should know and be able to do upon completion of a given curriculum. Cohen refers to this heresy as being part of what he calls the "defined outcomes" approach to management in education. Cohen states, "Defined outcomes is an ends-oriented concept. It means that the college spells out in advance--and accepts accountability for--the changes it expects to produce in its students, and often in its community." (161)

Cohen believes that American colleges and universities must define their ultimate goals and objectives. He says:

> . . . most schools make little conscious effort to construct goals which stem from the consideration of predictable outcomes, philosophical timidity or vacuity is the prevailing norm. The most recurrent criticism made of American college and university programs is that they lack definite aim. [Stecklein, 1960:268] A form of this aimlessness is apparent in efforts as broad as state master plans that fail to postulate the effects of the institutions they propose to build, and as narrow as the frequently directionless classroom activities of a single instructor. The ends are too often left in the void. (160)

Cohen sees the specification of goals and objectives as being a solution to the problem of directionless classroom activities and teaching of subject matter which may meet the needs of the instructor more than the needs of the students. Cohen joins the use of goals and objectives with the concept of accountability in education. This is seen when he states:

> Without accountability there is little to prevent instruction from becoming aimless activity in which staff members engage for various purposes that stem from their own predilections. With it, instruction becomes a set of sequences that must lead learners to certain capabilities or attitudes--otherwise the sequences are changed methodically. (161)

Cohen states that an institution using a defined-outcomes approach to education would have an instructional design that requires learning outcomes to be stated in terms of "The student will be able to. . ." rather than stating "The instructor will discuss. . . ." Cohen summarizes this point by saying, "One approach depicts <u>ends</u>,

the other means; one defines product, the other process." (161)

Amo DeBernardis, President of Portland Community College, sees education as a product to be merchandized to customers (students). He refers to the College as the "educational shopping center." DeBernardis believes that the goals and objectives of a curriculum should be clearly stated and made available to students before they enroll. His "truth in packaging" theme is seen when he stated:

> In a shopping center you have no difficulty finding out what's for sale. . . . It is packaged and openly displayed, clearly labeled, priced and described. You can easily compare product, value, and cost.
>
> We should make sure we display the label and describe our educational offerings just as clearly. (2)

Not many public educational institutions are like Portland Community College when it comes to the "truth in packaging" philosophy. Cohen points out that objectives have been well established in military and some industrial educational programs since World War I. However, Cohen comments that:

> . . . the deliberate specification of objectives has never enjoyed great popularity within the realm of public education. Many reasons may be advanced for this situation, not the least of which is the fact that specific objectives are not evidently needed unless schools are operating within a defined-outcomes rationale. Without the philosophical base, objectives seem purposeless. It is not necessary for them to be specified in order that an assessment of structure, process, or effort be completed. (164-165)

In the military environment, in many instances, it can be easier to define what is "worth learning" because the military has very specific applications of information. In military vocational-technical training, the equipment one is trained to use is probably identical to the equipment to be used after leaving the training environment. Procedures are also highly standardized. Such is not the case in the public domain. However, an educator who supports the concept of competency-based curriculums would say that goals and objectives apply to any curriculum. Cohen states:

> Objectives are the link between the concept of defined outcomes and the practice of instruction. The process of specifying objectives is applicable to any area, field, subject, discipline, body of knowledge, or desired teaching outcome. It is applicable whether an institution is expected to provide liberal, general, technical, or eclectic education. The ends specified may refer to appreciations, understandings, attitudes, skills and awarenesses. A rule of thumb: if an educational purpose can be defined, it may be cast in the form of an objective. (167)

The following statements by Wenrich and Wenrich provide an insight as to why there is a lack of literature in the area of context evaluation of competency-based curricula:

> A frequent critique of educational evaluation is that it has too often focused primarily on process and input, and only secondarily on context and product. As a result, educational goals and objectives are frequently not revised to reflect society's

> priorities, and institutional operations are not modified in response to the career needs of students and graduates.
>
> For some people, evaluation merely means empirical measurement with no inferences as to the value of the measured characteristic. In education, evaluation has frequently been viewed as the determination of the degree to which performance meets the stated objectives of the program. Too often, there is insufficient evaluation of the objectives themselves. (262)

The study presented herein directly addresses the "evaluation of the objectives themselves."

Monroe's statements are at odds with Wenrich and Wenrich when Monroe speaks to the question of evaluating curricula which have been taught for a period of time. Wenrich and Wenrich encourage context evaluation as being an important part of evaluating curricula which have been taught for a while. Monroe focuses entirely on product evaluation in the following statement:

> A difficult and important task is the evaluation of the curriculum after it has been put into operation. Often this phase of curriculum building is never done. However a self-respecting community college should not need these external pressures to do that which the collective conscience of the college says should be done. More and more college administrators are becoming conscious of the need for periodic evaluation of what they are attempting to do. Merely to declare publicly that we are a 'first-rate college; we have the very best faculty and offer the best courses, and we are comparable to the first two years of the best state and private four-year colleges and universities' sounds empty, if not ridiculous, to an outside objective observer, unless there is proof to back up the claims.

> . . . The most obvious evaluation technique is the follow-up study on the students who have left the college. Just as the best measure of a teacher's effectiveness in the classroom is the evaluation of his students in terms of measurable behavioral objectives, so for the college curriculum the best evidence is how well students do when they go to work or transfer to a senior institution. (56-57)

Though Wenrich and Wenrich are advocates of context evaluation for the revisions of curricula, they see the advisory committee as the source of information. This is seen in the following statement:

> A final problem related to curriculum is revision. Curriculum revision has to do with updating course and program content to incorporate new technology and practices related to changing job needs. . . .
>
> Program advisory committees are the best mechanism for revising and updating course content and adding new courses. They can be helpful in weeding out substantive material which is no longer germane. (169)

The advisory committee is a critical jury which should be involved in the context evaluation of a curriculum which is being revised, but by no means are they the "best mechanism." They are only one of the "best mechanisms." For vocational-technical programs, advisory committees usually represent many facets of the given subject area. It is possible that only one or two members of the total committee have expertise in a given curriculum. That is why the study presented herein utilized a jury of experts who were not members of the advisory committee.

These individuals had expertise in the specific content being evaluated. Another perspective included in the study is that of program completers. This jury is defined under "Population" in Chapter II.

Wenrich and Wenrich do not suggest any references which one could use when establishing an evaluation process of a curriculum to be revised. The present study gives specific directions as to how to conduct such an evaluation.

Monroe discusses the need for faculty and student involvement in the development, as well as revision, of curricula. Wenrich and Wenrich said that the determination of curriculum content should be left to the advisory committee in the case of community college vocational-technical programs. The present research utilized students, faculty, students who had completed the curriculum, an advisory committee, and a non-advisory committee expert jury. For the model presented in this study, it was the instructional team rather than the advisory committee that had the final say as to what the curriculum contained. Monroe's statements regarding the involvement of faculty and students are seen in the following paragraphs:

> In the larger community colleges, curriculum making is delegated to an administrative person, the dean or the director of instruction or curriculum, who operates under the direction of the

> college president. This dean may work with a faculty committee chosen by the president. Two things should be noted: (1) the absence of faculty power in decision making on curriculum matters and (2) the absence of any student participation. (52)
>
> Faculty leadership in curriculum construction is much more time consuming and produces more internal conflicts than does construction of curriculum by administrative fiat. However, the price paid for democratic participation is well worth it since the college secures the advantage of having a commitment by the faculty. (53)
>
> Somewhere in the process of fact finding and gathering information, student involvement is often desirable. Whether students are demanding the right to participate or not, the faculty should invite selected groups of students to sound off and react to the faculty proposals. The students may not respond with enthusiasm or be willing to give their time to the curriculum committee. However, the effort to involve students is necessary if one wishes to learn what the prospective customers think of the product which is to be offered to them. (54-55)

The need for this study is evident. The literature repeatedly encourages evaluation of objectives, but the literature lacks a context evaluation model which will yield specific evaluative information about each objective contained in the competency-based curriculum. The model developed and field tested in this study will assist in obtaining such information.

Selection of Curriculum and Institution

The institution selected for participating in this study was Portland Community College which is located in

Portland, Oregon. The curriculum selected for study was a course entitled "Soild and Drainage." It was a three credit hour, five clock hour per week occupational preparatory course which was part of the first year curriculum in Landscape Technology.

In 1974, all of the instructors in the Landscape Technology Department reviewed and endorsed the 109 objectives for the "Soils and Drainage" course. Since 1974, the course instructor made sure that the students showed competence for the 109 objectives every time the course was offered. As a result of this background, the "Soils and Drainage" course was one of the prime candidates for use in the present research.

Process Used to Determine Objectives for a Curriculum

The goal and objective identification process used at Portland Community College (hereafter referred to as "the College") can range from several months to several years. The process initially involves faculty, administration, and the curriculum's advisory committee. All occupational curricula have advisory committees whereas only a few college transfer curricula have advisory committees.

The curriculum specialist meets with an instructor for approximately one hour per week. In these sessions

there is a discussion of the course goals and objectives. Then, for each topical heading in the course, objectives are written which clearly state what the student should know and be able to do by the end of the instruction. The curriculum coordinator may write and edit the objectives; the instructor serves as the resource person. This process can save the instructor time. Eventually, the instructor indicates that the goals and objectives represent the best statement he can make regarding what is to be learned in the course. At this point, a series of one hour review sessions is held with all members of a given instructional staff. Then, there may be changes in the goals and/or objectives. Once there is agreement among the instructors as to goals and objectives, all of the instructors and associated administrators sign-off the curriculum for printing and context evaluation by students and knowledgeable individuals from outside the College.

The above process for identification and evaluation of goals and objectives reflects the context evaluation elements cited earlier by Monroe, Cohen, and the Wenrichs.

Definitions

The following list defines and clarifies the meaning of words or phrases as used in this study. Words and

phrases not in this list are considered to be self-explanatory.

CIPP Evaluation Model. D. L. Stufflebeam developed an evaluation model widely recognized as the CIPP evaluation model. The CIPP (Context, Input, Process, Product) model has the following elements:

> Context Evaluation
>
> Context evaluation is the most basic kind of evaluation. Its purpose is to provide a rationale for determination of objectives. . . . Decisions served by context evaluation include deciding upon the setting to be served, the general goals to be sought, and the specific objectives to be achieved. (Stufflebeam)
>
> Input Evaluation
>
> The purpose of input evaluation is to provide information for determining how to utilize resources to achieve project objectives. (Stufflebeam)
>
> Process Evaluation
>
> Once a designed course of action has been approved and implementation of the design has begun, process evaluation is needed to provide periodic feedback to persons responsible for implementing plans and procedures. (Stufflebeam)
>
> Product Evaluation
>
> Its purpose is to measure and interpret attainments not only at the end of a project cycle, but as often as necessary during the project term. (Stufflebeam)

Competency-Based Curriculum. A set of objectives for an instructional sequence which could be of any length

from a module taking only a few hours to complete, a thirty clock hour lecture/lab course, a 300 clock hour lecture/lab course, or even an entire degree program.

Curriculum. As used in this study, it has the same meaning as "competency-based curriculum" which was defined previously.

Goals and Objectives. Cohen distinguishes between the two by saying:

> . . . they are both statements about the purposes of action. But in this context a goal is a basic aim--a value-construct, the achievement of which can be assessed only in inferential terms. An objective, on the other hand, is a concrete criterion of achievement, measurable in terms of overt behavior. In educational practice, both are necessary. (167)

Instructional Team. As used in this study, it refers to the instructors, department chairperson, dean, and curriculum coordinator.

Key Group. The Key Group was formed by combining the data from the Program Completers' Jury, Non-Advisory Committee Expert Jury, and the Advisory Committee Jury.

Objective. This is a statement of what a student should know and/or be able to do by the end of a given curriculum. The statements may or may not include specification of conditions (what will or will not be given) and criteria (how fast or how well).

The College. Portland Community College, Portland, Oregon.

The Guide. The Soils and Drainage Course Content Guide which contains the goals and objectives for the course. The Guide is a statement of product, not process.

Variable. For each objective in this study there is a Question A and a Question B. Any given objective plus Question A or B is referred to as a variable. Thus, Question B for objective 3.4.1 would be referred to as variable 3.4.1 B.

II. REVIEW OF THE LITERATURE

In the first chapter of this study, there was an examination of the need for competency-based curricula and the need for evaluation of objectives. Chapter II focuses on the literature dealing with evaluation of objectives in order to determine which objectives are appropriate for a given curriculum.

The Oregon State University Kerr Library's "Library Information Retrieval Service" (LIRS), which is an on-line bibliographic computer search service, was used to identify literature as well as on-going federally funded projects related to this study. The initial search was conducted in April 1977 and covered a ten-year period from 1967 to April 1977. An update search was conducted via LIRS in February 1979.

The federally funded projects, which were in progress and thus not yet reported in the literature, were searched by the "Smithsonian Science Information Exchange" computer bank. The Smithsonian computer bank is accessed through LIRS.

The LIRS searches determined that there is no reported context evaluation process similar to the model presented in this study. However, this chapter reviews other approaches to evaluation of objectives for competency-based curricula. There were no articles

or projects dealing only with the problem of evaluating objectives. Evaluation of objectives was always one of many steps covered in a project or article. There was a great deal of variation in the sophistication of evaluation strategies. Some of the books on instructional development just passed over the evaluation of objectives with a sentence or short paragraph.

Extensive work on development and refinement of competency-based curricula is being done at (a) the College of Pharmacy, University of Minnesota, and (b) the School of Medicine, Southern Illinois University.

The most thorough approach located in the literature was the work being done at the Southern Illinois University's School of Medicine. Williams (1976) reports on a project where the major goal of the project was to modify the competency-based medical curriculum of Southern Illinois University's School of Medicine so that essential competencies were identified and mechanisms were established to ensure that the students not only learned, but also retained and integrated the competencies. Williams states:

> The objectives were written by instructional teams, each composed of medical faculty (M.D.s and basic Scientists), practicing (non-academic) physicians and at least one instructional designer. The committees were carefully and continually coached to ensure that

> each objective was relevant to the practice of medicine. (2)

Later in the report, in a section entitled, "Strategy for Identifying Critically Important Competencies," it is stated:

> Defining the maintenance of objectives is of major importance in implementing this competency maintenance strategy. The procedure used must identify from the essential competencies to be retained from the curriculum and should remain sensitive to the level of maintenance required for these competencies. (15)
>
> . . . Since the S.I.U. medical curriculum was already written in the form of behavioral objectives, and since these objectives serve as a ready made list of statements to be rated by the specialists, it was decided to rely primarily on a survey questionnaire procedure for preliminary establishment of priorities of objectives. This procedure required relatively little time on the part of the raters, and therefore, allowed the input of many individuals with differing perspectives at a relatively small cost. Likewise, it allowed for input from all members of the faculty. Since faculty members actually deliver the curriculum, their opinions and involvement in setting the priorities are essential. The desires of the faculty become the curriculum regardless of how that curriculum is presented. (16)

A questionnaire evaluating the following was sent out:

> Every Sequence I module is being rated by two representatives of each of the four groups--making a total of eight ratings per module. Basic science faculty rated modules they authored and others in their area of expertise. Clinical faculty, advanced standing students and residents rated modules which were randomly assigned to them. Basic science faculty rated the objectives from approximately 15 modules each (or 120 objectives)

> while the other groups rated objectives from an average of eight modules (or 64 objectives). (17)

The returned rate of questionnaires was 59 percent. Only 16 percent of the residents and 39 percent of the unpaid clinical associates returned their questionnaires.

The survey instrument used a multiple choice response sheet. The multiple choice items ran A, B, C, D, and E. The meaning of each of the letters was as follows:

A = Retention of this competency in its originally learned form and detail is essential for the duration of Sequence I.

B = Retention of this competency in its originally learned form and details is highly desirable but only retention of the main idea is essential for the duration of Sequence I.

C = Retention of the main idea is desirable but not essential.

D = Important only to recall existence and to be able to look up when needed.

E = This objective is inappropriate for undergraduate medical education.

Blank = Leave the item blank if you have absolutely no understanding of the terminology or the concept and therefore have no basis for judgement.

The data was coded by respondent identification information, and the analysis gave reports showing the background of individuals who rated the competencies and also then gave descriptive statistics on the ratings.

During 1975, the College of Pharmacy at the University of Minnesota began an ambitious project to identify

competencies. The article, by Daniel Dobbert (1975), was entitled, "Competency Identification: A Report to the Professional Committee of the College of Pharmacy, University of Minnesota." The report outlines a very lengthy and involved process whereby descriptive words and phrases were elicited from each panel member. The words and phrases were an attempt to describe the competencies which pharmacists should possess. After all the lists were gathered, a two-day conference was held where the various panels worked through a consensus process to gain agreement on the objectives. Finally, a list of competencies was identified.

Dobbert states:

> A move to Competency-Based Curriculum necessitates (1) competency identification, (2) validation or evaluation of competencies, (3) establishment of competency criteria level, (4) development of assessment for individuals to determine the presence or lack of a specified competency, (5) appropriate instructional design, and (6) a maintenance program for the total Competency-Based Curriculum. (8)

Under the heading of "competency identification," the author discusses content and logical analysis. He states that:

> Content analysis aims at the objective quantification of content classified using a system of categories and explicitly formulated rules. It gives guidance as to objectives contained in content. It's a fancy way of obtaining objectives from the present program. (9)

> Logical analysis is the examination of the rationale behind each objective and competency. If a rationale supporting an objective or competency logically leads to the accomplishment of the goal then that objective or competency should be retained. If there is not such support, then that objective or competency should not be kept.

Later, Dobbert states:

> Derivation of a competency is not the end. Our next step should be to validate or evaluate that competency. The purpose of validation and evaluation is fourfold. First is to determine the value of the competency for a person in their subsequent performance. Second is to ensure that we identified an inclusive set of competencies. Third, are the competencies performed by practitioners or should they be? Lastly is to verify that the competency identification reference group was, in fact, the people for whom the competencies are intended. The specific purpose must be phrased with reference to the type of competency identified ('should have' synthesis or 'essential' analysis).
>
> You realize measurement, evaluation, and validation procedures are not as tight individually as one might desire. Therefore, I recommend that the multiple data point method, a method consisting of multiple strategies for collecting data be used to examine a question. If two or three procedures support a position then that statement may be better than if one or more did. Naturally, there are many pitfalls here and neither one of the procedures may be appropriate or sensitive for the variable to be measured. Therefore, non-support does not allow one to say that the competency examined is not a valuable competency, only that the procedure used did not offer support for it. (12-13)
>
> . . . To clarify, multiple data point method can be used for the 'should have' and 'necessary' competencies. One could ask the same question of many members of the population. Or actually, several data types could be collected from several members of the

> population. The key is repeated measure and sample selection. . . . The greater the number of respondents the greater the reliability. Validity has a better chance as amount of data collected on an individual increases. (13-14)

Dobbert's "multiple data point method" for competency evaluation and validation involves three things: (1) task analysis, (2) survey, and (3) case studies. Dobbert does not give specific direction as to how to determine when an objective should be recommended for retention or rejection in a given curriculum.

The article ends by stating that:

1) The competencies identified by the panel should be examined through a rigorous validation and evaluation procedure.

2) Care should be taken to prevent premature implementation, modification, acceptance, or rejection of these (as of yet) unsubstantiated competency statements. They should be treated as hypotheses and tested as such. (13)

Three years after Dobbert (1975) published his article about the work at the University of Minnesota's College of Pharmacy, Cyrs (1978) published an article about the progress of the work at the same College of Pharmacy. Cyrs asked the question, "How should professional competencies be identified, evaluated, and validated?" He points out that:

> A review of the literature has revealed that there is a great deal of confusion over the meaning of the term competency and competency-based education. . . although a comprehensive attempt was made by Gale and

> Pol, but failed to address the issue of validation and assessment requirements. . . .

In the model being used by Cyrs at the College of Pharmacy there was involvement of practitioners, students, consumers, and faculty. However, all the initial identification of competencies was done in group discussion sessions and later the materials sent out for evaluation to over five hundred practitioners, students, and faculty within Minnesota. They were asked to evaluate the competencies. Cyrs states:

> All except two of the competency statements were highly valued by 50% or more of the 93% responding to the survey. The job-relatedness of the competencies was determined by two different on-the-site visitations where trained graduate pharmacy administration students conducted job analysis of the 14 different pharmacy settings using the guidelines established by the U.S. Employment Service. The results were compared to the identified and valued competencies and final confirmation and validation made. The integration and synthesis of these three procedures provide an empirical basis to identify those competencies which when combined with the 'should have' competencies will determine the overall pharmacy curriculum.

Cyrs used the "multiple data point method" spoken of by Dobbert (1975).

Halyard (1978) reports on a project at Clayton Junior College in Morrow, Georgia. The project had the following goals:

> a. Identify those competencies characteristic of a liberally educated person which are reasonably expected by the faculty, once

> a student has completed the General Education portion of the Core Curriculum at Clayton Jr. College.
>
> b. Identify the strengths and weaknesses in the curriculum relative to the desired competencies.
>
> c. Revise the curriculum in order that students may acquire the desired competencies.
>
> Although some progress was made during the Academic Year 1975-76, the identification of competencies and efforts and their assessment were very meager. (1)

The process used at Clayton Jr. College was that of having the faculty and administration decide what was important for a student to know and be able to do upon completion of the general education portion of the Core Curriculum. The article does not report the utilization of individuals, or groups of individuals, from outside the institution to help in the process of evaluating the competencies.

The Halyard article was one of two articles under the Halyard and Murphy (1978) reference. The second article was written by Norman Murphy. Murphy dealt with the process of identification of competencies at Piedmont Technical College in Greenwood, South Carolina. The competencies which were being identified at Piedmont were of a much broader nature than what was being identified at Clayton Junior College. Murphy states:

> This presentation will focus on the question of what is important to learn. There are numerous potential sources of input for answering this

> question. Here are the sources of input we capped and how we did it. Teachers, traditionally regarded as experts in their subject matter, have normally controlled what has gone into the curriculum. Typically, English instructors in freshman composition determine what you teach within the broad framework of a course syllabus. Piedmont, however, expanded the scope of this source of input. First, our Vice-President for Educational Affairs established a Task Force, composed of faculty members of the three academic divisions responsible for the instruction of degree students. This Task Force was charged with the responsibility of determining what general competencies all degree students should possess. Among other activities, this Task Force ensured that all faculty members, through a survey, had the opportunity to express what was important for their students to learn in General Education. So instructors played the pivotal role in identifying competencies.
>
> There are other sources of input as well. One place to look is the community at large. . . . To gather community perceptions, Piedmont, led by the Task Force, took a random sample of 342 people in its service region. Students, the Task Force believed, should also have a role in shaping the curriculum. Consequently, a random sample of students, including 177 graduates, non-graduates, continuing education and 220 current students cooperated in a survey designed by the Task Force. Next, the Task Force recognized the impact employers could have on technical curricula through the Advisory Boards, but saw an additional role for other community leaders. Based on the literature and personal knowledge, the Task Force knew that community leaders and employers were quite concerned about skills other than technical. So we surveyed 204 of them. (15)

Piedmont reports that there was "striking congruence on the results people expected from Piedmont, given that they could choose from 31 items." (16)

One of the performance based education articles dealt with the identification of objectives for an individually paced learning modular system for a civil engineering technology program in South Carolina. The funding was through the National Science Foundation. In the portion of the report dealing with "Defining Competencies," Sharples (1976) states:

> When a concensus had been reached by the faculty members concerning specific courses to be developed, the project staff set about determining the core content of each course. To accomplish this objective, a series of meetings was held with the faculty committee. In preparation for these meetings, each school was asked, through their civil engineering Department Head, to submit their existing course objectives. These objectives were reproduced and complete sets were returned to all CET faculty members so that each instructor was aware of other programs within the consortium. During the subsequent faculty meetings, each instructor participated in the process of identifying those objectives which should be consistent among all ten schools. The end result of this series of meetings was a comprehensive task analysis of the core curriculum which resulted in a collective list of 163 competencies for the 11 courses in the CET program.
>
> The next task was to verify that the 163 competencies identified by the consortium faculty were consistent with the needs of the potential employers throughout the state. A second round of meetings was organized between representatives of faculty and industry. Although time-consuming, these meetings provided a valid and realistic list of competencies required of a civil engineering technician. (5-6)

The remaining articles, identified by the LIRS computer search of the literature, provided information in areas other than in the methodology of context evaluation of objectives for competency-based curricula. The articles are briefly reviewed in this Chapter so as to indicate the difference between the articles reported up to this point in the Chapter.

Jacobs (1976) has a section entitled, "Developing and Validating Component Objectives," (19) in which he states:

> Systematic instruction builds on instructional objectives. Popham reminds us of the subjective nature of final decisions on objectives because of many possibilities; the wise educator, though, looks at the three major sources specified by Ralph Tyler: the learner, the society, and the subject matter (Popham and Baker, 1970). To determine the dictates of society (in our case, the industrial setting in which our students gain employment) Fryklund and others emphasize utilizing occupational analysis and lay advisory committees (Fryklund, 1970; Criteria for Technical Education: A Suggested Guide, 1968; Barlow, 1965; . . . .)
>
> We developed and validated thoroughly objectives for this instructional component on basic materials science for this project. The procedures included study of textbooks and curricula guides, search of Research and Education, update of previous occupational analysis (J. Jacobs, 1969), examination of other occupational analysis (State of Washington Coordinating Council for Occuational Education, 1970), and an extensive NOVA Practicum in which 12 researching engineers and technicians with the National Aeronautics & Space Administration's Langley Research Center

> assisted in teaching, developing, and evaluating objectives, and developing evaluation instruments for the course in industrial materials and processes of industry at Norford State College. (21)

Briggs (1970), in his discussion of "Selecting Objectives," does not give specific models for evaluating curricula. He summarizes by saying:

> There are no general guidelines that can be offered here other than to consider the appropriateness of the above sources of guidance in terms of courses to be designed. For some this will be no great problem--the boss or the job description (in the industrial or the military training situation) describes what objectives should be achieved. Try to define an appropriate reference for any input data needed to guide you in selecting objectives--from your own discipline; from research in the field; from predictions of the nature of future employment in society; from the learner; or, in some cases of professional training, from your own experience concerning what skills are needed most for success. (34)

Fraser's report was noted in the LIRS search. The article, entitled "The Vocational Educator's Guide to Competency-Based Personalized Instruction," does not give any real direction as to how or when we are to evaluate the competencies selected for a course. Fraser states:

> You can develop a competency-based curriculum by first identifying the competencies necessary for a person to find employment in an occupation. Identified competencies are observable and measurable on the job. They are further verified by an advisory committee composed of representatives from industry. This list of competencies must be updated continuously to reflect changes which must be met by entry-level workers to maintain success in the industry. (19)

Knief (1973) presented a model whereby the overall course goals are determined first, and then the major components of the course are determined and sequenced. Lastly, the objectives for the various components are written. Knief does not suggest a review process which can be used for determining if the objectives are, in fact, what should be taught.

None of the eight federally funded on-going projects identified via the LIRS "Smithsonian Science Information Exchange" computer bank dealt with the evaluation of objectives for competency-based curricula. The projects dealt with other descriptors which were part of the search strategy developed by the LIRS librarian at Oregon State University.

Summary

The "Library Information Retrieval Service" (LIRS), which is an on-line bibliographic computer search service, was used at Oregon State University's Kerr Library to identify literature related to the context evaluation of objectives which are part of competency-based curricula. The search included articles listed between 1967 and February 1979. The search determined that there were no reported context evaluation models similar to the model presented in this study. However, this chapter reviews

several research reports dealing with other approaches to evaluation of objectives. Additional articles are reported in order to indicate the general status of the literature regarding the subject of this study.

LIRS was also used to access the "Smithsonian Science Information Exchange" computer bank to determine if there were any on-going federally funded projects which related to this study. No such projects were identified.

The three research articles which used evaluation strategies noted at length in this chapter were based on work at the College of Pharmacy at the University of Minnesota and work at Southern Illinois University's School of Medicine. Evaluation of objectives, in these articles, was not the central research effort, but multiple data inputs were used to help the researchers evaluate the appropriateness of the objectives.

III. RESEARCH METHOD AND DESIGN

The Population

The population included in this study consisted of five juries which were selected to represent the following perspectives of the course objectives:

KEY GROUP

1. Students
2. Program Completers
3. Non-Advisory Committee Experts
4. Advisory Committee
5. Instructors

In two of the three research problems addressed in the study, Juries 2, 3, and 4 were combined to form one statistical data pool assigned the title of "Key Group." This "Key Group" gave the instructional team an understanding as to how knowledgeable individuals from outside of the College rated the course objectives.

The size and composition of the juries were as follows:

Students' Jury. A random selection of 10 students was made from a listing of 85 students who: (a) received at least a "C" grade in the "Soils and Drainage" course, (b) were still enrolled at the College for at least one or more courses in Landscape Technology, and (c) had completed this course between Winter Quarter 1977 and Winter

Quarter 1978. Nine of these students served on this jury.

Program Completers' Jury. Criteria for membership on this jury stated that the individual:

a) Must have completed at least the one-year Certificate in the Landscape Technology Program.

b) Could not be presently taking Landscape courses at the College.

c) Must have been working full-time in the field of Landscape Technology for at least six months.

Members of this jury were randomly selected from a list of individuals who met the above criteria. For the evaluation of the original curriculum there were nine members who served on the jury, but only eight members served on the evaluation of the revised curriculum because one of the members moved away from the Portland area.

Non-Advisory Committee Experts' Jury. The individuals who served on this jury were required to have had at least five years of full-time employment in the landscape industry. They had to meet the specific criteria of having experience with long-term plant growth within the same soil environment. This aspect of the criteria was critical because ornamental plants require different care

than agricultural crops which are grown in short-term soil conditions.

The instructional team identified 25 potential members for this jury, and ten were randomly selected via use of a Table of Random Numbers. Nine members served on the jury.

None of the members of this jury had ever enrolled in the Soils and Drainage course which is the focus of this study.

Advisory Committee Members' Jury. The members of this jury comprise the College's Landscape Technology Advisory Committee, a group which had been officially approved by the College's Board of Directors. The Advisory Committee represented a broad range of backgrounds within the landscape industry. Various members were involved in landscape design, landscape installation and maintenance, nurseries, and/or turfgrass installation and maintenance.

For the evaluation of the original curriculum there were nine members who served on the jury, but only eight of the members served on the evaluation of the revised curriculum because one of the members was too ill to participate.

The Advisory Committee members were not necessarily experts in the specific curriculum evaluated in the study.

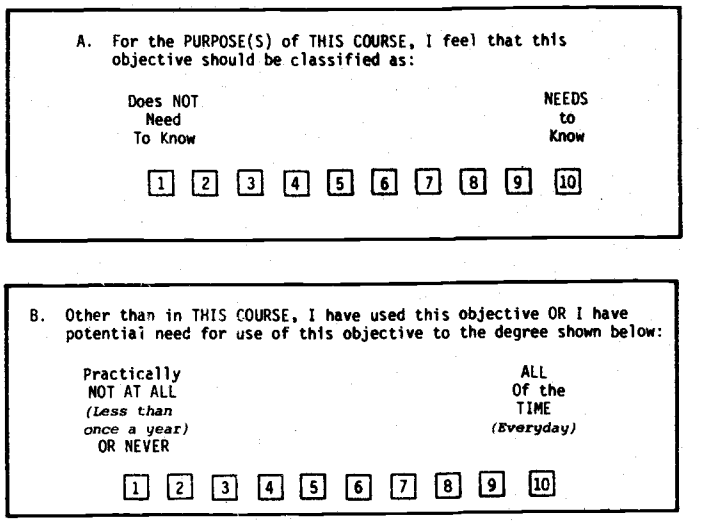
None of the members of this jury had ever enrolled in the Soils and Drainage course which is the focus of this study.

Instructors' Jury. All instructors in the Landscape Technology Department served on this jury, although only one of the instructors taught the course which was the subject of this study. He had been teaching the course for the past five years and was the resource person who worked with the College's curriculum coordinator in the writing of the objectives for both the original curriculum and the revised curriculum.

The Research Instruments

The Dependent Variable

The dependent variable in this study was a score, judgmentally and independently assigned by each jury member in the sample, to denote (a) the appropriateness of each objective in the original curriculum and the revised curriculum and (b) the degree of use or potential use of each objective. For each objective, the scores were assigned for Questions A and B on the basis of the ten-point scales shown on the next page. Question A was treated separately from Question B. Hence, there was a total of 218 dependent variables on the original curriculum and 222 dependent variables on the revised curriculum. Appendix B



contains a one-page sample of the research instrument for the original curriculum and Appendix C contains a one-page sample of the research instrument for the revised curriculum.

The First Research Instrument

Description. The first research instrument contained 109 objectives which were published in Soils and Drainage--Course Content Guide (1974). The 109 objectives were developed via the curriculum development process described in Chapter I of this study. These objectives had been taught from 1974 to 1978.

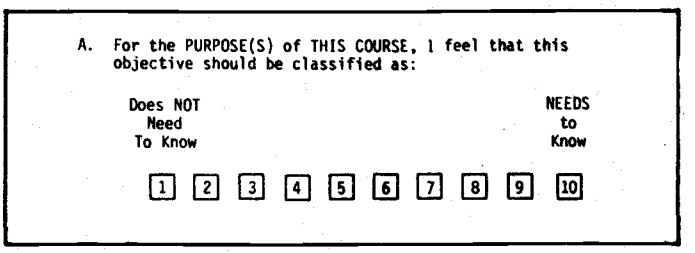
The topical outline and subheadings from Soils and Drainage--Course Content Guide were shown on the research instrument so that there was a one-to-one correspondence between the way the objectives were displayed in the Guide and the way they were displayed in the research instrument.

To just list 109 objectives, without showing how they topically fit into the schema of the course, would have possibly confused the respondents.

The objective identification system used in the Guide was also used in the research instrument. This was done for ease of interfacing the Guide and the research instruments. As an example, Objective 10.1.1 in the Guide states "Describe and explain the hydrologic cycle. The description should include a simple diagram." The same objective is stated for 10.1.1 in the original curriculum and in the revised curriculum. The variables on the computer printouts were also coded in this way.

Development of Research Instrument. The context evaluation literature did not provide any prototypes to follow for the research instrument needed for this study. The format of the research instruments was selected after field testing evidenced problems when the respondents (a) were recording their responses and (b) became frustrated with more than two questions per objective. Questions A and B were selected because of the decision-making information which could be derived from them. Each question is discussed separately in this Chapter.

Question A. Question A is shown on the next page as it appeared on the research instruments. This question was designed to determine how the various jury members rated

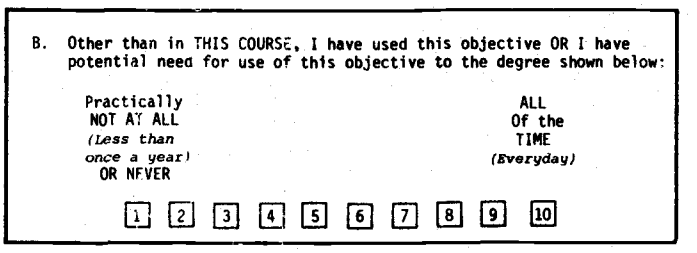


each objective with respect to the stated purpose(s) of the course. Each jury member was given a written statement of the purpose of the course. This statement was prepared, and agreed to, by all instructors in the Landscape Technology Department. The inclusion of the reference to "the purpose(s) of THIS COURSE" was important in this question because there is always a chance that well-written and legitimate objectives can end up in a curriculum and yet not be appropriate for the course when considering the purpose(s) of the course.

With respect to the statistical data collected in this study, Question A was the question which determined whether or not a recommendation was made to drop the objective as written. The "as written" qualification is important because it is possible for a rejected objective to be accepted when modifications are made to clarify the objective.

Question B. Question B is shown on the next page as it appeared in the research instrument.

The ". . . OR I have potential need for use of this objective" aspect of Question B did not appear in the



literature identified by the computer search. This wording was used because it is very possible that an objective could receive a low rating if the respondent was asked how much they "used" an objective, but receive a very high rating if the respondent was asked about "potential need for use" of the objective. For example, an objective could deal with recognizing the effects of excessive radioactivity levels upon plant life and soils. A respondent working within 50 miles of the Trojan Nuclear Facility may give a low rating if asked only about "use," but a very high rating if also asked about "potential use."

Also, Question B is important because it is related to Question A. For instance, it is possible that an objective could be rated very low on Question A, "need to know for the course," and yet be rated average on Question B, "use or potential use." Such a rating would indicate that the objective was not appropriate for the course being evaluated, but the objective is one which is used or has potential use and therefore could be placed in another course.

The "other than in THIS COURSE" part of this question was intended to be addressed to those jury members who had

taken the course during the last four years when the 109 objectives were being taught. There were two juries, with nine members each, on which all members had taken the course during the last four years. Question B was worded the way it was in anticipation of the possibility that a jury member could have used a given objective as part of passing the course, but had not applied the information since leaving the course. By framing Question B in such a way that it excluded use of the objective during the course, the ratings would reflect post-course "use or potential use."

The Second Research Instrument

The second research instrument contained the revised curriculum. The revised curriculum eliminated some of the objectives which were in the original curriculum, added some new objectives as well as new topics, and clarified some of the objectives which were in the original curriculum.

The format of the second research instrument was identical to that of the first research instrument except that the second instrument was printed on both sides of the paper whereas the first instrument was printed on one side. This was done to conserve paper. It is not anticipated that the printing on both sides would have an adverse influence on the responding of the jury members.

Administration of Research Instruments

After the potential jury members were identified, each of them was contacted by phone and invited to participate in the study. Then, each jury member received a letter from the President of Portland Community College. The letter thanked them for accepting the invitation and informed them as to the date and time of the first evaluation session. They had a choice of a luncheon or a dinner followed by an evaluation session. The original curriculum was evaluated in April 1978. The revised curriculum was evaluated by the same jury members in October 1978. The luncheon or dinner format was repeated for evaluation of the revised curriculum.

At the beginning of the evaluation session an explanation was given as to the purpose of the study, the role of the jury members, and the relationship between the Soils and Drainage--Course Content Guide and the research instrument. Each jury member received a copy of the Statement of Purpose which the instructors had prepared to indicate the purpose of the course. A time was reserved for the jury members to ask questions about the course and to become familiar with the response format used on the research instrument.

The first research instrument was printed on a different color for each of the five juries. This was done to

provide jury identification for the processing of data. The identity of the respondents was kept confidential via the use of a number written on each research instrument. Each jury member was given two 3x5 cards. On each card they wrote the number which was on the first page of their research instrument. They then folded one of the two 3x5 cards and placed it in a letter-sized envelope. They then sealed the envelope and wrote their name on the front of the envelope. The second 3x5 card they folded and placed in their purse or wallet. The envelopes were collected and placed in a safe deposit box. Six months later the unopened envelopes were distributed to the jury members when they returned to evaluate the revised curriculum. The color of their second research instrument, which contained the revised curriculum, was the same color they had on the first research instrument. Each jury member opened his envelope, checked the number he had written, and recorded this number of the face of the second research instrument. This process freed the jury members from concern for being identified by the instructional team which was involved in the study.

Processing of the Data

The identification data for each jury member included (a) an identification number which was written on the front of the first research instrument, (b) the jury

number, and (c) a code to identify the quarter and year during which the evaluation instrument was completed. A total of three 80 x 80 key punch cards was used for each jury member on the first research instrument in April 1978. The same information was entered on another set of three 80 x 80 key punch cards for the data gathered in October 1978 when the second research instrument was completed by the same jury members.

The key punch cards were processed by the Oregon State University Computer Center. The data was processed on the Statistical Package for the Social Sciences which was developed by the Vogelback Computer Center at Northwestern University.

The Research Problems

Introduction

The study was designed to develop and field test a context evaluation model which could be used in assessing the objectives for any given competency-based curriculum. The curriculum which was selected for the study was a three credit hour course entitled "Soils and Drainage." This course was one of the first year courses in the Landscape Technology Program at Portland Community College.

Five juries, representing various vantages from which to judge the curriculum, were selected to evaluate the 109 objectives contained in the "Soils and Drainage" course.

Then, after six months of data analysis and revision of the original curriculum, the jury members were again called together to evaluate the revised curriculum which contained 111 objectives.

The study considered three research problems and the retention or rejection of two null hypotheses under each of the research problems. Different statistical tools were used for each of the three research problems. Therefore, the method of analysis is presented separately for each research problem.

An alpha level of .05 was selected for this study. The literature did not contain research similar to that reported in this study and thus there was no previous experience upon which to judge the alpha level.

First Research Problem: Design of the Study

The first research problem identified the degree to which the Key Group (a) rated each objective as being appropriate for the purposes of the course, and (b) used each objective, or had potential need to use each objective.

H_{1A} and H_{1B}. The Paired "t" was used to test the following null hypotheses:

H_{1A} = Considering separately the original curriculum and the revised curriculum, the Key Group's mean rating of Question A for each objective will not significantly differ from the respective grand mean of Question A.

H_{1B} = Considering separately the original curriculum and the revised curriculum, the Key Group's mean rating of Question B for each objective will not significantly differ from the respective grand mean of Question B.

Procedures. The procedures used for the first research problem were as follows:

1. The original curriculum was evaluated via the first research instrument as well as the written comments of the jury members. The original curriculum was evaluated in April 1978. The procedures for administration of the research instruments are explained in detail earlier in this chapter in the section entitled, "Administration of Research Instruments."
2. Though all five juries evaluated both the original curriculum and later the revised curriculum, only the data from the Key Group (i.e., pooled data of the Program Completers' Jury, Non-Advisory Committee Experts' Jury, and the Advisory Committee Jury) were used in the first research problem. The Key Group was selected because it represented a perspective which is independent of involvement with the College as a student or an instructor.

3. A computer search of the literature for context evaluation of competency-based curricula did not locate any statistical criteria which had been used to determine when an objective should be recommended for deletion from the curriculum. As part of this study, a method was developed to set a statistical criteria for determining when an objective should be recommended for deletion from the curriculum. This method became the basis on which the Matrix for Analysis of Rated Competencies (MARC) was developed to provide a decision and information matrix which would display and interrelate the statistical results for Questions A and B of each objective for both the original curriculum and the revised curriculum. MARC is shown in Table 3.1 and Table 4.1.

There were 109 objectives to be evaluated in the original curriculum. Each objective had a Question A and Question B. It was postulated that if one were to pull out the Key Group's data on Question A for a given objective on the original curriculum, and then compute the grand mean of Question A for the remaining 108 objectives in the original curriculum, the result would be

a mean value representing the ratings given by the Key Group. By taking the Key Group's rating data for Question A of the objective being evaluated, and bouncing this data against the grand mean of Question A of the original curriculum, one could determine if the data for the given objective were sufficiently different from the grand mean that the objective landed beyond the critical "t" value. Using this process, the objective could be rated as being significantly high, significantly low, or not significantly different with respect to the grand mean on Question A. An a priori alpha level of .05, adjusted for error rate, was used for the first research problem. Error rate is discussed later in this chapter.

The criteria setting process just discussed was used for each Question A and B in the original curriculum as well as in the revised curriculum. Thus, since the original curriculum had 109 objectives, there were 109 Paired "t" Tests (Snedecor and Cochran) run for Question A of the original curriculum and 109 Paired "t" Tests run for Question B. The revised curriculum would have 111 Paired "t" Tests for Question A and 111 Paired "t" Tests for Question B.

4. The Paired "t" Tests data for the first research problem was run at the Oregon State University Computer Center. Though special instructions had to be given to the computer in order to organize the data as discussed in the preceding procedure, the data were run on the Statistical Package for the Social Sciences which was devel oped by the Vogelback Computing Center at Northwestern University.
5. During the session in which the original curriculum was evaluated via the first research instrument, the jury members were encouraged to make written comments regarding the curriculum in general as well as comments regarding specific objectives which were in the curriculum or should be in the curriculum. For comments regarding objectives in the original curriculum, the jury members were instructed to note the identification number of each objective on which they were commenting. There was no attempt made to identify the jury or jury member which was the source of any written comment. However, six months later, in October 1978, when the revised curriculum was being evaluated, each jury was given a different color of blank paper on which to write comments

regarding the curriculum. This allowed the instructional team to identify a respondent's jury, but not the specific jury member. Jury members were given the option of stating their names on the comment sheets.

6. After the statistical report was returned from the Oregon State University Computer Center, the College's curriculum coordinator entered the statistical information on MARC (Table 4.1). Then, during the summer of 1978, the curriculum coordinator met with the instructional team to review the statistical findings and the jury members' written comments. Changes were made in the original curriculum and eventually a revised curriculum was approved by the instructional team. The revised curriculum was then prepared for evaluation via the second research instrument.
7. The same juries met in October 1978 to evaluate the revised curriculum. The same procedures were followed as was done on the evaluation of the original curriculum. The revised curriculum contained 111 objectives. Oregon State University ran the statistical data as it had done on the original curriculum. The data are shown in

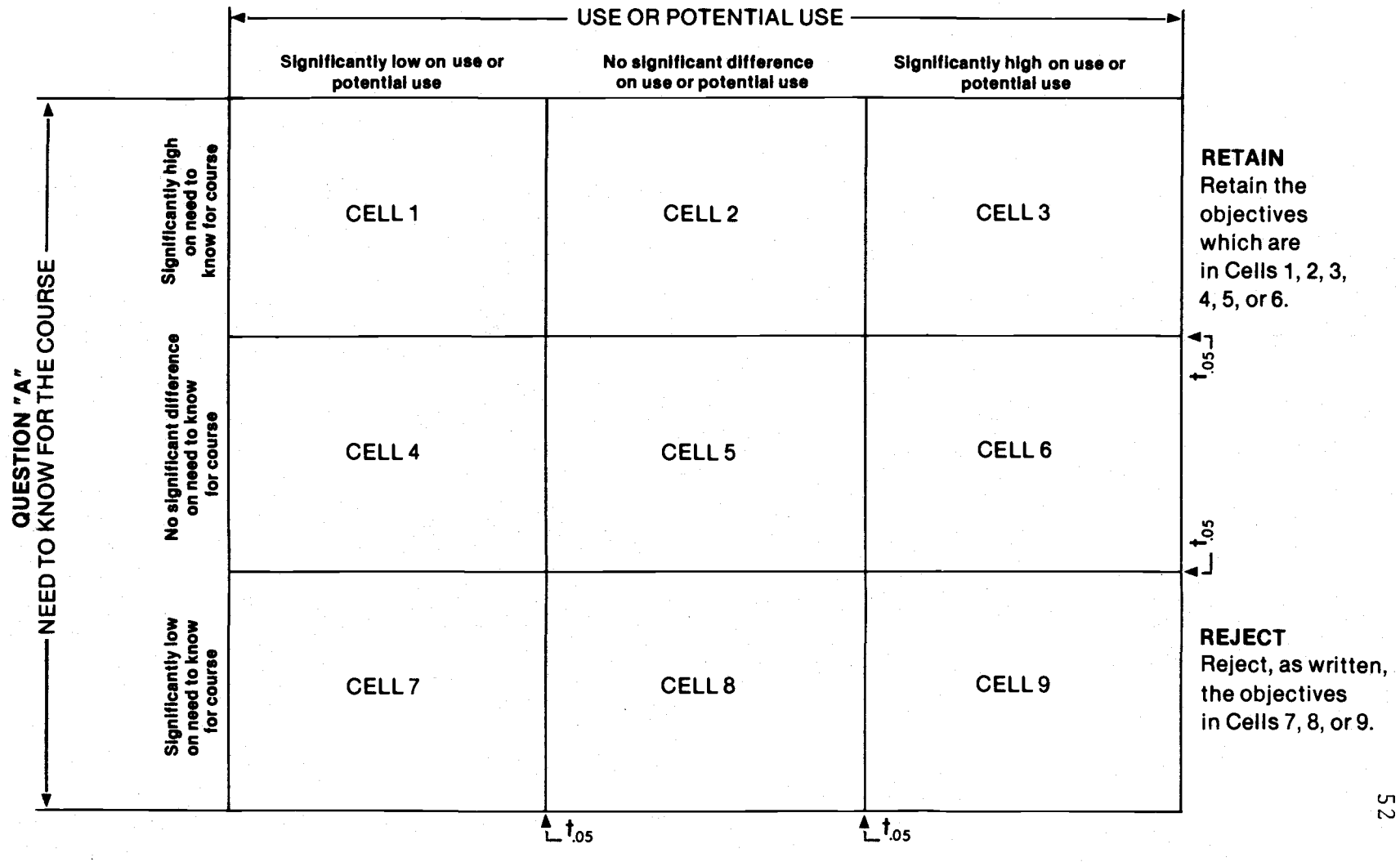
Appendix A. Appendix D contains a detailed analysis of the data obtained in the study of the first research problem.

First Research Problem: Method of Analysis

Matrix for Analysis of Rated Competencies (MARC). Before analyzing the data for the first research problem, there was a need to (a) find some meaningful way to show the relationship between Question A and B for each objective, and (b) determine how to decide when an objective should be dropped from the curriculum. Both needs were met via a matrix which was developed as part of this study. The matrix simultaneously displays and interrelates the ratings for Questions A and B of each objective in the original curriculum and the revised curriculum. The matrix was entitled the Matrix for Analysis of Rated Competencies (MARC). MARC is a nine cell matrix which displays analysis of the competencies (objectives) which have been rated by the Key Group. MARC appears to be unique to the literature and thus a possible contribution to the literature.

MARC (Table 3.1) is used in Chapter IV of this study to display the statistical data for the first research problem. For Question A, Cells 1, 2, and 3 would contain any objectives which the Key Group rated so high that

TABLE III.1
MATRIX FOR ANALYSIS OF RATED COMPETENCIES (MARC)



they would be classified as significantly high as compared to the grand mean of Question A. Cells 7, 8, and 9 would contain any objectives which the Key Group rated so low that they would be classified as significantly low as compared to the grand mean of Question A.

Cells 1, 4, and 7 would contain any objectives which the Key Group rated significantly lower than the grand mean for Question B. Cells 3, 6, and 9 would contain objectives which the Key Group rated as significantly higher than the grand mean for Question B.

An explanation of each cell in MARC is as follows:

CELL 1: Significantly Low on "Use or Potential Use," But Significantly High on "Need to Know for Purposes of the Course"

No objectives should be in this Cell. It would be incongruent to have an objective which was significantly high on "need to know for the purposes of the course," and then be significantly low on "use or potential use."

CELL 2: No Significant Difference on "Use or Potential Use," But Significantly High on "Need to Know for the Purposes of the Course"

The Key Group's ratings on "use or potential use," for a given objective, was not

significantly different from the grand mean rating for Question B. However, the Key Group's ratings on "need to know for the purposes of the course" was significantly higher than the grand mean for Question B. Any objective in Cell 2 would be kept in the curriculum.

CELL 3: Significantly High on "Use or Potential Use," and also Significantly High on "Need to Know for the Purposes of the Course"

This Cell contains objectives with the highest possible ratings.

CELL 4: Significantly Low on "Use or Potential Use," and No Significant Difference on "Need to Know for the Purposes of the Course"

Any objective in this Cell could be kept in the curriculum.

CELL 5: No Significant Difference on "Use or Potential Use," and No Significant Difference on "Need to Know for the Purposes of the Course"

Any objective in this Cell could be kept in the curriculum.

CELL 6: Significantly High on "Use or Potential Use," and No Significant Difference on

"Need to Know for the Purposes of the Course"

Any objective in this Cell could be kept in the curriculum.

CELL 7: Significantly Low on "Use or Potential Use," and Significantly Low on "Need to Know for the Purposes of the Course"

Any objective in this Cell should be eliminated from the curriculum or be rewritten to meet criticism of the Key Group.

CELL 8: No Significant Difference on "Use or Potential Use," and Significantly Low on "Need to Know for the Purposes of the Course"

Any objective in this Cell should be eliminated from the curriculum or be rewritten to meet criticism of the Key Group. The "use or potential use" rating would indicate that the objective could be used in another course. The significantly low rating on "need to know for the purposes of the course" does not preclude the possibility that the objective could be acceptable in another course.

CELL 9: Significantly High on "Use or Potential Use," and Significantly Low on "Need to Know for the Purposes of the Course"

> Any objective in this Cell should be eliminated from the curriculum or be rewritten to meet criticism of the Key Group. Due to the objective's high rating on "use or potential use," the objective could probably be placed in another course.

As shown on the right-hand side of Table 3.1, MARC could be viewed as a two-part decision matrix. Cells 1 through 6 could be labeled as "retain these objectives." Cells 7 through 9 could be labeled as "eliminate these objectives as they are presently written." However, all nine cells are displayed because the instructional team can clearly see how the Key Group rated the objectives. This information has many implications for instruction.

Bonferroni Multiple Comparison Method. The Bonferroni Multiple Comparison Method (Neter and Wasserman) was used in this study to help control for error rate. In this study, the *a priori* alpha level of .05 was set for the first research problem. However, since there was a total of 218 Paired "t" Tests conducted on the original curriculum, and 222 Paired "t" Tests conducted on the revised curriculum, one would commit a serious statistical error if one failed to recognize the influence of multiple comparisons upon the increased number of null hypotheses

which would be falsely rejected. This would seriously increase the number of Type I Errors.

Kirk (82-83) discusses "error rate per comparison." He states:

> An error rate per comparison is defined as the probability that any one of C comparisons will be falsely declared significant.
>
> $$\text{Error rate per comparison} = \frac{\text{number of comparisons falsely declared significant}}{\text{total number of comparisons}}$$
>
> This is the error rate that is controlled when a t ratio is used as the test statistic in performing multiple comparisons and alpha is the level of significance for each comparison. . . . Thus controlling error rate for comparison allows the error rate considered over the entire experiment to vary as a function of the number of comparisons that are made. The larger the number of comparisons performed in an experiment, the greater the probability that one or more of the comparisons will be falsely declared significant.

Due to several technical considerations, in this study the Bonferroni method was preferred over Kirk's "error rate per comparison" formula. For the Paired "t" Test, Bonferroni's method is stated as:

$$\beta = 1 - \frac{\alpha}{2s}$$

Where:

β = Bonferroni Multiple Comparison Method

α = a priori alpha level of .05

2 = Two tail test is used for the Paired "t" Test

s = Number of comparisons

For the original curriculum, there were 109 Paired "t" Tests conducted on Question A ("need to know for purposes of the course") and 109 Paired "t" Tests conducted on Question B ("use or potential use"). The data were not independent since these two questions were answered by the same jury members. Therefore, the number of comparisons was 218. Using Bonferroni's method, the critical "t" value for H_{1A} and H_{1B} of the original curriculum would be:

$$\beta = 1 - \frac{.05}{(2)\ (218)} = 1 - .000115 = .999886$$

One tail has .000115 and two tails has .000230

df = n-1 = 27-1 = 26

$t_{.05}$ for df = 26 and two tail probability of .000230 is shown below:

$$t_{.05} = \pm 4.2710$$

For the revised curriculum, there were 111 Paired "t" Tests conducted on Question A ("need to know for purposes of the course") and 111 Paired "t" Tests conducted on Question B ("use or potential use"). Therefore, the total number of comparisons was 222. Using Bonferroni's method, the critical "t" value for H_{1A} and H_{1B} of the revised curriculum was:

$$\beta = 1 - \frac{.05}{(2)\ (222)} = 1 - .0001126 = .999887$$

One tail has .000113 and two tails has .000226

df = n-1 = 25-1 = 24

$t_{.05}$ for df = 24 and two tail probability of .000226 is shown below:

$$t_{.05} = \pm 4.3341$$

The Paired "t" Test. The Paired "t" Test (Snedecor and Cochran:91-99) was the statistical tool utilized in this study to test H_{1A} and H_{1B} on both the original curriculum and the revised curriculum. In the third procedure listed under "Procedures" (First Research Problem: Design of the Study section of this chapter), there is a discussion of the way in which the statistical cut-off point was developed in this study. Table 2 on the next page summarizes the information in a different form

Written Comments. Earlier in this chapter there was a statement as to the instructions which were given to jury members for recording written comments about the curriculum in general as well as specific objectives. Every written comment was grouped according to objective identification and reproduced in a report which was given to the instructional team for study and discussion. For every comment from the jury members, the primary instructor prepared a written response as to what he recommended be done regarding the jury member's comment. All of this

TABLE III.2

SUMMARY OF THE PAIRED "t" TEST FOR QUESTION A AS WELL AS QUESTION B FOR EACH OF THE 109 OBJECTIVES IN THE FIRST RESEARCH PROBLEM

NOTE: Variable 3.4.1A is one of 218 variables in the original curriculum. The data below would have to be repeated for each of the remaining 217 variables.

Hypothesis

$H_{1A} : \mu_1 = \mu_2$

Assumptions

1. The data take the form of pairs of scores, and these pairs of observations are randomly sampled. Often these two observations are made on the same or closely matched subjects.
2. The population distribution of the D_i is normal. (McCall:188)

Decision Rules

Given .05 significance level adjusted via Bonferroni's method, N-1 = 26df

If $t_{obs} < \pm 4.2710$, do not reject Ho

If $t_{obs} > \pm 4.2710$, reject Ho

Computation

Variable = 3.4.1A

TABLE III.2 cont.

Juries of Key Group	Rating Given on Variable	Mean Rating of All Other 108 Objectives for Question Being Evaluated in the 109 Objective Curriculum	Di	Di^2
Program Completers' Jury				
Respondent 1	x_1	y_1	x_1-y_1	$(x_1-y_1)^2$
Respondent 2	x_2	y_2	x_2-y_2	$(x_2-y_2)^2$
. .	.	.	.	.
. .	.	.	.	.
Respondent 9	x_9	y_9	.	.
Non-Advisory Committee Expert Jury				
Respondent 1	x_{10}	y_{10}	.	.
Respondent 2	x_{11}	y_{11}	.	.
. .	.	.	.	.
. .	.	.	.	.
Respondent 9	x_{18}	y_{18}	.	.
Advisory Committee Jury				
Respondent 1	x_{19}	y_{19}	.	.
Respondent 2	x_{20}	y_{20}	.	.
. .	.	.	.	.
. .	.	.	.	.
Respondent 9	x_{27}	y_{27}	.	.
	N = 27		ΣDi	ΣD_i^2

$$t_{obs} = \frac{\Sigma Di}{\frac{N\Sigma Di^2 - (\Sigma Di)^2}{N-1}}$$

information was shared with the instructional team. The team made decisions as to what was to be done to the curriculum with the points brought out in the written information gained from the jury members and the primary instructor.

Second Research Problem: Design of the Study

The second research problem determined if the revised curriculum was an improvement over the original curriculum. Only the Key Group's data was utilized.

H_{2A} and H_{2B}.

H_{2A} = For any given objective present in both the original curriculum and the revised curriculum, there is no significant difference in the ratings when comparing the Key Group's ratings for Question A of the original curriculum with the Key Group's ratings for Question A of the revised curriculum.

H_{2B} = For any given objective present in both the original curriculum and the revised curriculum, there is no significant difference in the ratings when comparing the Key Group's ratings for Question B of the original curriculum with the Key Group's ratings for Question B of the revised curriculum.

Procedures. The procedures for the second research problem were as follows:

1. The Key Group's data were collected via exactly the same instruments and procedures as discussed earlier in this chapter's section entitled, "First

Research Problem: Design of the Study." However, the second research problem utilized a different statistical procedure than was utilized on the first research problem.

2. The data collected for each member of the Key Group were contained on the same three keypunch cards that were used on the first research problem. A Wilcoxon matched-pairs ranked-signs test was used to test H_{2A} and H_{2B}. Detailed analysis of results is presented in Appendix E.

Second Research Problem: Method of Analysis

Wilcoxon Matched-Pairs Ranked-Signs Test. The only objectives involved in the second research problem were those objectives which were common to both the original curriculum and the revised curriculum.

The Wilcoxon test is a nonparametric statistical test which requires (a) at least ordinal data, (b) two samples, and (c) that the samples must be related. Siegel (75-77) states that:

> The Wilcoxon test is a most useful test for the behavioral scientist. With behavioral data, it is not uncommon that the researcher can (a) tell which member of a pair is 'greater than' which, i.e., tell the sign of the difference between any pair, and (b) rank the differences in order of absolute size. That is, he can make the judgment of 'greater than' between any pair's two performances, and also can make that judgment between any two difference scores

arising from any two pairs. With such information, the experimenter may use the Wilcoxon test.

Due to the fact that the Wilcoxon test was repeated many times in this study, it was necessary to apply the Bonferroni method. The Wilcoxon test is a two tail test just as was the case for the Paired "t" Test used in the first research problem. The same equation is used as was used in the first study. Therefore, the details regarding the Bonferroni method will not be repeated here.

In the second research problem, there were 99 objectives which were common to both the original curriculum and the revised curriculum. Since each of the 99 objectives had a Question A and a Question B, there was a total of 198 comparisons which were made via the Wilcoxon test. Thus, the Bonferroni method as applied to the second research problem was as follows:

$$\beta = 1 - \frac{.05}{(2)\ (198)} = 1 - .0001262 = .9998738$$

One tail has .0001262 and two tails has .000252

df = 0

$z_{.05}$ for two tail probability of .000252 is shown below:

$$z_{.05} = \pm 3.6598$$

Siegel (76) states that the "z" distribution must be used when N > 25. In this study, considering only the data from the Key Group, there were 27 respondents on the original curriculum and 25 on the revised curriculum.

The last column of Appendix A lists the "z" values for all of the objectives which were common to both the original and the revised curriculum.

Third Research Problem: Design of the Study

The question asked in the third research problem was whether, for any given objective and question, there were significant differences in the ratings given by the five juries. The One-Way Analysis Variance Test was used to test the following null hypotheses for the third research problem:

H_{3A} = Considering separately the original curriculum and the revised curriculum, for Question A of each objective, there is no significant difference in the ratings given by the five juries.

H_{3B} = Considering separately the original curriculum and the revised curriculum, for Question B of each objective, there is no significant difference in the ratings given by the five juries.

Procedures. The procedures for the third research problem are:

1. Whereas the first and second research problems used only the data from the three juries which

TABLE III.3

SUMMARY TABLE FOR WILCOXON MATCHED-PAIRS SIGNS-RANKED TEST

Hypotheses

H_{2A} = For any given objective present in both the original curriculum and the revised curriculum, there is no significant difference in the ratings when comparing the Key Group's ratings for Question A of the original curriculum with the Key Group's ratings for Question A of the revised curriculum.

H_{2B} For any given objective present in both the original curriculum and the revised curriculum, there is no significant difference in the ratings when comparing the Key Group's ratings for Question B of the original curriculum with the Key Group's ratings for Question B of the revised curriculum.

Assumptions

1. The pairs of subjects are randomly selected (or the same subjects are measured under two different conditions).

2. Ordinal measurement is available both within pairs and between the N differences between members' scores. (McCall:309)

Decision Rules

Given .05 significance level adjusted via Bonferroni's method, df = 0:

If $z_{obs} = < \pm 3.6598$, do not reject H_{2A} or H_{2B} depending upon which one is being tested.

If $z_{obs} = \geq \pm 3.6598$, reject H_{2A} or H_{2B} depending upon which one is being tested.

TABLE III.3 cont.

Computation (Siegel:79-83)

NOTE: The Wilcoxon Test must be run 198 times to test Question A as well as Question B for all 99 objectives common to the original curriculum and the revised curriculum. Variable 3.4.1A is used as an example.

Variable = 3.4.1A

Juries of Key Group	Rating Given Variable On Original Curriculum	Rating Given Variable On Revised Curriculum	d	Rank of d	Rank with Less Frequent Sign
Program Completers' Jury					
Respondent 1					
Respondent 2					
.					
.					
Respondent 9					
Non-Advisory Committee Expert Jury					
Respondent 1					
Respondent 2					
.					
.					
Respondent 9					
Advisory Committee Jury					
Respondent 1					
Respondent 2					
.					
.					
Respondent 9					
				T =	

TABLE III.3 cont.

n = number of pairs minus the number of zero differences

If N > 25 use z distribution.

Therefore, z for variable 3.4.1A is:

$$z = \frac{T - \mu_T}{\sigma_T} = \frac{T - \frac{N(N+1)}{4}}{\sqrt{\frac{N(N+1)\ (2N+1)}{24}}}$$

comprised the Key Group, the third research problem utilized the data from the student jury and the instructor jury as well as the three juries which comprised the Key Group. Thus, there were five juries which provided data for the third problem.

2. Data for the third research problem were collected via exactly the same instruments and procedures as were used for the first and second research problems.

Third Research Problem: Method of Analysis

One-Way Analysis of Variance (ANOVA). ANOVA was the statistical tool used to test H_{3A} and H_{3B}. Then, two multiple range tests were used on any variable for which the null hypothesis was rejected. In the event that none of the null hypotheses were rejected, then the five F values closest to the critical F value would be studied to determine which juries clustered together in homogeneous subgroups. The multiple range tests would reveal how the various juries related to one another in terms of the similarity, or lack of similarity, of the ratings for each variable.

Sedgwick and Courtney (Use of the F Statistic) state that:

> In the testing of differences between means, the means are hypothesized as being not different from one another (i.e., H_o: $\mu_1 = \mu_2 = \mu_3$) and the variances are compared to ascertain if differences exist. (Actually, we are comparing the variance of the means of the experimental variance--or mean square error--since the formula for the F statistic requires these values.) (2)

In the third research problem, for each of the 218 variables on the original curriculum, and the 222 variables on the revised curriculum, ANOVA was used to determine whether there was any significant difference in the way the five juries rated each variable. Since ANOVA was run hundreds of times, it was necessary to use the Bonferroni method to compensate for error rate. The F statistic is always positive and therefore it is a one tailed test. Therefore, the denominator of the Bonferroni method showed the number of comparisons to be multiplied by one rather than two as was the case in the first and second research problems. Therefore, for the original curriculum, the Bonferroni method for the F statistic was as follows:

$$\beta = 1 - \frac{.05}{(1)\ (218)} = 1 - .000229 = .999771$$

$$df = 4\ \&\ 36$$

$$F_{\text{critical ratio}} = 7.1993$$

$$F_{\text{critical probability}} = .000229$$

ANOVA was run 222 times for the revised curriculum. Hence, the Bonferroni method for the F statistic was as follows:

$$\beta = 1 - \frac{.05}{(1)\ (222)} = 1 - .000225 = .999775$$

$df = 4$ & 34

$F_{\text{critical ratio}} = 7.3415$

$F_{\text{critical probability}} = .000225$

The F probability level, rather than the F ratio, was selected for reporting the ANOVA data in Appendix A and in Appendix F.

TABLE III.4

SUMMARY TABLE FOR ONE-WAY
ANALYSIS OF VARIANCE

Hypotheses

General null hypothesis: $\mu_1 = \mu_2 = \mu_3 = \mu_4 = \mu_5$

Specific null hypotheses:

H_{3A} = Considering separately the original curriculum and the revised curriculum, for Question A of each objective, there is no significant difference in the ratings given by the five juries.

H_{3B} = Considering separately the original curriculum and the revised curriculum, for Question B of each objective, there is no significant difference in the ratings given by the five juries.

Assumptions

Sedgwick and Courtney state:

1. The dependent variable must be normally distributed.
2. The variances are common or equal.
3. The samples are randomly drawn.

Mathematical Model

$$Y_i = \mu + \alpha_i + \varepsilon_{ij}$$ (Courtney:1976)

TABLE III.4 cont.

Decision Rules

Given .05 significance level adjusted via Bonferroni's method,

For original curriculum:

df = 4, 36

If $F_{obs} \geq F_{ratio}$ of 7.1993 or $F_{probability}$ of .000229, do not reject H_{3A} or H_{3B} depending upon which H_3 is being tested.

If $F_{obs} \leq F_{ratio}$ of 7.1993 or $F_{probability}$ of .000229, reject H_{3A} or H_{3B} depending upon which H_3 is being tested.

For revised curriculum:

df = 4, 34

If $F_{obs} \geq F_{ratio}$ of 7.3415 or $F_{probability}$ of .000225, do not reject H_{3A} or H_{3B} depending upon which H_3 is being tested.

If $F_{obs} \leq F_{ratio}$ of 7.3415 or $F_{probability}$ of .000225, reject H_{3A} or H_{3B} depending upon which H_3 is being tested.

TABLE III.4 cont.

Appendix A contains all of the F values calculated for both the original curriculum as well as the revised curriculum. Appendix F contains a detailed analysis of the data for the third research problem.

Variable 3.4.1A NOTE: ANOVA must be run 218 times on original curriculum and 222 times on revised curriculum.	μ_1 Students' Jury	μ_2 Program Completers' Jury	μ_3 Non-Advisory Committee Experts' Jury	μ_4 Advisory Committee Jury	μ_5 Instructors' Jury
	x_1	x_1	x_1	x_1	x_1
	x_2	x_2	x_2	x_2	x_2
	.	.	.	.	.
	.	.	.	.	.
	.	.	.	.	.
	=	=	=	=	=
	x_9	x_9	x_9	x_9	x_9
	n=9	n=9	n=9	n=9	n=5

TABLE III.4 cont.

One-Way ANOVA Matrix Table Layout:

Source of Variation	df	SS	MS	F
Between	k-1	A	A/k-1	MS_B / MS_W
Within (Error)	k(n-1)	B	B/k(n-1)	
TOTAL	N-1	C		

IV. ANALYSIS OF THE DATA

Introduction

Three research problems were addressed in this study. Each of the three problems had a null hypothesis dealing with Question A and another null hypothesis dealing with Question B. The statistical data for Question A of Hypothesis One (H_{1A}) were assessed by conducting 109 Paired "t" Tests on the original curriculum and 111 Paired "t" Tests on the revised curriculum. The same process was followed for Question B of Hypothesis One (H_{1B}). The null hypothesis for H_{2A} and H_{2B} was assessed by running 180 Wilcoxon Matched Pairs Ranked Signs Tests. The statistical data for H_{3A} were assessed by conducting 109 one-way-analysis of variance tests on the original curriculum and 111 one-way-analysis of variance tests on the revised curriculum. This same process was followed for H_{3B}. The LSD Procedure as well as the Student-Newman-Keuls Procedure was used to determine homogeneous sub-groups for variables which approached the critical F probability levels for the original curriculum and the revised curriculum.

An *a priori* alpha level of .05 was used for all analysis in the study. Due to the hundreds of statistical tests run in this study, the Bonferroni Multiple Comparison Method was employed to reduce the number of

spurious significant differences which can be evidenced when many statistical tests are run on the same data base.

Appendices D, E, and F contain detailed analysis, procedural steps, and tables used in the analysis of the data for each of the three research problems addressed in this study. Appendix D contains tha data for the first research problem, Appendix E the data for the second research problem, and Appendix F the data for the third research problem.

First Research Problem

The Matrix for Analysis of Rated Competencies (MARC) is shown in Table IV.1. MARC displays all results of the data analysis for the first research problem. Appendix D gives a detailed analysis of Table IV.1.

The analysis of H_{1A}, "need to know for the course," indicated that eight of the 109 objectives in the original curriculum were rated significantly low and 23 of 109 objectives were rated significantly high. One of the main efforts in the revision process was to reduce the number of objectives which were rated significantly low. The revisions made by the instructional team met the criticisms of the Key Group. Of the 111 objectives in the revised curriculum, only one was rated significantly low on H_{1A}. One would expect three objectives to be significantly low by chance. Intthe revised curriculum, 18 objectives were rated significantly high on H_{1A}. This reduction from 23

significantly high objectives in the original curriculum to 18 in the revised curriculum was not a concern to the instructional team because the team's efforts were directed at the significantly low ratings on Question A rather than on increasing the number of significantly high ratings for Question A. Also, the means on the revised curriculum were higher and thus the number of significant differences would be less than was obtained in the original curriculum.

The analysis of H_{1B} "use or potential use," indicated that ten of the 109 objectives in the original curriculum were rated significantly low and 18 of the 109 objectives were rated significantly high. Of the ten objectives rated significantly low on Question B, seven were also rated significantly low on Question A. As mentioned earlier in this paper, the objectives rated significantly low on both Questions A and B were the target of considerable revision efforts by the instructional team because the team was especially concerned about significantly low ratings on Question A. Thus, the successful effort to reduce the number of significantly low objectives on Question A resulted in a fifty percent reduction in the number of objectives rated significantly low on Question B. Just as there was a reduction in the number of significantly high objectives in the revised curriculum for Question A, there was also a reduction in the number of significantly high ratings for Question B in the revised curriculum.

TABLE IV.1
MATRIX FOR ANALYSIS OF RATED COMPETENCIES
(MARC)

QUESTION "B" USE OR POTENTIAL USE

QUESTION "A" NEED TO KNOW FOR THE COURSE

CELL 1 ORIGINAL: 0 REVISED: 0	**CELL 2** ORIGINAL: 3.3.2 8.4.6; 6.3.2 9.1.1; 6.4.2 9.1.3; 8.1.8 11.1.2; 8.4.2 11.1.3 REVISED: 3.4.1 8.7.2; 3.4.2 8.7.3; 3.4.3 9.1.1; 5.1.3 9.1.2; 6.2.3 11.1.3; 6.3.2 13.1.1; 8.4.1 13.1.4; 8.4.3	**CELL 3** ORIGINAL: 1.1.5 8.4.1; 3.1.1 8.4.5; 3.4.2 8.4.7; 5.1.3 8.4.8; 5.2.4 10.1.3; 6.2.3 13.1.5 REVISED: 5.2.4; 6.4.2; 8.1.1; 8.4.5
CELL 4 ORIGINAL: 7.1.4 Ed; 8.1.5 Ed REVISED: 8.1.2; 8.1.5; 10.1.1	**CELL 5** CELL 5 contains the remaining objectives which are not shown in the other cells of MARC	**CELL 6** ORIGINAL: 1.1.2; 1.1.3; 1.1.4; 3.4.3; 8.1.1 REVISED: 1.1.1; 1.1.2; 1.1.3; 1.1.4; 1.2.1
CELL 7 ORIGINAL: 2.1.2 SM; 2.2.1 SM; 3.1.3 Ed; 3.2.2 SM; 4.1.2 SM; 4.2.1 SM; 8.2.2 SM REVISED: 3.1.3	**CELL 8** ORIGINAL: 2.2.3DC REVISED: 0	**CELL 9** ORIGINAL: 0 REVISED: 0

RETAIN

REJECT

Second Research Problem

The second research problem addressed in this study dealt with whether there was any significant difference between the ratings of the objectives which were common to both the original curriculum and the revised curriculum. Since some objectives in the original curriculum were dropped or combined with other objectives, and some new objectives were added to the revised curriculum, the revised curriculum had 99 objectives which also appeared in the original curriculum. The 99 objectives contained a total of 198 variables. The Wilcoxon Matched-Pairs Ranked-Signs Tests, a non-parametric test, was used to determine if there were any significant differences between the ratings of the variables which were common to the original curriculum and the revised curriculum.

Bonferroni's method was used to account for error rate. None of the variables were equal to, or less than, the critical "z" value of $\pm$ 3.6598. Therefore, the null hypothesis for H_{2A} and H_{2B} was not rejected. Table A-1 shows that 195 of the 198 variables had a positive "z" value. Three variables had a "z" value of 0.0000. Hence, one can conclude that the Key Group members rated the revised curriculum as being more positive than the original curriculum.

Third Research Problem

The third research problem in this study involved all five juries and determined if there were significantly different ratings given by the five juries when looking at Question A and then separately at Question B for each objective from the original curriculum as well as each objective from the revised curriculum. A one-way analysis of variance was used for each H_{3A} and H_{3B}. To account for error rate, the a priori alpha level of .05 was adjusted via the Bonferroni method.

For H_{3A} and H_{3B} the null hypothesis was not rejected on the original curriculum nor on the revised curriculum. Normally, no further statistical tests are conducted when the null hypothesis is not rejected. However, due to the developmental nature of this study it was decided to conduct two different multiple range tests on the data which produced the F probability levels closest to being significant. The multiple range tests were conducted on five variables from the original curriculum and five from the revised curriculum. Each of these ten variables had F probability levels less than .05. The multiple range tests were conducted to determine the homogeneous groupings of the various juries. It was anticipated that the instructors and students would tend to cluster together in a homogeneous subset and then the other three juries would

tend to cluster together as a separate homogeneous subset. The assumption was made that students would perceive the instructors as knowing what was "real, true, and good" with respect to the curriculum and thus the students would rate the curriculum as did the instructors. The Least Significant Difference Procedure indicated that this was not true. In fact, of the five variables presented in Table F-2 for the original curriculum, three of the five variables showed the students and the instructors to be at opposite ends of the rating scales. The students were at the lowest end and the instructors were at the highest end. This extreme polarization was true in only one of the five variables of Table F-4 showing the data for the revised curriculum. In the revised curriculum, there was only one of the five variables where the students were in a separate subgroup from the instructors. Thus, in the revised curriculum, the students tended to move closer to the instructors in their ratings. In the one case where the students were in a separate subset from the instructors, the mean rating of the Students' Jury was 7.5556 and the Instructors' Jury mean rating was 9.8000. These two ratings are quite high; therefore, the fact that the students were in a different subset should probably not be a concern to the instructional team.

Written Comments by Jury Members

All jury members were instructed to make written comments regarding changes which needed to be made in the curriculum. From these written comments, a report was prepared for the instructional team. All comments made by the jury members were included in the report. The report was revised by the course instructor, and he prepared a written response to every comment made by the jury members. The course instructor's responses were analyzed in a meeting of the instructional team. The instructional team then decided the changes which needed to be made for the revised curriculum.

The comments by jury members indicated a need to drop the portion of the course dealing with "drainage." Drainage is dealt with in other courses. It was thought that a better title for the course would be "Soils and Plant Nutrition" rather than the original title of "Soils and Drainage."

Section 12.0 of the original curriculum, "Irrigation," was entirely dropped in the revised curriculum. In its place was a new section entitled "Problem Solving: Typical Northwest Soil and Plant Nutrition Problems." There were a number of students and program completers who indicated that this was an area of emphasis which they would like to see expanded in the course.

"Nutrient Analysis," Section 8.5.0, was another new section.

During the last four years, the instructor used the last four weeks of the class to deal with field based laboratory experiences. He stated that this was sufficient emphasis upon practical application of the knowledge and skills learned in the course. However, some of the students indicated that they did not see the practical application of some of the course content. Therefore, as a result of the research discussion sessions which were held as a part of this dissertation study, the instructor has made a number of changes in the course. These changes more clearly express his interest in the practical application of the material learned in the course and identify specific projects related to the background information.

For the evaluation of the revised curriculum each jury had a different color of paper on which to record their comments. The idea of using a different color for each committee was to assist the researcher and the instructors in interpreting comments. The comments sheet was not color coded for the evaluation of the original curriculum.

The comments on the revised curriculum fitted into two categories. The first category consisted of comments on specific objectives. The second category consisted of comments on the overall revised curriculum. For the first

category there were comments on 31 objectives. No two committee members commented on the same objective. Of the 31 comments, 17 of them were by one member of the Non-Advisory Committee Expert Jury. There were only three objectives on which students commented. Only one comment was made by the Advisory Committee Jury. The Program Completers' Jury had three objectives which received comments, and two of the comments were by the same person. There were three objectives which received comments by the Instructors' Jury. This is a rather low comment range when considering there were 111 objectives and over 40 jury members.

The second category of comments dealt with the overall revised curriculum. Here, the number of responses was greater. Five members of the Non-Advisory Committee Experts' Jury commented on the improved status of the objectives. Comments were also made by three members of the Advisory Committee Jury, four members of the Students' Jury, four members of the Program Completers' Jury, and two members of the Instructors' Jury.

The comments on the revised curriculum unanimously indicated there was a definite improvement in the revised curriculum as compared to the original curriculum.

V. SUMMARY, CONCLUSIONS, AND DISCUSSION

Summary

Statement of the Problem

A computer search of the literature did not locate a context evaluation model which provided definitive information upon which instructional and administrative staff could evaluate objectives which are part of the foundation for the development and implementation of competency-based curricula.

Procedure and Sample

There were ten procedural steps in this study. Each of the ten steps is listed below.

1. Identify a competency-based community college curriculum which had been taught for at least two years.
2. Identify a population of participants which represented different perspectives of the curriculum so that possible improvements could be identified.
3. Identify critical questions to be asked about the objectives and select a scaling system which yielded information needed to make decisions about the appropriateness of the objectives for the given curriculum.

4. Develop a research instrument which was efficient in accurately obtaining the data.
5. Conduct evaluation of original curriculum via use of the first research instrument.
6. Perform statistical analysis of data and analysis of written comments.
7. Work with the instructional and administrative staff in revising the curriculum.
8. Conduct evaluation of the revised curriculum via use of the second research instrument.
9. Perform statistical analysis of data from the second research instrument and study the written comments made by jury members.
10. Write report of the study.

A brief discussion of each of the ten procedural steps will introduce what is covered in detail in this study.

Step 1. The competency-based community college curriculum selected for this study was a course entitled "Soils and Drainage" (La. 8.104). This course was developed and taught at Portland Community College in Portland, Oregon. The objectives for the course are listed in a publication entitled Soils and Drainage - Course Content

Guide. The Guide is a result of a rigorous curriculum development process utilized at the College. The development process took place between 1972 and 1974. The instructor who teaches the course was primarily involved in working with the College's curriculum coordinator in the writing of the course objectives. All instructors, the department chairperson, dean, and president were involved in a review and critique of the curriculum. All of these instructors and administrators signed an acceptance of the curriculum in 1974. Between 1974 and 1978 the objectives were taught by the same instructor who was the key instructor in writing of the objectives for the course.

Step 2. The population utilized in this study was selected to represent different informed perspectives of the curriculum. Five juries were used in the evaluation of the original curriculum. The same jury members evaluated the original curriculum, and six months later, the revised curriculum. The five juries were as follows:

1. Students' Jury: This jury had nine randomly selected students who completed the course within the twelve months prior to the first evaluation conducted in this study.
2. Program Completers' Jury: This jury had nine randomly selected individuals who

completed the course as well as at least the first 48 credit hours of the Landscape Technology Program. Also, these jury members had to have been working full time in the landscape industry for at least six months.

3. Non-Advisory Committee Experts' Jury: This jury had nine randomly selected individuals who were identified as having expertise in solving landscape soils and drainage problems.
4. Advisory Committee Jury: This jury had nine individuals who served on the College's Landscape Technology Advisory Committee. These members represented a broad range of specialities within the landscape industry. They had expertise, but not necessarily in the solution of landscape soils and drainage problems.
5. Instructors' Jury: This jury was comprised of the five instructors who teach in the College's Landscape Technology Department. Only one of the five had ever taught the Soils and Drainage course.

The pooling of the data from Juries 2, 3, and 4 comprised what is referred to in this study as the Key Group. The Key Group represents a perspective of the curriculum from outside the College.

Step 3. The first and second research instruments used in this study were developed as part of this study. After field testing of several earlier versions of the research instrument, two questions were identified which would obtain information which could assist in making decisions about the objectives. The same two questions were asked about each of the 109 objectives in the original curriculum and the 111 objectives in the revised curriculum. Each question had a ten-point scale. Appendix B contains a one-page sample of the research instrument used to evaluate the original curriculum. Appendix C contains a one-page sample of the research instrument used to evaluate the revised curriculum.

Question A and Question B are shown under each objective. Question A is shown below:

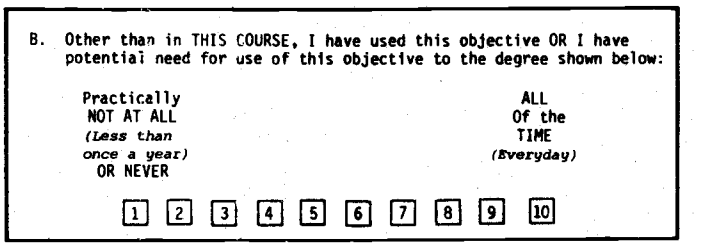
A. For the PURPOSE(S) of THIS COURSE, I feel that this objective should be classified as:

Does NOT Need To Know — NEEDS to Know

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

Question A stresses the purpose(s) of the course. There is always the possibility that a well-written and legitimate objective can end up in a curriculum and yet not be appropriate for the course when considering the purpose(s) of the course.

Question B is shown below as it appeared on the research instruments:



The ". . . OR I have potential need for use of this objective. . ." aspect of Question B did not appear in the literature identified by the computer search. This wording was used because it is very possible that an objective could receive a low rating if the respondent was asked only how much he "used" an objective, but receive a very high rating if the respondent was asked about "potential need for use" of the objective. For example, an objective could deal with recognizing the effects of excessive radioactivity levels upon plant life and soils. A respondent working within 50 miles of the Trojan Nuclear Facility may give a low rating if asked only about "use," but a very high rating if also asked about "potential use."

Step 4. Once Questions A and B were developed, a number of field tests were conducted prior to settling on the response format shown on the research instruments. There were attempts to utilize a standard multiple choice computer scoring sheet. However, the respondents made

frequent errors in coordinating the computer multiple choice form with the research instrument listing the objectives and questions.

The research instruments in Appendices B and C involve a little more work for the key punch operators, but the accuracy and speed gained in obtaining information from the respondents far out-weighed the additional burden placed on the key punch operators.

Step 5. The original curriculum was evaluated in April 1978. The jury members were given their choice of attending a luncheon or a dinner which was then followed by the evaluation session. In the evaluation session, each participant was given a copy of the survey instrument. The survey instruments were color coded for each committee and each individual was given an identification code which was unknown to the researcher. These same identification codes and color systems were used six months later when the revised curriculum was evaluated. Appendix B displays one page of the 39 page research instrument. During the evaluation session, the participants were encouraged to make written comments regarding individual objectives as well as comments on the overall curriculum. The original curriculum involved 109 objectives with a Question A and a Question B for each objective; thus there were 218 responses required of each participant. The average time

it took the participants to complete the original curriculum was 45 minutes.

The responses from the survey instruments were recorded on key punch cards and sent to Oregon State University for processing on the Statistical Packages for Social Sciences computer program, which was written by Vogelback Computing Center at Northwestern University.

The written comments were reported in a document which was presented to all instructors and administrators of the Landscape Technology Program. The instructor who wrote the original curriculum with this researcher reviewed the various comments with the instructional staff. The curriculum was revised based upon statistical data and narrative comments. After several months, a meeting was held with all of the instructors in the Landscape Technology Department as well as the department chairman and dean of the division. The recommended changes were presented to the group, and the end product of the meeting was an agreement on the revised curriculum which contained 111 objectives. A research instrument for the revised curriculum utilized the identical format used on the research instrument for the original curriculum. Appendix C displays one page of the 46 page research instrument used to evaluate the revised curriculum.

A luncheon or dinner preceded the evaluation of the revised curriculum. The evaluation was held in October

1978. The procedural instructions were the same as had been used in the evaluation held in April.

The data for Questions A and B were key punched as had been done on the original curriculum and sent to Oregon State University for processing on the same statistical programs as had been used for the original curriculum. The jury members' written comments were typed and made available to the instructional team.

Step 6. The statistical analyses for the original curriculum as well as for the revised curriculum are displayed in Table A-1 of Appendix A.

Three research problems were addressed in this study. Each research problem had a sub-hypothesis dealing with Question A and a separate sub-hypothesis dealing with Question B.

The results of the statistical analyses for the first research problems are displayed in Table IV.1, which is entitled, "Matrix for Analysis of Rated Competencies" (MARC). MARC was a matrix developed as part of this study and appears to be unique to the literature of context evaluation of competency-based curriculums.

The null hypothesis for the first research problem was:

H_{1A} = Considering separately the original curriculum and the revised curriculum, the Key Group's mean rating of Question A for each objective will not significantly differ from the respective grand mean of Question A.

For the original curriculum, H_{1A} was rejected at an *a priori* alpha level of .05 for a total of eight times on the significantly low side and 23 times on the significantly high side. For the revised curriculum, H_{1A} was rejected once on the significantly low side and 18 times on the significantly high side.

For Question B of the first research problem, the null hypothesis and results are as follows:

H_{1B} = Considering separately the original curriculum and the revised curriculum, the Key Group's mean rating of Question B for each objective will not significantly differ from the respective grand mean of Question B.

For the original curriculum, H_{1B} was rejected on the significantly low side ten times and eighteen times on the significantly high side. For the revised curriculum, H_{1B} was rejected five times on the significantly low side and nine times on the significantly high side.

For the first research problem, there were 109 Paired "t" Tests run on Question A and 109 Paired "t" Tests run on Question B. Due to the hundreds of "t" Tests which were run, the Bonferroni Multiple Comparison Method was employed to adjust the "t" value so that Type I errors were held as close as possible to the .05 level.

MARC (Table IV.1) appears to be a useful tool for displaying and evaluating the massive data involved in this study's first research problem.

A detailed analysis of the data for the first research problem is presented in Appendix D.

The second research problem sought to determine if the revised curriculum was an improvement over the original curriculum. Only the data from the Key Group were used in this analysis. For those objectives which were common to the original curriculum and the revised curriculum, the null hypotheses stated that there was no significant difference between the original curriculum and the revised curriculum for Question A nor Question B for any given objective. The Wilcoxon Matched-Pairs Ranked-Signs Test was used to test the null hypotheses H_{2A} and H_{2B}.

The null hypotheses, and findings, were as follows:

H_{2A} = For any given objective present in both the original curriculum and the revised curriculum, there is no significant difference in the ratings when comparing the Key Group's ratings for Question A of the original curriculum with the Key Group's ratings for Question A of the revised curriculum.

H_{2B} = For any given objective present in both the original curriculum and the revised curriculum, there is no significant difference in the ratings when comparing the Key Group's ratings for Question B of the original curriculum with the Key Group's ratings for Question B of the revised curriculum.

The null hypotheses were not rejected for H_{2A} nor H_{2B}. However, 195 of 198 Wilcoxon Tests yielded positive "z"

values which indicated that the revised curriculum was rated more positively than the original curriculum on 195 of 198 variables. Three variables had "z" values of .0000.

The third research problem in this study involved all five juries and determined if there were significantly different ratings given by the five juries when looking at Question A and then separately at Question B for each objective from the original curriculum as well as each objective from the revised curriculum. A one-way analysis of variance was used for each H_{3A} and H_{3B}. The a priori alpha level of .05 was adjusted via the Bonferroni method, which was employed to take error rate into consideration.

The null hypotheses for the third problem were:

H_{3A} = Considering separately the original curriculum and the revised curriculum, for Question A of each objective there is no significant difference in the ratings given by the five juries.

H_{3B} = Considering separately the original curriculum and the revised curriculum, for Question B of each objective there is no significant difference in the ratings given by the five juries.

The null hypothesis was not rejected for any of the 218 one-way analysis of variance tests conducted on the original curriculum. Likewise, the null hypothesis was not rejected for the 222 one-way analysis of variance tests conducted on the revised curriculum.

For the five lowest "F" probability levels in the original curriculum and the five lowest in the revised curriculum, the study conducted both a Student-Newman-Keuls Procedure as well as a Least Significant Difference Procedure (LSD) to study the nature of the homogeneous sub-grouping of ratings on each of the five variables in each curriculum. It was anticipated that the students and the instructors would cluster together in the same homogeneous sub-group because the students would accept as reality whatever the instructors defined as being worth learning. Such did not happen. On the original curriculum, the students and instructors were at opposite ends of subgroups. The differences were greatly reduced in the revised curriculum.

Conclusions

The conclusions listed below are based upon findings of the study presented herein. Such conclusions may, or may not, have applicability beyond this study. The conclusions from this study are:

1. Use of the context evaluation model developed in this study can identify objectives which are not appropriate for the stated purposes of a given curriculum. Elimination of such objectives has implications for all levels of education

because errors in the selection of objectives can be costly in terms of staffing, facilities, equipment, materials, and can be a poor investment for the taxpayer as well as a waste of time and money for the student.

2. Knowledgeable individuals from outside the educational institution will reject few, if any, of the objectives for a given curriculum if the development and evaluation model presented in this study is utilized.
3. With respect to objectives developed by the model presented in this study, there will be no significant difference in the ratings given by instructors as compared to ratings given by other juries representing students and knowledgeable individuals from outside the educational institution which developed the objectives.
4. Students' and instructors' ratings of the revised curriculum will be much closer to each other than were their ratings of the original curriculum.
5. The Matrix for Analysis of Rated Competencies (MARC) is an effective tool for organizing and displaying the statistical information regarding each objective as well as for adsisting the

instructional team in making decisions about the objectives.

Suggestions for Further Study

The following suggestions for further study are presented for the purpose of providing directions for future research.

1. This study should be replicated with a curriculum developed in the same stringent manner in which the Soils and Drainage curriculum was developed. Such a study would determine if the data obtained in this study are typical of curricula developed via the same process.
2. This study should be replicated with a curriculum written by an instructor, but not put through the extensive review and approval process used in this study prior to the objectives being evaluated via the context evaluation process presented in this study.
3. Future studies should reduce the alpha level to .10 rather than the .05 used in this study.
4. Due to the time and expense involved in conducting a study of this magnitude, it would be well for the comparative aspect of the study to be dropped. Thus, the curriculum would be evaluated every

several years rather than in just a few months as was the case in this study.

5. Future studies may determine if respondents can comfortably evaluate more than 115 to 120 objectives in one session.

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APPENDICES

APPENDIX A

SUMMARY OF STATISTICAL DATA

TABLE A-1

SUMMARY OF STATISTICAL DATA

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
1.1.1A	.3661	.58	5	Ed	1.1.1A	.7473	1.74	6	+1.8671
1.1.1B	.0113	1.77			1.1.1B	.0689	4.36*		+ .9566
1.1.2A	.6204	2.49	6	Ed	1.1.2A	.2742	2.52	6	+ .4543
1.1.2B	.8214	5.12*			1.1.2B	.4914	4.68*		+ .3077
1.1.3A	.6794	1.03	6	Ed	1.1.3A	.1888	1.58	6	+ .9780
1.1.3B	.7902	5.02*			1.1.3B	.5695	4.89*		+ .3920
1.1.4A	.5729	4.26	6	Ed	1.1.4A	.0278	1.59	6	+ .5883
1.1.4B	.7067	9.16*			1.1.4B	.6116	5.05*		+ .3266
1.1.5A	.5981	4.28*	3	Ed	1.1.5A	.3723	.55	5	+ .8237
1.1.5B	.5483	10.61*			1.1.5B	.2519	4.12		+1.8459
1.2.1A	.0202	- 2.06	5	Ed	1.2.1A	.1241	2.50	6	+3.1801
1.2.1B	.2662	- .11			1.2.1B	.0694	5.53*		+3.0703
1.2.2A	.0133	- 2.82	5	SM	1.2.2A	.5227	-2.48	5	+1.8727
1.2.2B	.1076	- 1.42			1.2.2B	.8625	1.58		+2.0033
				New	1.2.3A	.2157	-2.21	5	none
					1.2.3B	.9263	.57		none

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
2.1.1A	.0019	- 2.40	5	SM	2.1.1A	.5824	-1.15	5	+1.9600
2.1.1B	.0034	- 3.84			2.1.1B	.5325	.77		+2.5041
2.1.2A	.0809	- 5.08	7	SM	2.1.2A	.2974	-3.21	5	+2.6783
2.1.2B	.6297	- 5.22			2.1.2B	.3133	- .21		+3.0986
2.1.3A	.0068	- 2.15	5	SM	2.1.3A	.1021	-2.15	5	+ .7384
2.1.3B	.1012	- 1.20			2.1.3B	.2060	- .28		+ .0871
2.1.4A	.0008	- 1.08	5	C	(Combined with 2.1.3 of Revised Curriculum)				
2.1.4B	.1762	- .48							
2.1.5A	.0754	- 2.88	5	U	2.1.4A	.3040	-2.47	5	+1.8769
2.1.5B	.2293	- 2.87			2.1.4B	.3702	-1.73		+1.9317
2.2.1A	.0485	- 4.51*	7	SM	2.2.1A	.2474	-2.52	5	+2.7923
2.2.1B	.2686	- 4.62*			2.2.1B	.2773	- .58		+2.7068
2.2.2A	.0161	- 3.99	5	SM	2.2.2A	.0483	-2.25	5	+3.4623
2.2.2B	.3777	- 2.82			2.2.2B	.7125	-1.84		+1.2774
2.2.3A	.0817	- 4.46*	8	D	(Combined with 2.2.2 of Revised Curriculum)				
2.2.3B	.7575	- 3.83							
3.1.1A	.1442	6.89*	3	Ed	3.1.1A	.5102	3.23	5	+ .8402
3.1.1B	.3238	4.82*			3.1.1B	.5740	3.75		+ .9371

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
3.1.2A	.1527	- 1.24	5	Ed	3.1.2A	.2819	-2.73	5	+ .0942
3.1.2B	.9332	- 1.74			3.1.2B	.0726	-3.17		+ .4024
3.1.3A	.1120	- 6.43	7	Ed	3.1.3A	.2385	-4.89*	7	+2.3340
3.1.3B	.0235	- 7.42			3.1.3B	.5058	-5.06*		+1.7042
3.1.4A	.5440	.43	5	U	3.1.4A	.0997	- .81	5	+ .0699
3.1.4B	.4697	1.10			3.1.4B	.2511	.46		+ .2327
				New	3.1.5A	.1142	-1.68	5	none
					3.1.5B	.5400	-2.90		none
3.2.1A	.7279	- 1.91	5	U	3.2.1A	.4762	-1.76	5	+1.2669
3.2.1B	.9654	- 1.05			3.2.1B	.4284	-2.38		+ .4692
3.2.2A	.0236	- 5.27*	7	SM	3.2.2A	.5517	-1.91	5	+3.1175
3.2.2B	.0259	- 5.68			3.2.2B	.7102	-2.09		+2.8407
3.2.3A	.1620	- 2.80	5	U	3.2.3A	.6769	-1.95	4	+1.9040
3.2.3B	.2061	- 4.19			3.2.3B	.3184	-5.01*		+ .8275
3.2.4A	.1872	- 1.27	5	Ed	3.2.4A	.7807	-1.78	5	+ .9333
3.2.4B	.4965	- 2.01			3.2.4B	.1540	-2.31		+ .9054
3.2.5A	.0049	.91	5	SM	3.2.5A	.4300	.53	5	+1.1927
3.2.5B	.7716	.14			3.2.5B	.5286	- .15		+ .1183

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
3.2.6A	.0544	- .23	5	U	3.2.6A	.3641	1.67	5	+2.0447
3.2.6B	.4466	.36			3.2.6B	.9154	- .88		+ .1183
3.3.1A	.4969	3.42	5	Ed	3.3.1A	.4344	2.61	5	+ .4739
3.3.1B	.1374	3.65			3.3.1B	.4291	1.31		+2.4797
3.3.2A	.1900	5.69*	2	Ed	3.3.2A	.2658	.46	5	+ .5099
3.3.2B	.7814	3.09			3.3.2B	.2758	.63		+1.6805
3.4.1A	.7765	.94	5	Ed	3.4.1A	.6494	.63	5	+ .1569
3.4.1B	.2782	1.01			3.4.1B	.4609	- .20		+1.1300
3.4.2A	.4941	6.74*	3	Ed	3.4.2A	.5998	5.38*	2	+ .7338
3.4.2B	.6725	4.92*			3.4.2B	.8388	3.73		+ .4543
3.4.3A	.2702	3.24	6	Ed	3.4.3A	.1879	4.42*	2	+ .2100
3.4.3B	.5136	4.33*			3.4.3B	.5508	3.49		+ .8475
4.1.1A	.5038	-1.96	5	U	4.1.1A	.4483	- .54	5	+2.5738
4.1.1B	.8316	-3.38			4.1.1B	.2477	-2.83		+1.0865
4.1.2A	.0311	-6.81*	7	SM	4.1.2A	.2477	-2.73	5	+3.3194
4.1.2A	.6144	-7.68*			4.1.2B	.5891	-4.31		+2.3538
4.2.1A	.0215	-4.92*	7	SM	4.2.1A	.0330	- .36	5	+3.2445
4.2.1B	.3651	-5.57*			4.2.1B	.9536	-1.33		+2.7253

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
4.2.2A	.2078	-1.27	5	Ed	4.2.2A	.6455	- .46	5	+1.5380
4.2.2B	.4390	-3.32			4.2.2B	.1698	-3.91		+ .3650
4.2.3A	.2932	-1.63	5	SM	4.2.3A	.7341	- .25	5	+2.4142
4.2.3B	.4160	-2.61			4.2.3B	.1005	-2.69		+1.1573
4.2.4A	.5082	.12	5	U	4.2.4A	.4297	1.23	5	+1.9147
4.2.4B	.5939	- .85			4.2.4B	.3775	-1.63		+ .1894
4.2.5A	.1113	1.47	5	SM	4.2.5A	.0885	1.10	5	+1.0193
4.2.5B	.5364	- .12			4.2.5B	.5013	- .06		+ .4573
4.2.6A	.3671	.51	5	Ed	4.2.6A	.0230	- .81	5	+ .2369
4.2.6B	.9855	- .54			4.2.6B	.2952	.21		+1.4201
5.1.1A	.4281	1.74	5	U	5.1.1A	.7440	.08	5	+ .0592
5.1.1B	.8412	1.68			5.1.1B	.2348	- .23		+ .7042
5.1.2A	.0202	- .75	5	SM (5.1.3 was added here)	5.1.2A	.3466	2.48	5	+2.2357
5.1.2B	.8342	-1.63			5.1.2B	.6161	2.46		+2.8773
5.1.3A	.2087	5.70*	3	C	(Combined with 5.1.2 in Revised Curriculum)				
5.1.3B	.4227	5.03*							
5.1.4A	.2426	3.81	5	Ed	5.1.3A	.3433	9.08*	2	+1.0662
5.1.4B	.7755	4.18			5.1.3B	.5629	3.33		+ .3620

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
5.2.1A	.4638	1.90	5	SM	5.2.1A	.2893	1.50	5	+ .5336
5.2.1B	.9809	2.26			5.2.1B	.7343	1.73		+ .3077
5.2.2A	.7438	-1.36	5	U	5.2.2A	.1263	-2.56	5	+ .0871
5.2.2B	.3578	.65			5.2.2B	.2178	1.23		+ .6968
5.2.3A	.0119	-2.79	5	SM	5.2.3A	.2373	.16	5	+3.1798
5.2.3B	.5582	-2.76			5.2.3B	.5432	.46		+2.9023
5.2.4A	.3527	7.37*	3	U	5.2.4A	.8383	5.64*	3	+ .8018
5.2.4B	.6496	7.25*			5.2.4B	.6346	6.11*		+ .2272
6.1.1A	.3118	- .89	5	Ed	6.1.1A	.7714	- .49	5	+ .6625
6.1.1B	.5408	- .68			6.1.1B	.3013	- .99		+ .2800
6.1.2A	.1539	.53	5	Ed	6.1.2A	.4651	2.72	5	+1.1558
6.1.2B	.6455	.65			6.1.2B	.5177	1.63		+ .7574
6.1.3A	.0270	.19	5	Ed	6.1.3A	.4959	1.48	5	+ .7845
6.1.3B	.4687	.20			6.1.3B	.2842	.81		+ .0852
					6.1.4A	.5979	.12	5	none
					6.1.4B	.7990	.74		none
6.2.1A	.4072	1.78	5	Ed	6.2.1A	.4935	1.08	5	+1.1558
6.2.1B	.4964	2.51			6.2.1B	.9383	2.21		+ .2012

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
6.2.2A	.0424	2.55	5	Ed	6.2.2A	.3017	1.94	5	+ .1747
6.2.2B	.7098	1.29			6.2.2B	.6033	2.39		+ .6907
6.2.3A	.4222	5.70*	3	U	6.2.3A	.2420	7.26*	2	+1.0662
6.2.3B	.5982	5.30*			6.2.3B	.6390	3.23		+ .5008
6.2.4A	.1774	3.41	5	Ed	6.2.4A	.2912	2.31	5	+ .9414
6.2.4B	.9492	1.45			6.2.4B	.8322	3.71		+1.1818
6.3.1A	.2474	.11	5	U	6.3.1A	.5832	- .07	5	+ .8037
6.3.1B	.5693	- .43			6.3.1B	.6715	-1.48		+ .6315
6.3.2A	.1124	6.44*	2	Ed	6.3.2A	.8257	5.01*	2	+ .8885
6.3.2B	.3328	1.62			6.3.2B	.5095	2.26		+ .5662
6.3.3A	.5449	2.54	5	U	6.3.3A	.0576	-1.32	5	+1.2929
6.3.3B	.6778	2.91			6.3.3B	.0604	1.73		+ .1680
6.4.1A	.0933	2.59	5	Ed	6.4.1A	.1728	1.26	5	+ .4395
6.4.1B	.3254	2.90			6.4.1B	.2642	2.23		+ .7467
6.4.2A	.0646	5.10*	2	Ed	6.4.2A	.5410	4.84*	3	+1.0502
6.4.2B.	.5643	3.33			6.4.2B	.5364	4.35*		+1.4737
6.4.3A	.0487	2.11	5	Ed	6.4.3A	.4707	- .41	5	0.0000
6.4.3B	.4064	- .31			6.4.3B	.6920	.32		+ .3421

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
7.1.1A	.0184	- .40	5	Ed	7.1.1A	.8791	.11	5	+2.2151
7.1.1B	.5282	-2.03			7.1.1B	.2459	- .49		+2.6748
7.1.2A	.0014	-1.61	5	SM	7.1.2A	.3076	-1.07	5	+1.4807
7.1.2B	.3339	-2.64			7.1.2B	.5135	-1.54		+1.5148
7.1.3A	.2362	.28	5	Ed	7.1.3A	.6501	.72	5	+1.5335
7.1.3B	.8754	- .36			7.1.3B	.6614	- .96		+ .2831
7.1.4A	.2148	-1.40	4	Ed	7.1.4A	.3868	- .07	5	+2.3432
7.1.4B	.8915	-4.41*			7.1.4B	.9715	-1.09		+2.6036
7.1.5A	.0607	- .00	5	Ed	7.1.5A	.6523	1.74	5	+1.9219
7.1.5B	.4362	.07			7.1.5B	.5279	.30		+ .5591
8.1.1A	.6068	2.35	6	U	8.1.1A	.6988	6.96*	3	+ .8090
8.1.1B	.5351	4.78*			8.1.1B	.5572	7.76*		+ .9021
8.1.2A	.5355	-2.84	5	U	8.1.2A	.9295	-2.22	4	+1.7707
8.1.2B	.9257	-3.50			8.1.2B	.1138	-5.07		+ .8441
8.1.3A	.2188	1.53	5	Ed	8.1.3A	.6560	2.87	5	+1.5375
8.1.3B.	.3961	- .23			8.1.3B	.6612	.26		+ .6981
8.1.4A	.0847	2.45	5	Ed	8.1.4A	.3389	3.19	5	+1.1300
8.1.4B	.3596	- .05			8.1.4B	.4088	1.45		+1.1670

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
8.1.5A	.1769	-3.18	4	Ed	8.1.5A	.2306	-2.07	4	+1.7752
8.1.5B	.3946	-4.91*			8.1.5B	.3589	-5.67		+ .3247
8.1.6A	.0919	- .00	5	U	8.1.6A	.5388	2.12	5	+1.7840
8.1.6B	.6962	-2.51			8.1.6B	.0368	-2.16		+ .6391
8.1.7A	.1284	.12	5	U	8.1.7A	.4219	.68	5	+1.6547
8.1.7B	.6973	-3.12			8.1.7B	.0519	-2.23		+ .7280
8.1.8A	.0306	7.10*	2	U	8.1.8A	.5436	3.76	5	+1.4368
8.1.8B	.3976	3.39			8.1.8B	.4778	3.20		+ .8519
8.1.9A	.6481	.39	5	Ed	8.1.9A	.2533	1.38	5	+1.3347
8.1.9B	.5669	- .39			8.1.9B	.0836	.98		+1.1670
8.2.1A	.0132	1.60	5	U	8.2.1A	.5041	4.04	5	+1.5115
8.2.1B	.8827	- .14			8.2.1B	.9796	1.12		+ .5909
8.2.2A	.1197	-4.41*	7	SM	8.2.2A	.4685	- .99	5	+3.3137
8.2.2B	.9829	-5.35*			8.2.2B	.5272	-3.61		+2.6320
8.3.1A	.3955	-2.23	5	Ed	8.3.1A	.9136	.35	5	+2.5842
8.3.1B	.7052	-2.70			8.3.1B	.7650	-2.63		+ .4708
8.3.2A	.3774	- .43	5	U	8.3.2A	.3803	- .23	5	+1.1114
8.3.2B	.5538	- .71			8.3.2B	.9751	- .92		+ .2760

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
8.4.1A	.1995	4.64*	3	U	8.4.1A	.1401	6.39*	2	+ .1826
8.4.1B	.3688	4.48			8.4.1B	.9316	3.00		+ .1420
8.4.2A	.2318	5.16*	2	U	8.4.2A	.4388	3.34	5	+ .7338
8.4.2B	.0879	2.79			8.4.2B	.9183	1.05		+1.7856
8.4.3A	.4404	1.89	5	SM	8.4.3A	.5689	7.45*	2	+1.8363
8.4.3B	.5746	2.14			8.4.3B	.5150	2.73		+ .0201
8.4.4A	.1229	-1.18	5	U	8.4.4A	.1118	-1.44	5	+1.6950
8.4.4B	.6949	-2.59			8.4.4B	.0942	-2.67		+ .7756
8.4.5A	.3186	7.63*	3	Ed	8.4.5A	.2990	6.79*	3	0.0000
8.4.5B	.5773	4.72*			8.4.5B	.3612	5.08*		+ .3692
8.4.6A	.0146	5.12*	2	U	8.4.6A	.5142	2.47	5	+ .1185
8.4.6B	.7188	.72			8.4.6B	.9449	.54		+ .1680
				New	8.4.7A	.1773	- .31	5	
					8.4.7B	.3157	-1.08		
				New	8.5.1A	.7363	- .88	5	
					8.5.1B	.0389	-2.44		
				New	8.5.2A	.2757	.85	5	
					8.5.2B	.4185	-1.23		

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
				New	8.5.3A 8.5.3B	.5800 .4731	- .06 -1.70	5	
				New	8.6.1A 8.6.1B	.2148 .0104	1.61 -2.21	5	
				New	8.6.2A 8.6.2B	.1011 .1896	-1.09 -2.39	5	
				New	8.6.3A 8.6.3B	.3954 .0341	.74 - .29	5	
				New	8.7.1A 8.7.1B	.6201 .0421	.38 - .68		
8.4.7A 8.4.7B	.1616 .1287	7.18* 5.99*	3	Ed	8.7.2A 8.7.2B	.4491 .4842	5.84* 1.52	2	+ .8452 +2.0524
8.4.8A 8.4.8B	.1061 .6498	8.13* 6.59*	3	Ed	8.7.3A 8.7.3B	.3119 .0940	6.48* 3.78	2	+ .3145 + .3018
9.1.1A 9.1.1B	.0012 .2448	5.46* 2.74	2	D					
9.1.2A 9.1.2B	.3285 .4601	1.52 .98	5	Ed	9.1.2A 9.1.2B	.5494 .1191	4.44* -1.55	2	+1.3183 +1.6720

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
9.1.3A	.1776	4.36*	2	Ed	9.1.1A	.3055	5.63*	2	+ .7113
9.1.3B	.3262	2.84			9.1.1B	.2949	.59		+ .8652
10.1.1A	.0324	-1.85	5	Ed	10.1.1A	.7079	-2.73	4	+1.5694
10.1.1B	.7576	-3.29			10.1.1B	.0733	-5.30*		+ .0402
10.1.2A	.5371	2.56	5	Ed	10.1.2A	.2993	3.38	5	+1.0590
10.1.2B	.1267	1.68			10.1.2B	.2911	.02		+1.0234
10.1.3A	.0034	7.61*	3	Ed	10.1.3A	.5117	4.21	5	+ .3145
10.1.3B	.2407	5.55*			10.1.3B	.4017	2.66		+1.7420
11.1.1A	.0136	2.01	5	Ed	11.1.1A	.2439	1.30	5	+1.1767
11.1.1B	.8218	.06			11.1.1B	.1974	- .71		0.0000
11.1.2A	.0392	4.34*	2	Ed	11.1.2A	.2904	1.15	5	+ .1177
11.1.2B	.5231	.36			11.1.2B	.3808	- .56		+ .1307
11.1.3A	.5447	5.89*	2	Ed	11.1.3A	.6202	5.66	2	+ .7113
11.1.3B	.2163	1.90			11.1.3B	.1258	- .09		+ .9385
					12.1.1A	.4570	3.29	5	
					12.1.1B	.1812	.54		
12.1.1A	.0508	.48	5	D					
12.1.1B	.3950	2.12							

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
12.1.2A	.0111	- .29	5	D					
12.1.2B	.2977	- .19							
12.1.3A	.0070	1.86	5	D					
12.1.3B	.0111	1.48							
13.1.1A	.2839	2.36	5	SM	13.1.1A	.2478	6.21*	2	+1.1832
13.1.1B	.3278	3.09			13.1.1B	.3504	2.57		+ .0473
13.1.2A	.1026	3.84	5	Ed	13.1.2A	.4820	4.19	5	+ .9435
13.1.2B	.1063	2.98			13.1.2B	.0717	.02		+2.0720
13.1.3A	.1188	1.13	5	SM	13.1.3A	.0870	3.19	5	+ .7108
13.1.3B	.0064	.59			13.1.3B	.2220	- .30		+ .7811
13.1.4A	.0579	- .19	5	D					
13.1.4B	.0017	- .10							
13.1.5A	.0984	4.72*	3	U	13.1.4A	.3105	5.74*	2	+ .4587
13.1.5B	.3622	4.41*			13.1.4B	.1388	1.25		+1.7515
13.1.6A	.0855	3.07	5	U	13.1.5A	.4720	2.11	5	+ .7557
13.1.6B	.2234	1.51			13.1.5B	.4663	.55		+1.3283
13.1.7A	.2355	- .09	5	Ed	13.1.6A	.3490	- .60	5	+ .3620
13.1.7B	.6280	-1.18			13.1.6B	.2115	-1.11		+ .6083

TABLE A-1 CONT.

Original Curriculum					Revised Curriculum				
Variable I.D.	F Probability $F_{critical}$ = .000229	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.2710	MARC Cell	Change Status	Variable I.D.	F Probability $F_{critical}$ = .000225	Mean vs. Grand Mean "t" Value $t_{critical}$ = ±4.3341	MARC Cell	Wilcoxon Test $z_{critical}$ = ±3.6598
13.1.8A	.2732	-2.97	5	D					
13.1.8B	.0997	-3.04							
13.2.1A	.0284	- .43	5	SM	13.2.1A	.0647	1.13	5	+1.8833
13.2.1B	.0099	- .92			13.2.1B	.1807	- .89		+ .4791
13.3.1A	.0099	1.20	5	Ed	13.3.1A	.0295	1.65	5	+ .8402
13.3.1B	.1204	1.11			13.3.1B	.3273	.62		+ .1006
13.3.2A	.2723	1.73	5	SM	13.3.2A	.2699	4.00	5	+ .9174
13.3.2B	.1882	- .35			13,3.2B	.2608	- .22		+ .1680
13.4.1A	.0839	.74	D						
13.4.1B	.0286	.43	D						

D = Dropped
Ed = Edited
New = New
SM = Significantly Modified
U = Unchanged

APPENDIX B

FIRST RESEARCH INSTRUMENT: A SAMPLE

Title	Prepared by	Approved by	Date	Page
CONTEXT EVALUATION OF SOILS & DRAINAGE COURSE	Barry Noonan		4-11-78	39 of 39

13.3.2 Explain the necessity of drainage in retaining walls.

A. For the PURPOSE(S) of THIS COURSE, I feel that this objective should be classified as:

Does NOT Need To Know — NEEDS to Know

1 2 3 4 5 6 7 8 9 10

B. Other than in THIS COURSE, I have used this objective OR I have potential need for use of this objective to the degree shown below:

Practically NOT AT ALL (Less than once a year) OR NEVER — ALL Of the TIME (Everyday)

1 2 3 4 5 6 7 8 9 10

13.4.0 Drainage

13.4.1 Install drain tile (or line) at appropriate level, grade, and spacing for a particular type of soil.

A. For the PURPOSE(S) of THIS COURSE, I feel that this objective should be classified as:

Does NOT Need To Know — NEEDS to Know

1 2 3 4 5 6 7 8 9 10

B. Other than in THIS COURSE, I have used this objective OR I have potential need for use of this objective to the degree shown below:

Practically NOT AT ALL (Less than once a year) OR NEVER — ALL Of the TIME (Everyday)

1 2 3 4 5 6 7 8 9 10

APPENDIX C

SECOND RESEARCH INSTRUMENT: A SAMPLE

8.6.0 Nutrient Analysis

8.6.1 *Perform a nutrient analysis using a soil test kit, such as the LaMotte Kit. Then, based upon interpretation of the nutrient analysis, make recommendations for nutrient alterations which would support a specified list of plants in a given landscape environment.*

A. For the PURPOSE(S) of THIS COURSE, I feel that this objective should be classified as:

Does NOT Need To Know — NEEDS to Know

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

B. Other than in THIS COURSE, I have used this objective OR I have potential need for use of this objective to the degree shown below:

Practically NOT AT ALL *(Less than once a year)* OR NEVER — ALL Of the TIME *(Everyday)*

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

8.6.2 *Conduct a soil analysis to determine organic content. Then, based upon interpretation of the soil analysis, make recommendations for soil alterations which would support a specified list of plants for a given landscape environment.*

A. For the PURPOSE(S) of THIS COURSE, I feel that this objective should be classified as:

Does NOT Need To Know — NEEDS to Know

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

B. Other than in THIS COURSE, I have used this objective OR I have potential need for use of this objective to the degree shown below:

Practically NOT AT ALL *(Less than once a year)* OR NEVER — ALL Of the TIME *(Everyday)*

[1] [2] [3] [4] [5] [6] [7] [8] [9] [10]

APPENDIX D

ANALYSIS OF FIRST RESEARCH PROBLEM

ANALYSIS OF FIRST RESEARCH PROBLEM

The first research problem identified the degree to which the Key Group (a) rated each objective as being appropriate for the given purposes of the course, and (b) used each objective, or had potential need to use each objective. The Paired "t" was used to test the following null hypotheses:

H_{1A} = Considering separately the original curriculum and the revised curriculum, the Key Group's mean rating of Question A for each objective will not significantly differ from the respective grand mean of Question A.

H_{1B} = Considering separately the original curriculum and the revised curriculum, the Key Group's mean rating of Question B for each objective will not significantly differ from the respective grand mean of Question B.

Matrix for Analysis of Rated Competencies (MARC)

The key to interpreting the data for the first research problem is the Matrix for Analysis of Rated Competencies (MARC). Chapter III discussed the conceptual and statistical details for MARC. MARC is shown in Table IV.1 and displays the research data for the first research problem. Cells 1, 2, and 3 of Table IV.1 would contain any objectives for which H_{1A} was rejected for being significantly high. Cells 7, 8, and 9 would contain

TABLE IV.1
MATRIX FOR ANALYSIS OF RATED COMPETENCIES
(MARC)

QUESTION "B" USE OR POTENTIAL USE

QUESTION "A" NEED TO KNOW FOR THE COURSE

	RETAIN	REJECT
	CELL 1 ORIGINAL: 0 REVISED: 0	CELL 2 ORIGINAL: 3.3.2 8.4.6; 6.3.2 9.1.1; 6.4.2 9.1.3; 8.1.8 11.1.2; 8.4.2 11.1.3 REVISED: 3.4.1 8.7.2; 3.4.2 8.7.3; 3.4.3 9.1.1; 5.1.3 9.1.2; 6.2.3 11.1.3; 6.3.2 13.1.1; 8.4.1 13.1.4; 8.4.3	CELL 3 ORIGINAL: 1.1.5 8.4.1; 3.1.1 8.4.5; 3.4.2 8.4.7; 5.1.3 8.4.8; 5.2.4 10.1.3; 6.2.3 13.1.5 REVISED: 5.2.4; 6.4.2; 8.1.1; 8.4.5
RETAIN	CELL 4 ORIGINAL: 7.1.4 Ed; 8.1.5 Ed REVISED: 8.1.2; 8.1.5; 10.1.1	CELL 5 CELL 5 contains the remaining objectives which are not shown in the other cells of MARC	CELL 6 ORIGINAL: 1.1.2; 1.1.3; 1.1.4; 3.4.3; 8.1.1 REVISED: 1.1.1; 1.1.2; 1.1.3; 1.1.4; 1.2.1
REJECT	CELL 7 ORIGINAL: 2.1.2 SM; 2.2.1 SM; 3.1.3 Ed; 3.2.2 SM; 4.1.2 SM; 4.2.1 SM; 8.2.2 SM REVISED: 3.1.3	CELL 8 ORIGINAL: 2.2.3DC REVISED: 0	CELL 9 ORIGINAL: 0 REVISED: 0

any objectives for which H_{1A} was rejected for being significantly low. Cells 1, 4, and 7 would contain the objectives for which H_{1B} was rejected for being significantly low. Cells 3, 6, and 9 would contain any objectives for which H_{1B} was rejected for being significantly high.

All cells except Cell 5 have headings of "Original" and "Revised." These headings refer to the original curriculum and the revised curriculum. Cell 5 does not have such headings because any objectives which are not shown in the other cells are under stood to be members of Cell 5.

The a priori alpha level was .05. As was discussed in Chapter III, the Bonferroni Method was employed to take into account error rate as discussed by Netter and Wasserman (480-482).

There were a number of objectives on which the null hypothesis was rejected for H_{1A}, H_{1B}, or both H_{1A} and H_{1B}. As discussed in Chapter III, the nine cell MARC may be viewed as a two part matrix; the first part includes the objectives which should be retained, and the second part contains objectives which should be eliminated as written. As shown in Table III.1, the objectives which are to be retained include Cells 1 through 6, while Cells 7, 8, and 9 contain objectives which need to be eliminated as written.

Of all the statistical information developed in this study, the most important information is derived from knowing which objectives are in Cells 7, 8, or 9. These cells constitute the critical cells on which the instructional team must make decisions regarding the complete elimination or modification of objectives in an attempt to meet the criticism of the Key Group. Cells 1 through 6 provide information which can be of use to the instructional team, but from a statistical point of view these cells are not critical in determining which objectives should remain in the course.

Since Cells 7, 8, and 9 are the critical decision making cells, the presentation and analysis of data in this Appendix begins with the data in Cell 7 of Table IV.1.

Significantly Low Ratings on Question A ("Need to Know for the Course")

Cells 7, 8, and 9 of the Decision and Information Matrix are the cells for the Key Group's significantly low ratings of Question A. On the original curriculum, H_{1A} was rejected seven times in Cell 7 and one time in Cell 8. No objectives were in Cell 9. On the revised curriculum, H_{1A} was rejected only one time and this was in Cell 8.

Table D-1 on the next page displays a comparison of "t" values for objectives which were rated significantly

TABLE D-1

COMPARISON OF OBJECTIVES WITH SIGNIFICANTLY LOW "t" VALUES FOR QUESTION A OF ORIGINAL CURRICULUM WITH THE CORRESPONDING OBJECTIVE IN THE REVISED CURRICULUM

Original Curriculum			Revised Curriculum	
Objective Number	"t" Value (-4.27=Crit)	Change Status	Objective Number	"t" Value (-4.33=Crit)
2.1.2A	-5.08*	SM	2.1.2A	-3.21
2.2.1A	-4.51*	SM	2.2.1A	-2.52
2.2.3A	-4.46*	C		
3.1.3A	-6.43*	Ed	3.1.3A	-4.89*
3.2.2A	-5.27*	SM	3.2.2A	-1.91
4.1.2A	-6.81*	SM	4.1.2A	-2.73
4.2.1A	-4.92*	SM	4.2.1A	-0.36
8.2.2A	-4.41*	SM	8.2.2A	-0.99

* P < .05
N = 8 df = 26
8/109 = 7%

* P < .05
N = 1 df = 24
1/111 = 0.9%

SM = Significantly Modified
Ed = Edited
C = Combined with Another Objective

low on Question A of the original curriculum with the corresponding objective in the revised curriculum. An objective rated significantly low on Question A strongly indicates that the objective should be dropped from the curriculum, or it should be rewritten to meet the concerns of the Key Group.

The "change status" column in Table D-1 indicates the nature of change which the instructional team made on each objective.

For H_{1A} to be rejected, the Key Group's mean rating for Question A of each objective must differ from the Key Group's grand mean for all other Question As to such an extent that the difference could be due to chance less than .000229 with a "t" Table value of $\pm$4.27. Bonferroni's Method was used to determine this significance level. Bonferroni's Method is employed because of the error rate which can occur when 218 Paired "t" Tests are conducted on data from the same sample. The .000230 was calculated by taking the alpha of .05 and dividing it by 2 x 218. The number 218 is the sum of 109 Paired "t" Tests which were run on Question A of each of the 109 objectives plus the 109 Paired "t" Tests which were run on Question B of each of the 109 objectives. The 2 is for a two tail test.

This low rejection rate may be due to the extensive curriculum development process which was used in the

preparation of the original curriculum. The curriculum development process was described in Chapter II.

After reviewing the statistical findings for the original curriculum as presented in MARC (Table IV.1), and after studying the comments written by the participants, the objectives were discussed with the instructors and administrators of the Landscape Technology Program. The discussions centered on which objectives should be altered, eliminated, or left in their original form. It was decided to retain the essence of all eight objectives which were rated significantly low on Question A. The instructional team thought that some of the eight objectives needed only additional information in order to clarify the meaning which the instructional team thought needed to be in the curriculum. As a result of the meetings with the instructional team, the objectives were changed as noted in the "change status" column of Table D-1. The criteria for the "change status" classifications are listed in Appendix G. Table D-1 shows that six of the objectives were "substantially modified," one objective was "edited," and objective 2.2.3 was combined with objective 2.2.1.

The revised curriculum had a total of 111 objectives. Therefore, the Bonferroni Method would require the alpha of .05 to be divided by 2 x 222. The resultant value was .000226 which then yielded a "t" value of $\pm$4.3341. The

computer at Oregon State University was used to determine the "t" value.

The revision effort evidently was successful. There was only one objective in the revised curriculum which was significantly low on Question A. This was objective 3.1.3 and is shown in Cell 7 of MARC (Table IV.1). Table D-1 shows that of the eight objectives in the original curriculum which were rated significantly low on Question A, Objective 3.1.3 was the only objective with a change status of "edit." Of the remaining seven objectives rated significantly low on Question A of the original curriculum, one was combined with another objective and six received a change status classification of "substantially modified." All of the objectives which were "substantially modified" did not receive significantly low ratings in the revised curriculum.

Objective 3.1.3 was the only objective out of 111 objectives on the revised curriculum to be significantly low on Question A. This is less than one would expect by chance. On the significantly low side of the distribution, chance would account for 2.5 percent (3 objectives) of the 111 objectives if an alpha level of .05 was used.

In the process of preparing the revised curriculum, the instructors arrived at the conclusion that the significantly low "t" value obtained for 3.1.3 was due to the

use of the wording "mechanical analysis of soil." The instructors decided to use the wording of "textural analysis of soil" and thought that this would make the objective acceptable to the Key Group. The statistical information on the revised curriculum indicates that the instructors did not correctly interpret that the Key Group was expressing by their significantly low rating on this objective.

Objective 2.2.3 was dropped as a separate objective and was combined with Objective 2.2.2. The instructors made some significant changes in the Objective in order to better communicate their intent. The "t" value of -2.52 for Objective 2.2.1 on the revised curriculum is not a significant "t" value. Thus, the revised Objective brought about a different rating than it did in the original curriculum.

Significantly High Ratings on Question A ("Need to Know for the Course")

Cells 1, 2, and 3 of MARC (Table IV.1) are the cells for the Key Group's significantly high ratings of Question A. On the original curriculum, H_{1A} was rejected ten times in Cell 2 and twelve times in Cell 3. No objectives were in Cell 1. On the revised curriculum, H_{1A} was rejected sixteen times in Cell 2 and four times in Cell 3.

Table D-2 displays a comparison of objectives with significantly high "t" values for Question A on either or both the original curriculum and/or the revised curriculum. An objective rated significantly high on Question A is an objective which the Key Group saw as being very important in meeting the stated purposes of the course.

The statistical criteria for determining if an objective was significantly high on Question A are the same criteria as were explained previously in the section entitled, "Significantly Low Ratings of Question A." The critical "t" value for the original curriculum was 4.2710. The critical "t" value for the revised curriculum was 4.3341.

The 22 objectives which were rated significantly high on Question A of the original curriculum represent 20.1 percent of the 109 objectives which were in the original curriculum. One would expect 2.5 percent of the 109 objectives to be significantly low by chance when using an alpha level of .05. Therefore, approximately three objectives could be due to chance and nineteen objectives could be considered significantly high due to non-chance factors.

The revised curriculum had four fewer objectives which were rated significantly high than did the original curriculum. There were 18, or 16.2 percent, of the 111

TABLE D-2

COMPARISON OF OBJECTIVES WITH SIGNIFICANTLY HIGH "t" VALUES FOR QUESTION A ON EITHER OR BOTH THE ORIGINAL CURRICULUM AND/OR THE REVISED CURRICULUM

Original Curriculum			Revised Curriculum	
Objective Number	"t" Value (+4.271=Crit)	Change Status	Objective Number	"t" Value (+4.3341=Crit)
1.1.5A	4.28*	Ed	1.1.5A	.55
3.1.1A	6.89*	Ed	3.1.1A	3.23
3.3.2A	5.69	Ed	3.3.2A	.46
3.4.2A	6.74*	Ed	3.4.2A	5.38*
3.4.3A	3.24	Ed	3.4.3A	4.42*
5.1.3A	5.70*	C		
5.1.4A	3.81	Ed	5.1.3A	9.08*
5.2.4A	7.37*	U	5.2.4A	5.64*
6.2.3A	5.70*	U	6.2.3A	7.26*
6.3.2A	6.44*	Ed	6.3.2A	5.01*
6.4.2A	5.10*	Ed	6.4.2A	4.84*
8.1.1A	2.35	U	8.1.1A	6.96*
8.1.8A	7.10*	U	8.1.8A	3.76
8.4.1A	4.64*	U	8.4.1A	6.39*
8.4.2A	5.16*	U	8.4.2A	3.34
8.4.3A	1.89	SM	8.4.3A	7.45*
8.4.5A	7.63*	Ed	8.4.5A	6.79*

TABLE D-2 CONT.

Original Curriculum			Revised Curriculum	
Objective Number	"t" Value (+4.271=Crit)	Change Status	Objective Number	"t" Value (+4.3341=Crit)
8.4.6A	5.12*	U	8.4.6A	2.47
8.4.7A	7.18*	Ed	8.7.2A	5.84*
8.4.8A	8.13*	Ed	8.7.3A	6.48*
9.1.1A	5.46*	D		
9.1.2A	1.52	Ed	9.1.2A	4.44*
9.1.3A	4.36*	Ed	9.1.1A	4.63*
10.1.3A	7.61*	Ed	10.1.3A	4.21
11.1.2A	4.34*	Ed	11.1.2A	1.15
11.1.3A	5.89*	Ed	11.1.3A	5.66*
13.1.1A	2.36	SM	13.1.1A	6.21*
13.1.5A	4.72*	U	13.1.4A	5.74*

* P < .05
N = 22 df = 26
22/109 = 20.2%

* P < .05
N = 18 df = 24
18/111 = 16.2%

C = Combined with Another Objective; in this case with 5.1.2

D = Dropped in the Revised Objective

Ed = Edited

SM = Significantly Modified

U = Unchanged

objectives in the revised curriculum which were rated significantly high by the Key Group. These eighteen objectives are listed under "Revised" in Cells 2 and 3 of MARC (Table IV.1). One would expect 2.5 percent of the 111 objectives to be significantly high by chance when using an alpha level of .05. Therefore, approximately three objectives could be due to chance and fifteen objectives could be considered significantly high due to non-chance factors. Table D-2 shows that there were nine objectives which were significantly high on both the original curriculum and the revised curriculum.

Table D-2 contains eight objectives which were not changed in any way between the original and the revised curriculum. These objectives are noted by a "U" in the "Change Status" column of Table D-2. Of the eight objectives, four of the objectives received higher "t" values on the revised curriculum as compared to the original curriculum. The greatest change in "t" value was in Objective 8.1.1. On the original curriculum it received a "t" of 2.35 and on the revised curriculum it received a "t" value of 6.96. This objective underwent absolutely no change between the original and the revised curriculum. The next greatest change in "t" value was with the Objective 8.1.8. Here, there was a decrease from a "t" of 7.10 in the original curriculum to 3.76 in the revised curriculum. The remaining objectives with an "unchanged" status

did not exceed ±2.65 in change of "t" value. Out of eight objectives in the original curriculum which were "unchanged" and had significant "t" values, there were a total of four objectives which were "unchanged" and received significant "t" values in both the original and the revised curriculum.

The percentage of drop in the number of objectives rated significantly high on Question A of the original curriculum as compared to the revised curriculum is the difference between 20.1 percent and 16.2 percent. This is 3.9 percent drop. This is close to the percentage of drop seen in the significantly low ratings. The low ratings dropped from 7.3 percent to 0.9 percent (a 6.4 percent drop). It would be interesting to see if future studies witness a similar drop in ratings of the revised curriculum for both the significantly high as well as the significantly low ends of the ratings for Question A.

For Question A, the drop from 22 significantly high "t" values in the original curriculum to 18 in the revised curriculum is not a major concern. The greater number of higher value means in the revised curriculum as compared to the original curriculum worked to decrease the number of significantly high ratings in the revised curriculum.

Significantly Low Ratings on Question B ("Use or Potential Use")

Cells 1, 4, and 7 of MARC (Table IV.1) are the cells for the Key Group's significantly low ratings of Question B. On the original curriculum, H_{1B} was rejected two times in Cell 4 and seven times in Cell 7. No objectives were in Cell 1. On the revised curriculum, H_{1B} was rejected three times in Cell 4 and one time in Cell 7.

Table D-3 displays a comparison of objectives with significantly low "t" values for Question B on either the original curriculum and/or the revised curriculum. The objectives rated significantly low on Question B are objectives which the Key Group rates, from their own professional experience, as having little or no "use or potential use."

The statistical criteria for classifying an objective as being significantly low on Question B were the same criteria explained previously in the section on "Significantly Low Ratings of Question A." The critical "t" value for the original curriculum was 4.27; the critical "t" value for the revised curriculum was 4.33.

The nine objectives which were rated significantly low on Question B of the original curriculum represent 8.2 percent of the 109 objectives which were in the original curriculum. One would expect 2.5 percent of the 109

TABLE D-3

COMPARISON OF OBJECTIVES WITH SIGNIFICANTLY LOW "t" VALUES FOR QUESTION B ON EITHER OR BOTH THE ORIGINAL CURRICULUM AND/OR THE REVISED CURRICULUM

Original Curriculum			Revised Curriculum	
Objective Number	"t" Value (-4.271=Crit)	Change Status	Objective Number	"t" Value (-4.3341=Crit)
2.1.2B	-5.22*	SM	2.1.2B	-0.21
2.2.1B	-4.62*	SM	2.2.1B	-0.58
3.1.3B	-7.42*	Ed	3.1.3B	-5.06*
3.2.2B	-5.68*	SM	3.2.2B	-2.09
4.1.2B	-7.68*	SM	4.1.2B	-4.31
4.2.1B	-5.57*	SM	4.2.1B	-1.33
7.1.4B	-4.41*	Ed	7.1.4B	-1.09
8.1.2B	-3.50	U	8.1.2B	-5.07*
8.1.5B	-4.91*	Ed	8.1.5B	-5.67*
8.2.2B	-5.35*	SM	8.2.2B	-3.61
10.1.1B	-3.29	Ed	10.1.1B	-5.30*

* P < .05
N = 9 df = 26
9/109 = 8.3%

* P < .05
N = 4 df = 24
4/111 = 3.6%

Ed = Edited
SM = Significantly Modified
U = Unchanged

objectives to be significantly low by chance when using an alpha level of .05.

The revised curriculum had five fewer objectives which were rated significantly low than did the original curriculum. This is a fifty percent reduction in rejection rate between the original curriculum and the revised curriculum. There were four objectives, or 3.6 percent of the 111 objectives in the revised curriculum, which were rated significantly low by the Key Group. These four objectives are listed in Table D-3 and are also listed under "Revised" in Cells 4 and 7 of the MARC (Table IV.1).

Cell 7 of MARC (Table IV.1) shows that there was a drop from seven objectives in the original curriculum to one objective in the revised curriculum. The drop may have been due to the revision efforts which were focused on modifying or eliminating the objectives which were in Cell 7 due to being rated significantly low on Question A ("need to know for the course"). In Cell 7, six of the seven objectives were "substantially modified." None of these six objectives were rated significantly low in the revised curriculum. Only Objective 3.1.3 went through a change classified as "edit" and it was rated significantly low in the revised curriculum.

The two objectives listed under the original curriculum column in Cell 4 were not a major focus of attention

in the revision effort because they were not rated significantly low on the Question A ("Need to know for the course"). Only one out of seven of the objectives in the original curriculum shown in Cell 7 appeared in the revised column of Cell 7. Also, one of the original two objectives in Cell 4 appeared again in the revised column of Cell 4.

Objective 8.1.5 of the original curriculum in Cell 4 underwent only "editing"; it was rated significantly low on Question B ("Use or potential use") in the revised curriculum.

As shown in Table D-3, none of the objectives which were "substantially modified" showed up in the revised curriculum as being rated significantly low. This indicates that the substantial modifications made in these objectives brought the objectives more in line with the thinking of the Key Group. Of the two objectives which were significantly low on Question B in both the original and revised curriculua, the change status of "edited" appeared twice. Just editing an objective does not appear to meet the criticisms of the Key Group.

Significantly High Ratings on Question B ("Use or Potential Use")

Cells 3, 6, and 9 of MARC (Table IV.1) are the cells for the Key Group's significantly high ratings on Question

B. On the original curriculum, H_{1B} was rejected twelve times in Cell 3 and five times in Cell 6. No objectives were in Cell 9. On the revised curriculum, H_{1B} was rejected four times in Cell 3 and five times in Cell 6.

Table D-4 displays a comparison of objectives with significantly high "t" values for Question B on either or both the original and/or the revised curriculum. An objective rated significantly high on Question B was an objective which the Key Group, based upon their own professional experience, rated as being used very frequently or having a high potential use.

The statistical criteria for determining if an objective is significantly high on Question B are the same criteria as are explained previously in this Appendix on the section entitled, "Significantly Low Ratings of Question A."

The critical "t" value for the original curriculum was 4.27. The critical "t" value for the revised curriculum was 4.33.

The revised curriculum had eight fewer objectives which were rated significantly high than did the original curriculum. This is a 47 percent reduction in the number of objectives which were rated significantly high in the original curriculum as compared to the revised curriculum. There were nine objectives, or 8.1 percent of the 111

objectives, in the revised curriculum which were rated significantly high by the Key Group. These nine objectives are listed in Table D-4. One would expect 2.5 percent of the 111 objectives.

The percentage of drop in the number of objectives rated significantly high in the original curriculum as compared to the revised curriculum is the difference between 15.6 percent and 8.1 percent; this is a 7.2 percent drop. This is close to the percentage of drop in significantly low ratings, which decreased from 8.3 percent to 3.6 percent, a loss of 4.7 percent.

For Question B, it appears that the type of change made (i.e., "edited," "unchanged," etc.) did not establish a pattern in the raising or lowering of "t" values. There was a definite pattern in the case of significantly low ratings on Question A. Seven of the "edited" objectives had non-significant "t" values in the revised curriculum. One of the "unchanged" objectives dropped in the level of "t" value, but still remained significant in the revised curriculum. One "unchanged" objective dropped from being significant in the original curriculum to being not significant in the revised curriculum. One "unchanged" objective actually increased in "t" value between the original and the revised curriculum. Thus, it appears that there is no clue as to how the classification of changed status determines the "t" value when

looking at the original curriculum and revised curriculum for significantly high "t" values for Question B.

For Question B, the drop from seventeen significantly high "t" values in the original curriculum to nine in the revised curriculum is not a major concern. The greater number of higher value means in the revised curriculum as compared to the original curriculum worked to decrease the number of significantly high ratings in the revised curriculum.

Significantly Low Ratings on Both Questions A and B

Cell 7 of MARC (Table IV.1) contains the Key Group's significantly low ratings on both Questions A and B. On the original curriculum, H_{1A} and H_{1B} were rejected seven times on the original curriculum and one time in the revised curriculum.

Table D-5 displays a comparison of objectives with significantly low "t" values for Questions A and B on either or both the original curriculum and/or the revised curriculum. An objective rated significantly low on Questions A and B was an objective which the Key Group saw as (a) having little or no basis for being in the course and (b) having little or no "use or potential use."

TABLE D-4

COMPARISON OF OBJECTIVES WITH SIGNIFICANTLY HIGH "t" VALUES FOR QUESTION B ON EITHER OR BOTH THE ORIGINAL CURRICULUM AND/OR THE REVISED CURRICULUM

Original Curriculum			Revised Curriculum	
Objective Number	"t" Value (-4.27=Crit)	Change Status	Objective Number	"t" Value (+4.33=Crit)
1.1.1B	1.77	E	1.1.1B	4.36*
1.1.2B	5.12*	E	1.1.2B	4.68*
1.1.3B	5.02*	E	1.1.3B	4.89*
1.1.4B	9.16*	E	1.1.4B	5.05*
1.1.5B	10.61*	E	1.1.5B	4.12
1.2.1B	- .11	E	1.2.1B	5.53*
3.1.1B	4.82*	E	3.1.1B	3.75
3.4.2B	4.92*	E	3.4.2B	3.73
3.4.3B	4.33*	E	3.4.3B	3.49
5.1.3B	5.03*	C		
5.2.4B	7.25*	U	5.2.4B	6.11*
6.2.3B	5.30*	U	6.2.3B	3.23
6.4.2B	3.33	E	6.4.2B	4.35*
8.1.1B	4.78*	U	8.1.1B	7.76*
8.4.1B	4.48*	U	8.4.1B	3.00
8.4.5B	4.72*	E	8.4.5B	5.08*
8.4.7B	5.99*	E	8.7.2B	1.52
8.4.8B	6.59*	E	8.7.3B	3.78
10.1.3B	5.55*	E	10.1.3B	2.66
13.1.5B	4.41*	U	13.1.4B	1.25

* $P < .05$

C = Combined with 5.1.2 of revised curriculum)

E = Edited

U = Unchanged

The statistical criteria for determining an objective that is significantly low on both Questions A and B are the same criteria as were explained previously in this Appendix in the section entitled, "Significantly Low Ratings of Question A." The critical "t" value for the original curriculum was 4.27. The critical "t" value for the revised curriculum was 4.33. The seven objectives which were rated significantly low on both Questions A and B of the original curriculum represent 6.4 percent of the 109 objectives in the original curriculum. The revised curriculum had only one objective, or 0.9 percent, of the 111 objectives which was rated significantly low on both Questions A and B. This represents an 86 percent reduction in rejection rate between the original curriculum and the revised curriculum. The only objective which was significantly low in the revised curriculum was Objective 3.1.3. This objective is shown in Table D-5 as also listed under "Revised" in Cell 7 of MARC (Table IV.1).

Later in this Appendix there is a discussion of the changes which took place in Cell 7 of MARC (Table IV.1).

TABLE D-5

COMPARISON OF OBJECTIVES WITH SIGNIFICANTLY LOW "t" VALUES=FOR QUESTIONS A AND B ON EITHER OR BOTH THE ORIGINAL CURRICULUM AND/OR THE REVISED CURRICULUM

Original Curriculum			Revised Curriculum	
Objective Number	"t" Value (-4.27=Crit)	Change Status	Objective Number	"t" Value (-4.33=Crit)
2.1.2A	-5.08*	SM	2.1.2A	-3.21
2.1.2B	-5.22*		2.1.2B	-0.21
2.2.1A	-4.51*	SM	2.2.1A	-2.52
2.2.1B	-4.62*		2.2.1B	-0.58
3.1.3A	-6.43*	Ed	3.1.3A	-4.89*
3.1.3B	-7.42*		3.1.3B	-5.06*
3.2.2A	-5.27*	SM	3.2.2A	-1.91
3.2.2B	-5.68*		3.2.2B	-2.09
4.1.2A	-6.81*	SM	4.1.2A	-2.73
4.1.2B	-7.68*		4.1.2B	-4.31
4.2.1A	-4.92*	SM	4.2.1A	-0.36
4.2.1B	-5.57*		4.2.1B	-1.33
8.2.2A	-4.41*	SM	8.2.2A	-0.99
8.2.2B	-5.35*		8.2.2B	-3.61

* $P < .05$

Ed = Edited

SM = Significantly Modified

Significantly High Ratings on Both Questions A and B

Cell 3 of MARC (Table IV.1) contains the Key Group's significantly high ratings of Questions A and B. On the original curriculum, H_{1A} and H_{1B} were rejected twelve times. On the revised curriculum, H_{1A} and H_{1B} were rejected only four times.

Table D-6 displays a comparison of objectives with significantly high "t" values for both Questions A and B on either or both the original and/or the revised curriculum. An objective rated significantly high on both Questions A and B is an objective which the Key Group saw as being very important for a student to know for the purposes of the course and also was an objective which the Key Group, based upon their professional experience, believed to be very high in "use or potential use."

The statistical criteria for determining if an objective was significantly high on Questions A and B were the same criteria aswere explained previously in this Appendix in the section entitled, "Significantly Low Ratings of Question A." The critical "t" value for the original curriculum was 4.27. The critical "t" value for the revised curriculum was 4.33.

The objectives which were rated significantly high on both Questions A and B represented 11 percent of the

TABLE D-6

COMPARISON OF OBJECTIVES WITH SIGNIFICANTLY HIGH "t" VALUES FOR BOTH QUESTIONS A AND B ON EITHER OR BOTH THE ORIGINAL CURRICULUM AND/OR THE REVISED CURRICULUM

Original Curriculum			Revised Curriculum	
Objective Number	"t" Value (+4.27=Crit)	Change Status	Objective Number	"t" Value (+4.33=Crit)
1.1.5A	4.28*	Ed	1.1.5A	0.55
1.1.5B	10.61*		1.1.5B	4.12
3.1.1A	6.89*	Ed	3.1.1A	3.23
3.1.1B	4.82*		3.1.1B	3.75
3.4.2A	6.74*	Ed	3.4.2A	5.38*
3.4.2B	4.92*		3.4.2B	3.73
5.1.3A	5.70*	C		
5.1.3B	5.03*			
5.2.4A	7.37*	U	5.2.4A	5.64*
5.2.4B	7.25*		5.2.4B	6.11*
6.2.3A	5.70*	U	6.2.3A	7.26*
6.2.3B	5.30*		6.2.3B	3.23
6.4.2A	5.10*	Ed	6.4.2A	4.84*
6.4.2B	3.33		6.4.2B	4.35*

TABLE D-6 CONT.

Original Curriculum			Revised Curriculum	
Objective Number	"t" Value (+4.27=Crit)	Change Status	Objective Number	"t" Value (+4.33=Crit)
8.1.1A	2.35	U	8.1.1A	6.96*
8.1.1B	4.78*		8.1.1B	7.76*
8.4.1A	4.64*	U	8.4.1A	6.39*
8.4.1B	4.48*		8.4.1BB	3.00
8.4.5A	7.63*	Ed	8.4.5A	6.79*
8.4.5B	4.72*		8.4.5B	5.08*
8.4.7A	7.18*	Ed	8.7.2A	5.84*
8.4.7B	5.99*		8.7.2B	1.52
8.4.8A	8.13*	Ed	8.7.3A	6.48*
8.4.8B	6.59*		8.7.3B	3.78
10.1.3A	7.61*	Ed	10.1.3A	4.21
10.1.3B	5.55*		10.1.3B	2.66
13.1.5A	4.72*	U	13.1.4A	5.74*
13.1.5B	4.41*		13.1.4B	1.25

* $P < .05$

** C = Combined with 5.1.2

Ed = Edited

U = Unchanged

109 objectives which were in the original curriculum and 3.6 percent of the 111 objectives which were in the revised curriculum. This represents a 7.4 percent reduction between the original curriculum and the revised curriculum.

It is interesting to note the "t" values for objectives in Table D-6 which had a change status of "unchanged." These objectives were presented in the revised curriculum in the exact form in which they appeared in the original curriculum. However, when comparing the "t" values of the original curriculum with the "t" values of the revised curriculum, there appears to be no consistent pattern in which the Key Group responded to these "unchanged" objectives.

Not Significantly High Nor Significantly Low On Questions A or B

Cell 5 of MARC (Table IV.1) contains the objectives which were not rated as being significantly high nor low on either Question A or B. The objectives are not listed individually in Cell 5. Objectives that are not listed elsewhere in MARC (Table IV.1) are understood to be in Cell 5.

In the original curriculum there were 73 objectives in Cell 5. The revised curriculum had 84 objectives in Cell 5.

Discussion of First Research Problem

The following is a discussion, not a summary, of the first research problem. The purpose of the discussion is to consider the interrelationships and interpretations of the data just presented. The discussion covers the following:

a. Overview of the data displayed in MARC (Table IV.1)

b. Cells 7 and 8: Cells Requiring Changes in the Curriculum

c. Comparison of Cells 2 and 3 with Cells 7 and 8

d. Cell 5: The Cell of No Significant Differences

e. Cells 1 and 9: The Empty Cells

For review, the null hypotheses were:

H_{1A} = Considering separately the original curriculum and the revised curriculum, the Key Group's mean rating of Question A for each objective will not significantly differ from the respective grand mean of Question A.

H_{1B} = Considering separately the original curriculum and the revised curriculum, the Key Group's mean rating of Question B for each objective will not significantly differ from the respective grand mean of Question B.

Overview of Data Displayed in MARC

MARC (Table IV.1) summarizes the findings of 218 Paired "t" Tests which were run on the original curriculum and 222 Paired "t" Tests which were run on the revised

curriculum. Cell 5 was the only cell in which neither H_{1A} nor H_{1B} was rejected. If an objective was not shown elsewhere in MARC, then it was understood to be in Cell 5.

Objectives in Cells 7, 8, or 9 were there because the Key Group rated them as being significantly low on the more important of the two questions asked in the study. Thus, Cells 7, 8, and 9 were classified as the "reject as written" cells. These objectives had to be eliminated from the curriculum or re-written in order to respond to the criticism expressed by the Key Group.

The results of the study indicated that the instructional team was able to satisfy the criticism of the Key Group on seven of the eight objectives rejected by the Key Group when they evaluated the original curriculum.

Cells 1 through 6 contained data which provided useful information for the instructional team, but these cells were not keys to deciding which objectives would be rejected from the curriculum.

When an instructor is teaching this course, the instructor can tell the students that the four objectives in the "Revised" column of Cell 3 are objectives which the Key Group rated as being significantly high on both the question of "need to know for the course," as well

as "use or potential use." This provides the students with reinforcement for the need of mastering these objectives. For those sixteen objectives in the "Revised" column of Cell 2, the instructors will be able to tell their students that the Key Group rated these objectives as being significantly high on "need to know for the course," as well as being objectives which they will use or have potential use of in their daily work.

The instructors can inform their students that those nine objectives listed in the "Revised" column of Cells 3 and 6 are objectives which the Key Group rated significantly high in terms of "use or potential use."

Until the revised curriculum undergoes another revision, the instructors will have to point out that Objective 3.1.3, shown in the "Revised" column of Cell 7, is an objective which the Key Group rated as significantly low on the questions regarding "need to know for the course" and "use or potential use." It is anticipated that the instructors would not spend any time on this objective until consultation with the Key Group and advisory committee clarifies the rating on this objective.

The three objectives in the "Revised" column of Cell 4 should be identified to the students as objectives which the Key Group indicated were important to know for

the course, but are also objectives which the Key Group rated significantly low on "use or potential use." Otherwise, the Key Group is saying that they seldom use the objective in their work, but the objective is still something that they rate as being appropriate with respect to the purposes of the course. This will be helpful information for a student. Sometimes, a student hears from a person working in the industry that a given objective isn't useful and, therefore, the student becomes frustrated when the instructor spends time teaching the objective. With the three objectives in the "Revised" column of Cell 4, the instructor can admit to the students that the Key Group rated the objective significantly low on the question of "use or potential use," but at the same time the Key Group did not rate the objectives as being significantly low on "need to know for the course."

The data displayed in MARC (Table IV.1) appears at this time to be information which will be of practical use to instructors and students. The decision information yielded in Cells 7 and 8 provided specific direction for the instructional team as they worked on the revision of the curriculum. The research data indicated that the instructional team was successful in meeting the criticism of the Key Group in all cases except for Objective 3.1.3.

Cells 7 and 8: Cells Requiring Changes in the Curriculum

Cells 7, 8, and 9 are the three cells of MARC which would contain objectives rejected, as written, by the Key Group. Objectives in these cells would need to be either eliminated from the curriculum or modified to meet the criticisms of the Key Group. In the present study, there were no objectives in Cell 9.

Objectives in Cell 7 received significantly low ratings from the Key Group on Question A, "Need to know for the purposes of the course," and also on Question B, "Use or potential use." The problem for the instructional team was to determine which of the seven objectives in the original curriculum should be eliminated and which objectives should be retained or be modified to some degree. The statistical findings were to be considered advisory information for the instrucitonal team. It was understood that the instructional team had the decision making power.

The Landscape Technology instructors wanted to retain the seven objectives which were in Cell 7. The instructors thought that the objectives were not communicating the intended information. They took the position that a careful re-writing would neutralize the criticism which the Key Group had expressed. As discussed earlier in

this Appendix, it appears that the instructors were correct for all but one objective. The revised curriculum contained only one objective in Cell 7; thus, the substantial modifications made to the other six objectives satisfied the criticisms of the Key Group. As a result, it must be stressed that when an objective in the original curriculum is in Cell 7, it must not be concluded that the objective should necessarily be eliminated from the curriculum. Given the statistical criteria for determining significant difference, the objectives were rejected in the form in which they appeared in the original curriculum.

The Key Group made very few written comments regarding those objectives which they rated significantly low. In the future, it would be of help to the instructional team if the Key Group made written comments regarding any objectives they rated low.

Cell 8 of MARC contained one objective on the original curriculum and none in the revised curriculum. An objective in this cell was one which the Key Group rated as significantly low on the question, "need to know for the course," but it was also an objective which the Key Group did not rate as significantly low on the question of "use or potential use." Thus, it was concluded that the objective might not be appropriate for

the curriculum under study, but it was a useful objective and should be mored to some other curriculum.

For the original curriculum, MARC shows Objective 2.2.3 as being in Cell 8. The instructional team considered the objective to be important and believed that the objective should remain in the curriculum. They decided to combine the objective with Objective 2.2.2 because the two objectives were so closely related. On the revised curriculum this was accepted by the Key Group as can be seen by the objective being in Cell 5.

Only eight of 109 objectives on the original curriculum were rated significantly low on Question A, "need to know for the course." The extensive curriculum development process, which is discussed in Chapter III, played an important role in introducing a competency based curriculum which yielded so few objectives which were "rejected as written." There is further evidence of the strength of the curriculum development process which was used in preparing the original curriculum. This evidence is seen in the fact that seven of the eight objectives which were "rejected as written" in the original curriculum were substantially modified by the instructional team and were not rejected when the revised curriculum was evaluated.

Another indication of the strength of both the original curriculum development process and the context evaluation process developed in this study is that only one of the 111 objectives in the revised curriculum was rated significantly low on Question A, whereas one would expect three objectives to appear significantly low by chance. The one objective was probably not rated low by chance because it was one of the objectives "rejected as written" in the original curriculum. Thus, seven of the eight objectives which were rejected in the original curriculum evidently contained information to which the Key Group did not object, but the Key Group did object to the way in which the seven objectives were written. The one objective which was rejected both in the original and revised curricula represented less than chance occurrence. It is very improbable that this objective would appear by chance in both the original and revised curricula. Therefore, one could conclude that Objective 3.1.3 contained information to which the Key Group objected and the instructional team failed to change the curriculum to the satisfaction of the Key Group. Thus, less than one percent (actually it was 0.9 percent) of the objectives in the original curriculum were unconditionally rejected when it was considered that the substantial modifications to seven of the objectives

in the original curriculum retained the original intent of the objectives, but were modified to clarify intent. These objectives were not rejected in the revised curriculum. Also, the strength of the curriculum development process in the context evaluation model presented in this study is seen in the fact that only one of 111 objectives was rated significantly low in the revised curriculum.

Of the eight objectives rated significantly low in the original curriculum in Question A, all six which were significantly modified did not receive significantly low ratings in the revised curriculum. Only the objective which was "edited" was rejected both in the original and the revised curricula. Thus, there is evidence that an objective rated significantly low on Question A, "need to know for the course," was one which needed substantial modification if it was to be retained in the curriculum and accepted by the Key Group when the revised curriculum was evaluated.

Comparison of Significantly Low Ratings on Questions A with Significantly High Ratings on Question A

Nowhere earlier in this Appendix has there been a comparison of the significantly low ratings on Question A with the significantly high ratings on Question A. The significantly low ratings would be in Cells 7, 8, and 9,

whereas the significantly high ratings would be in Cells 1, 2, and 3.

Cells 7 and 8 show that seven of eight objectives rated significantly low on Question A were also rated significantly low on Question B. Thus, what the Key Group rated as being significantly low on Question A ("need to know for the course") was also rated seven of eight times as significantly low on Question B ("use or potential use"). Hence, it could be said that when the Key Group rated an objective significantly low on one of the questions, it also rated it significantly low on the other question.

In the revised curriculum, the objective the Key Group rated as significantly low on Question A was also rated as significantly low on Question B. There were no exceptions.

For the significantly high ratings on Question A, there was not a similar pattern as was seen on the significantly low ratings for Question A. What was rated significantly high on Question A was not necessarily rated significantly high on Question B in the original curriculum nor in the revised curriculum. Also, there was not the dramatic drop in the number of objectives in the original curriculum as compared to the revised curriculum when comparing the significantly high with the significantly

low ratings. The significantly high ratings had 22 objectives in the original curriculum and 18 objectives in the revised curriculum. This is a small change when compared with the change seen in the significantly low ratings for Question A.

Cell 5: The Cell of No Significant Difference

Cell 5 of MARC (Table IV.1) contained those objectives which the Key Group rated neither significantly high nor significantly low on H_{1A} or H_{1B}. Therefore, Cell 5 could be called the "cell of no significant difference."

In the original curriculum, 73 of the 109 objectives were in Cell 5. This represented 67 percent of the objectives in the original curriculum. In the revised curriculum, 84 of the 111 objectives were in Cell 5. This represented 76 percent of the objectives in the revised curriculum.

The increase in the number of objectives in Cell 5 is a result of the decrease in the number of objectives for which the null hypothesis was rejected for H_{1A} and H_{1B} in the revised curriculum. Many of the objectives in Cell 5 of the original curriculum were rewritten for the revised curriculum due to written comments by members from all five juries.

Cells 1 and 9: The Empty Cells

Cells 1 and 9 were the only cells in which there were no entries for the original or revised curriculum. An objective appearing in Cell 1 would be a bit of a problem. It would be difficult to understand how the Key Group could say on the one hand that the objective was one which they rated significantly high on the question of "need to know for the course," and yet at the same time be an objective which the Key Group rated significantly low on the question of "use or potential use."

There were no entries in Cell 9. However, Cell 9 entries would not be the interpretation problem one would have when trying to understand why an objective would be in Cell 1. If there had been entries in Cell 9, the Key Group would have been saying that the objective was important because they gave it a significantly high rating on the question of "use or potential use." However, being in Cell 9, the Key Group would have been giving a significantly low rating to the question of "need to know for the course," indicating that the objective belonged in some other course. Since there were no entries in Cell 9 for the original curriculum or the revised curriculum, it was concluded that the Key Group did not find any objectives which they believed were significantly high in "use or potential use" but should be placed in another course.

APPENDIX E

ANALYSIS OF SECOND RESEARCH PROBLEM

ANALYSIS OF SECOND RESEARCH PROBLEM

The second research problem sought to determine if the revised curriculum was an improvement over the original curriculum. Only the data from the Key Group were used in this analysis. The instructional team was interested in how individuals who were neither students nor instructors at the College rated the revised curriculum. For those objectives which were common to the original curriculum and the revised curriculum, the null hypothesis stated that there was no significant difference between the original curriculum and the revised curriculum for Question A or Question B for any given objective. The Wilcoxon Matched-Pairs Ranked-Signs Test was used to test the null hypotheses H_{2A} and H_{2B}.

The null hypotheses for the second research problem are:

H_{2A} = For any given objective present in both the original curriculum and the revised curriculum, there is no significant difference in the ratings when comparing the Key Group's ratings for Question A of the original curriculum with the Key Group's ratings for Question A of the revised curriculum.

H_{2B} = For any given objective present in both the original curriculum and the revised curriculum, there is no significant difference in the ratings when comparing the Key Group's ratings for Question B of the original curriculum with the Key Group's ratings for Question B of the revised curriculum.

Of the 111 objectives in the revised curriculum, 99 objectives were common to the original and revised curricula. None of the objectives were equal to, or less than, the critical "z" value and thus the null hypothesis for H_{1A} as well as for H_{1B} was not rejected. The last column in Appendix A contains the "z" values for Questions A and B of each objective common to the original curriculum and the revised curriculum.

Since the Wilcoxon Matched-Pairs Ranked-Signs Test was run 198 times, it was necessary to use the Bonferroni method to take error rate into account. The use of the Bonferroni method for the Wilcoxon Test is explained in Chapter III in the section dealing with the second research problem. In brief, the a priori alpha level of .05 must be adjusted by the Bonferroni method to determine the critical "z" value. The computation was as follows:

$$\beta = 1 - \frac{.05}{(2)\ (198)} = 1 - .0001262 = .9998738$$

$df = 0$

$z_{.05}$ for two tail probability of .000252 is shown below:

$$z_{.05} = \pm 3.6598$$

TABLE E-1

OBTAINED "z" VALUES EXCEEDING 3.0000

Original Curriculum			Revised Curriculum		
Variable Number	"t" Value	Change Status	Variable Number	"t" Value	"z" Value
1.2.1A	-2.06	Ed	1.2.1A	2.50	+3.1810
1.2.1B	- .11	Ed	1.2.1B	5.53	+3.0703
2.1.2B	-5.22	SM	2.1.2B	- .21	+3.0986
2.2.2A	-3.99	SM	2.2.2A	-2.25	+3.4623
3.2.2A	-5.27	SM	3.2.2A	-1.91	+3.1175
4.1.2A	-6.81	SM	4.1.2A	-2.73	+3.3194
4.2.1A	-4.92	SM	4.2.1A	- .36	+3.2445
5.2.3A	-2.79	SM	5.2.3A	.16	+3.1798
8.2.2A	-4.41	SM	8.2.2A	- .99	+3.3137

Ed = Edited

SM = Significantly Modified

Table E-1 displays eight "z" values which exceed 3.000. Objective 1.2.1 had "z" values above 3.000 for Question A as well as for Question B. This indicated an almost statistically significant positive change in the ratings of the original and revised curricula. This objective's "t" value was neither significantly high nor significantly low on Questions A or B in the original curriculum. Thus, it was a Cell 5 objective in MARC (Table IV.1).

In the original curriculum, Question B for Objective 2.1.2 received a significantly low "t" value of 5.22. In the revised curriculum, it received a "t" value of -.21, which meant that it was neither significantly low nor significantly high. The change between the original and revised curricula produced a "z" value of +3.0986.

Question A of Objective 2.2.2 went from a -3.99 "t" value in the original curriculum to a -2.25 "t" value in the revised curriculum. Neither of these values was significantly low in the original curriculum. However, the difference in ratings between the original and revised curricula produced a "z" = +3.4623. In this study, it was the closest value to the critical "z" of $\pm$3.6598.

In Table E-2, four of the last five variables had "t" values which were significantly low on Question A of the original curriculum. Their significantly low rating of Question A placed them in Cell 7 of MARC

(Table IV.1). Cell 7 contained the objectives which were significantly low on both Questions A and B. The "change status" column of Table E-2 indicates that these objectives underwent significant modifications. The revised curriculum's "t" values indicated that the objectives were not significantly low after the significant modifications were made. The "z" values indicated a very positive change in ratings of the Key Group.

APPENDIX F

ANALYSIS OF THIRD RESEARCH PROBLEM

ANALYSIS OF THIRD RESEARCH PROBLEM

The third research problem determined if there were any significant differences in the ratings given by the five juries. The one-way analysis of variance test was used to test the null hypotheses H_{3A} and H_{3B}.

The null hypotheses for the third problem were:

H_{3A} = Considering separately the original curriculum and the revised curriculum, for Question A of each objective there is no significant difference in the ratings given by the five juries.

H_{3B} = Considering separately the original curriculum and the revised curriculum, for Question B of each objective there is no significant difference in the ratings given by the five juries.

The null hypothesis was not rejected for any of the 218 one-way analysis of variance tests conducted on the original curriculum. Likewise, the null hypothesis was not rejected for the 222 one-way analysis of variance tests conducted on the revised curriculum. The Bonferroni method was used to account for error rate and adjust the a priori alpha level of .05. The critical F probability level was .000229 for the original curriculum and .000225 for the revised curriculum. Appendix A displays the F probability values for each objective.

The critical F probability was determined by using the Bonferroni method, which yielded a very conservative critical level. The critical F probability for the

original curriculum was determined by taking the a priori alpha level of .05 then dividing it by 218. The denominator of the 218 represents the number of one-way analysis of variance conducted on the original curriculum. For the revised curriculum, the critical F probability of .000225 was determined by taking the a priori alpha level of .05 and dividing it by 222.

Chapter IV explains why multiple range tests were used in this study in spite of the lack of significant F probability levels being reached in the third research problem.

Since there were no variables which reached the conservative critical F probability values of .000229 for the original curriculum nor .000225 for the revised curriculum, the five lowest F probability values from both the original curriculum and the revised curriculum were selected. These values represented the greatest rating differences between the juries. Table F-1 contains a comparison of the original and revised curricula F probability values for the five lowest F probability values of the original curriculum. Table F-2 reports the results of a multiple range test which was used to determine which juries were causing the low F probability levels. Tables F-3 and F-4 present, for the revised curriculum, the same kind of information that Tables F-1 and F-2 contained for the original curriculum.

TABLE F-1

ORIGINAL CURRICULUM:
THE FIVE LOWEST F PROBABILITY VALUES

Original Curriculum				Revised Curriculum		
Objective Number	F Probability	Cell	Change Status	Objective Number	F Probability	Cell
2.1.1A	.0019	5	SM	2.1.1A	.5824	5
2.1.4A	.0008	5	C	2.1.3A	.1021	5
7.1.2A	.0014	5	SM	7.1.2A	.3076	5
9.1.1A	.0012	2	D			
13.1.4B	.0017	5	D			

C = Dropped as a separate objective, but combined with another objective in the Revised Curriculum. In this case, combined with 2.1.2

D = Dropped from the curriculum

SM = Significant Modification

Table F-1 shows the five lowest F probability values contained in the original curriculum. Three of these objectives were retained in the revised curriculum. Table F-1 shows that the lowest F probability level of the revised curriculum was higher than the highest F probability level of the original curriculum. Thus, in the revised curriculum there were not the great differences among the juries as were seen in the original curriculum.

The low F probability values indicated a difference among the ratings given by the five juries. Two multiple range tests were employed in this research project to determine, for each variable, the homogeneous sub-groups of juries. One of the multiple range tests was the "Least Significant Difference Procedure" (LSD Procedure); the other multiple range test was the "Student-Newman-Keuls Procedure." It was concluded that the Student-Newman-Keuls procedure was not as sensitive to differences as was the LSD procedure; hence, the LSD procedure is the test used in the analysis of data in this study. From looking at the hundreds of LSD procedures and Student-Newman-Keuls procedures conducted in this study, one finds that when the F probability is greater than .0104, the Student-Newman-Keuls loses its ability to accurately identify the subsets. For instance, Variable 8.6.1B had an F probability of .0104. The LSD procedure and the

Student-Newman-Keuls procedure totally agree with each other. However, Variable 13.3.1A had an F probability of .0295. The LSD procedure showed two subsets whereas the Student-Newman-Keuls procedure showed all five juries in one subset. Thus, the Student-Newman-Keuls is a much more conservative procedure which says, though there may be a significant difference as seen in the F probability value, the difference is not such that it would generate the various subsets. The LSD procedure is not as conservative and says, when there is a significantly low F probability level, there are some subsets which are statistically distinguishable from one another.

The subsets contain homogeneous groups of means where the means of the first and last juries differed by less than the critical value for a subset of that size.

Table F-2 shows that, for all the variables except 13.1.4B, the Students' Jury was responsible for generating the low ratings which caused the low F probability level. In the case of Variable 13.1.4B, it was the Advisory Committee Jury which caused the difference. However, in this case, the difference is not due to the low ratings of one group but rather to the very high ratings of one group. The Advisory Committee Jury was very high with a mean of 9.2222. The remaining juries gave much lower ratings and were not statistically significantly different from each other.

Table F-2 shows that Variable 2.1.1A had an F probability of .0019 and that the remaining F probabilities were all smaller.

In Table F-2, variables 2.1.1A, 2.1.4A, and 7.1.2A show that the Students' Jury was different in its ratings from the rest of the juries. The Instructors' Jury was at the opposite end of the rating spectrum. The implications of this phenomenon are presented in the "Discussion" section of this Appendix.

Variable 9.1.1A shows the Students' Jury to have the lowest mean ratings. However, the Advisory Committee replaced the Instructors' Jury as having the highest mean ratings. The Instructors' Jury mean rating of 9.8000 was very close to the Advisory Committee's mean rating of 9.8889.

Variable 13.1.4B is unique among the five objectives in that the Advisory Committee was significantly different from all other juries when using an F probability of equal to, or less than, .001. The Advisory Committee gave very high ratings which generated a mean of 9.2222. The other four juries had mean ratings below that of the Advisory Committee.

The implications of the information presented in Table F-2 is examined in the "Discussion" section of this Appendix.

TABLE F-2

LSD PROCEDURE FOR THE FIVE LOWEST F PROBABILITY VALUES OF THE ORIGINAL CURRICULUM

		Juries	Means
Variable 2.1.1A			
F Probability = .0019			
LSD Procedure			
	Subset 1	Students	4.8889
	Subset 2	Program Completers	6.8889
		Non-Advisory Committee Experts	7.0000
		Advisory Committee	8.7774
		Instructors	9.0000

		Juries	Means
Variable 2.1.4A			
F Probability = .0008			
LSD Procedure			
	Subset 1	Students	5.2222
	Subset 2	Advisory Committee	7.8889
		Non-Advisory Committee Experts	8.0000
		Program Completers	8.6667
		Instructors	9.8000

TABLE F-2 CONT.

	Juries	Means
Variable 7.1.2A		
F Probability = .0014		
LSD Procedure		
Subset 1	Students	5.1111
Subset 2	Non-Advisory Committee Experts	7.5556
	Program Completers	8.2222
	Advisory Committee	8.3333
	Instructors	9.6000

	Juries	Means
Variable 9.1.1A		
F Probability = .0012		
LSD Procedure		
Subset 1	Students	7.6667
Subset 2	Non-Advisory Committee Experts	9.1111
	Program Completers	9.5556
	Instructors	9.8000
	Advisory Committee	9.8889

	Juries	Means
Variable 13.1.4B		
F Probability = .0017		
LSD Procedure		
Subset 1	Program Completers	4.1111
	Students	5.5556
	Non-Advisory Committee Experts	5.7778
	Instructors	5.8000
Subset 2	Advisory Committee	9.2222

Tables F-3 and F-4 present the data for the five lowest F probability values of the revised curriculum. The five lowest F probability values of the revised curriculum are shown in the right half of Table F-3. None of the five values were low enough to meet the critical F probability value of .000225, which was determined by employing the Bonferroni method to account for error rate.

Variable 1.1.4A had very high mean ratings by each of the five juries. Table F-4 shows that the lowest mean rating was given by the Advisory Committee; the mean was 8.6250. The next highest rating was given by the students with a mean of 9.2222. Each instructor gave a rating of 10, yielding a 10.0000 mean for the Instructors' Jury. Thus, the Advisory Committee was statistically homogeneous with only the Students' Jury.

In the original curriculum, Variable 1.1.4A had all of its group means ranging from 9.0000 to 10.0000. The differences among the five juries were not sufficient to form more than one homogeneous subset. The existence of two subsets for Variable 1.1.4A was not of concern to the instructional team due to the fact that the means were so high that the difference in ratings had no practical implications as to informing the students that such differences existed.

TABLE F-3

REVISED CURRICULUM: THE FIVE LOWEST F PROBABILITY VALUES

Original Curriculum				Revised Curriculum		
Objective Number	F Probability	Cell	Change Status	Objective Number	F Probability	Cell
1.1.4A	.5729	4	Ed	1.1.4A	.0278	6
4.2.1A	.0215	7	SM	4.2.1A	.0330	5
			New	8.6.1B	.0104	5
			New	8.6.3B	.0341	5
13.3.1A	.0099	-	Ed	13.3.1A	.0295	5

Ed = Edited

SM = Significantly Modified

TABLE F-4

LSD PROCEDURE FOR THE FIVE LOWEST F PROBABILITY VALUES OF THE REVISED CURRICULUM

	Juries	Means
Variable 1.1.4A		
F Probability = .0278		
LSD Procedure		
Subset 1	Advisory Committee	8.6250
	Students	9.2222
Subset 2	Students	9.2222
	Non-Advisory Committee Experts	9.4444
	Program Completers	9.6250
	Instructors	10.0000

	Juries	Means
Variable 4.2.1A		
F Probability = .0330		
LSD Procedure		
Subset 1	Students	7.5556
	Non-Advisory Committee Experts	7.7778
Subset 2	Non-Advisory Committee Experts	7.7778
	Advisory Committee	9.2500
Subset 3	Advisory Committee	9.2500
	Program Completers	9.5000
	Instructors	9.8000

TABLE F-4 CONT.

	Juries	Means
Variable 8.6.1B		
F Probability = .0104		
LSD Procedure		
Subset 1	Advisory Committee	4.2500
	Program Completers	5.8750
	Non-Advisory Committee Experts	6.1111
Subset 2	Program Completers	5.8750
	Non-Advisory Committee Experts	6.1111
	Students	7.6667
	Instructors	8.0000

	Juries	Means
Variable 8.6.3B		
F Probability = .0341		
LSD Procedure		
Subset 1	Program Completers	4.6250
	Advisory Committee	6.5000
Subset 2	Advisory Committee	6.5000
	Students	7.5556
	Non-Advisory Committee Experts	7.5556
	Instructors	8.2000

	Juries	Means
Variable 13.3.1A		
F Probability = .0295		
LSD Procedure		
Subset 1	Non-Advisory Committee Experts	8.2222
	Students	8.4444
Subset 2	Students	8.4444
	Program Completers	9.7500
	Advisory Committee	9.7500
	Instructors	9.8000

Table F-3 shows that Variable 4.2.1A was in Cell 7 of MARC (Table IV.1). Cell 7 contains those objectives with significantly low ratings on both Questions A and B. The significant modifications made to the objectives in Cell 7 moved the objectives to Cell 5 of MARC. Table F-4 shows that the Students' Jury and the Non-Advisory Committee Experts' Jury were not in the same homogeneous grouping as the Instructors' Jury. Since Variable 4.2.1A of the revised curriculum was in Cell 5 of MARC, it was concluded that the objective should be retained in the curriculum. However, the instructors need to inform the students as to the importance of this objective.

Objective 8.6.1 was not in the original curriculum. The rating of the Key Group placed this objective in Cell 5 of MARC. This indicated that the objective was appropriate and useful in the course. Variable 8.6.1B asked the jury members to rate the degree of "use" or "potential need for use of this objective." The objective dealt with using a soil test kit to perform a nutrient analysis of the soil. The data in Table F-4 indicate that the Advisory Committee Jury was the only jury which was not present in the same homogeneous subset as the Students' Jury and Instructors' Jury. This is one of the rare instances where the Students' Jury and the Instructors' Jury were not separated by other juries. This may

indicate that the farther one gets away from the actual field practice, the higher are the ratings given on the question of "use" or "potential need for use." The other way to look at this response pattern might be that students and instructors realize the need for nutrient analysis of soils, but the practitioners tend to overlook this particular time-consuming step in their daily work.

A further consideration of the question of practitioners not performing soil analysis could be helpful. It is possible that the practitioners who mainly install landscapes rather than maintain landscapes would not be particularly concerned with long-range growth condition as much as would practitioners who receive a great portion of their income from maintaining existing landscapes. A study of the work experience of the jury members would possibly assist in understanding the results of Variable 8.6.1B.

Table F-3 shows that Variable 8.6.3B was not present in the original curriculum. In Table F-4, one can see the similarity in the lowest and highest jury means for Variables 8.6.1B and 8.6.3B. Both variables dealt with soil analysis. For Variable 8.6.3B, the Program Completers' Jury was the only jury that was not in the same subset as the Instructors' Jury. Again, the instructors gave the highest rating on "use." Variable 8.6.1B required

the students to "perform a nutrient analysis using a Soil Test Kit." Variable 8.6.3B dealt with interpreting a report which was supplied to the student. The Advisory Committee Jury, Students' Jury, Non-Advisory Committee Experts' Jury, and Instructors' Jury were all in the same homogeneous subset with respect to this variable. The fact that the Key Group gave a rating to this variable such that it would land in Cell 5 of MARC indicated that the objective was useful and should remain in the curriculum. However, the instructors may need to ponder why the Program Completers' Jury gave a rating so different from that of the Instructors' Jury.

Table F-3 shows that the Key Group's rating placed Variable 13.3.1A in Cell 5 of MARC. This indicates that the objective was seen by the Key Group as being worthwhile for the curriculum. Table F-4 shows that the Non-Advisory Committee Experts' Jury was in a separate subset from that which contained the other four juries. However, the lowest mean rating in Subset 1 was 8.222. This is a rather high mean rating. Therefore, it was concluded that there was no reason why the instructional team would be concerned about this difference in the subset ratings.

Hypotheses H_{3A} and H_{3B} were not rejected for any of the variables in either the original curriculum or the revised curriculum.

Discussion of Research Problem Three

The following is a discussion, not a summary, of the third research problem. To review, the null hypotheses were:

H_{3A} = Considering separately the original curriculum and the revised curriculum, for Question A of each objective there is no significant difference in the ratings given by the five juries.

H_{3B} = Considering separately the original curriculum and the revised curriculum, for Question B of each objective there is no significant difference in the ratings given by the five juries.

There were 218 one-way analysis of variance tests conducted on the original curriculum and 222 one-way analysis of variance conducted on the revised curriculum. The null hypotheses were not rejected for any of these 440 tests. Normally, when null hypotheses are not rejected rejected, one would not proceed with further analysis of those variables that approached the critical F probability value. However, Chapter IV contains a statement as to why the further analyses were pursued. The multiple range tests were used because there was an interest in determining (a) if the students and instructors tended to cluster together in their ratings of the curriculum, and (b) if the other three juries tended to cluster together in a homogeneous group. There was a concern as to whether the students might be so influenced by the opinions of the

instructors that the students would give ratings which were close, if not identical, to the ratings given by the instructors.

By examining the data in Table F-2 and Table F-4, it can be seen that the students and instructors did not cluster together in the same homogeneous groupings. In fact, in three of five of the variables in Table F-2, the students and instructors were at the extreme opposite ends of the rating spectrum from each other. For the revised curriculum, Table F-4 shows that three of the five variables show the student ratings to be at the extreme opposite end of the rating scale from those given by the instructors. In only one instance in Table F-4 did the students and instructors end up immediately adjacent to each other, and that was in Variable 8.6.1B.

Thus, this study showed that of the five lowest F probability values obtained in this study, the Students' Jury rated the variable lower than the other four juries. In three of five variables, the Students' Jury and Instructors' Jury were at the opposite ends of two homogeneous subsets where the means of the first and last groups within homogeneous subsets differed by less than the critical value for a subset of that size.

In four of five variables in Table F-2, the Key Group juries were together in the same homogeneous subset as

had been anticipated. However, in the revised curriculum, the picture is a little different. Here, the students and instructors moved much closer to each other and are found in the same homogeneous subset in three of five variables in Table F-4. The Key Group juries are seen distributed across three subsets and sometimes a given Key Group jury will be found in two subsets. However, one must look at the means of these subsets because the means were rather high considering a scale of 1 to 10. The mean rating of 7.5556 was the lowest mean rating given to the top three variables in Table F-4. The next lowest mean rating for a variable in Table F-4 was 8.2222. Therefore, there was no concern about the differences in the sub-groups when looking at three of the five variables in Table F-4.

The differences which are seen in Variables 8.6.1B and 8.6.3B of Table F-4 are different from the other three variables discussed in Table F-4. These are the only two variables in Table F-4 which deal with Question B, "use or potential use." The lowest and highest mean values are very close to being identical. Both of these variables deal with nutrient analysis of the soil. Variable 8.6.1B deals with performing a nutrient analysis using a Soil Test, and Variable 8.6.3B deals with analyzing an OSU soil report. Both of these variables were in Cell 5 of MARC. This would indicate that these variables were appropriate

for the course and were of use. However, as discussed earlier in this Appendix, one could see that the spread in means indicates a difference in perception as to how much these variables are used or have potential use. In fact, for Variable 8.6.1B the students and instructors are immediately next to each other in their mean ratings. The students gave the mean rating as 7.6667 and the instructors gave the mean rating as 8.0000.

APPENDIX G

CRITERIA FOR CHANGE STATUS CLASSIFICATIONS

CRITERIA FOR CHANGE STATUS CLASSIFICATIONS

The "Change Status" classifications used in this study define the nature of change from what was in the original curriculum to what was in the revised curriculum. The "Change Status" classifications were used in Appendix A as well as in most tables in this study. The definitions for each "Change Status" classification are:

Symbol		Meaning
C	COMBINED:	The objective was dropped as a separate objective and combined with another objective in the revised curriculum.
D	DROPPED:	The objective was in the original curriculum, but it was not carried over to the revised curriculum in any form.
Ed	EDITED:	Words and/or punctuation were changed, but the original meaning and specifications were unchanged.
SM	SIGNIFICANTLY MODIFIED:	The main meaning used in the original curriculum was retained, but the objective had material added (a) from another objective which was in the original curriculum, but which was dropped as a separate objective, or (b) to extend the information required from the student. The SM classification was also used when an objective had two or more parts and one part was dropped.
U	UNCHANGED:	Absolutely nothing was changed.