A STUDY OF THE TEACHING SKILLS NEEDED FOR OUTDOOR BIOLOGY INSTRUCTION

by

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TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

THIS BOOK CONTAINS NUMEROUS PAGES WITH THE ORIGINAL PRINTING BEING SKEWED DIFFERENTLY FROM THE TOP OF THE PAGE TO THE BOTTOM.

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Chapter 1

INTRODUCTION

The aim of this paper is to contribute to the field of environmental education, by determining those special skills which are necessitated by the circumstances encountered when the biology classroom is extended to the out of doors. The focus of research has been to consider what teaching skills are useful in outdoor biology instruction, one category of environmental education prevalent in secondary schools.

It is hoped that the findings of this research will help to define what skills are essential for, and perhaps unique to, effective outdoor biology instruction. It is further anticipated that such information might lead to programs to enhance teacher training, wherever such training is nonexistent.

This paper is written in keeping with the emphasis that has been placed on knowledge of the environment in the past several years, as public interest and concern have deepened. As Helgesen, Helborn, Wiley, and Blosser (1971, p. 4) have said,

> Environmental quality has become established as a national concern, prominent in the news media, in statements by government officials and in the lives of the public. A major focus of this concern is with the role of the schools in educating people to deal with the problems of a deteriorating environment.

Statement of the Problem

This study was undertaken because of the realization that outdoor biology instruction has become widespread practice. The problem of this study is to identify those teaching skills necessary for successful outdoor biology instruction in Kansas. The intent is to develop a priority group of requisite teaching skills, or competencies, in this field, based on the input of practicing outdoor biology teachers. It was hoped that those who train prospective teachers will use the results of the study in designing programs for preservice and inservice training. If successful, the ultimate result would be enhancement of the role of schools in preparing citizens to make informed decisions about issues of the environment. The identification of necessary competency areas should help prospective teachers in preparing meaningful programs of outdoor biology instruction.

The second part of the problem addresses the issue of skills for which there may be a need for further training of practicing teachers. Such a determination could facilitate design of future inservice training programs for teachers of outdoor biology.

Rationale for the Study

Many curricular areas in the schools have emphasized environmental awareness. Attention has often been centered in the natural sciences, particularly in biology. A significant component of the move to explain environmental concepts through biology has been the integration of outdoor studies into school science programs. This tendency has become a

major part of many school programs, often leading to the creation of school study sites, outdoor laboratories, and school camps.

A review of the literature regarding different types of programs available in the area of outdoor biology instruction in the nation's schools makes it apparent that a diversity of skills is necessary to make an instructor an effective participant in any of the programs. It is the concern of this study that, in many cases, skills are required for which training may not have been provided, either through preservice or inservice experiences and, therefore, that teachers of outdoor biology may be in need of further opportunities to learn techniques to improve their teaching.

Any of several studies aimed at identifying teaching skills (competencies) in science instruction have pointed to the need for special kinds of preparation for laboratory teaching skills of various kinds. James and Stallings (1979) have identified a group of skills areas for which secondary biology teachers may need special training. Similar findings were made in studies by Gennaro and Boeck (1968) and by Biesenherz (1973). Such studies have indicated that there are skills needed for the teaching of biology for which teachers may not have acquired adequate preparation. Related studies, by Voltmer and James (1982), and by James and Schaaf (1975), have noted similar trends in other areas of science instruction.

The object of this paper is to continue this process of identifying instructional skills essential to success in the teaching of outdoor biology. It is hoped that this study might lead to the specialized kinds of training envisioned by Stapp and Cox (1974, p. 21).

> In order to provide the first hand experiences, active involvement and adequate preparation, most school systems will need to develop a comprehensive inservice teacher education program to orient teachers and administrators to the philosophy and model of environmental education and the enclosed supporting materials.

Definition of Terms

In an attempt to clarify discussion, some mention must be made of the meanings attached to terms essential to this study. Any such attempt meets with difficulty, due to the somewhat varied usages applied to such terms as "environmental education" and "outdoor education." As reported by research in the Billings, Montana School District 2 (1971, p. 4), "a semantic morass exists" concerning the meanings of such terms.

While a review of the literature reveals an abundance of definitions for the term "environmental education," common elements exist in enough of the samples to select a representative meaning. Such a one is quoted in the Billings (p. 4) report (from Brennan and Brandwein):

> Environmental education consists of the recognition by man of his interdependence with his environment and with life everywhere, and the development of a culture which maintains that relationship through policies and practices necessary to secure the future of the environment fit for life and fit for living.

The report mentions that, although "environmental education" and "outdoor education" are often used interchangeably, such usage is probably inappropriate, because of the common acceptance of the latter as any type of activity done outdoors. Such interpretation is a reference to the term's traditional association with the field of physical education and its focus on sports activities.

In order to avoid the confusion caused by such lack of agreement, the use of the term "environmental education" is infrequent in this paper. "Outdoor education" is not used. Rather, the writer has taken the liberty of using the term "outdoor biology instruction" to describe the field with which the research is concerned. Although no standard definition for this term was located in the literature, McCormack (1974, p. 9) used the term "outdoor biology" and described some of the skills it encompasses -- skills which, in large part, are the subject matter of this study. In this study, "outdoor biology instruction" shall be taken to mean the pursuit of student understanding of living organisms, enhanced by a natural setting for learning.

Limitations

The writer acknowledges the limits to which generalizations can be drawn from the findings of this study. Because the focus of the research was to acquire information concerning the status of outdoor biology instruction from practicing professionals in Kansas, the study was necessarily limited to those school districts in the state where such programs existed. As such, any conclusions reached must be viewed with this limit to generalizability in mind.

Chapter 2

REVIEW OF THE LITERATURE

Introduction

A survey of the literature concerned with outdoor biology instruction was undertaken. It became clear after reading the comments of professional educators on the subject that skills commonly attributed to outdoor biology instruction can be grouped into a few general categories. Once a preliminary list of the skills mentioned in the literature was completed, it was decided that six major categories would suffice to divide the skills mentioned. The categories decided upon were assigned the following headings: Living Organisms, Equipment, Printed Material, Data Treatment, Human Relations, and Outdoor Laboratory. Following is a discussion of the findings in the literature concerning each of the major skills areas.

Living Organisms

Inasmuch as the basic discipline with which this study is concerned is the science of biology, it was not unexpected that a major area of emphasis in the literature concerned interactions with living organisms. Because of the broad scope of discussion in the literature of skills in this category, individual citation of reference is somewhat ambiguous.

Overviews of curricula, like those provided by Richards (1968), and by Major and Cissell (1971) make it clear that a diversity of skills for working with living organisms is essential to outdoor biology instruction. Skills which received attention from these authors, and from virtually all others surveyed, include: observation of organisms in their habitats; identification of various types of living things; collection/capture of organisms; and maintenance of collected specimens by a variety of techniques (use of aquaria, terraria, plant presses, etc.).

Equipment

It is evident that in order to implement many of the skills mentioned above, expertise with various kinds of equipment, often unique to outdoor biology instruction, is a prerequisite. Specific reference to teacher competence in using scientific equipment was generally absent from the discussion in the literature. However, by examining student learning objectives and activities mentioned in the literature, it was possible to discover the kinds of equipment teachers would need to know how to use for instructional purposes.

For instance, Warpinski (1971) outlines a program of instruction in which students would be expected to use various kinds of kits for analysis of water, soil, and air. Richards (1968) mentions the microscope as an essential component of instruction. Major and Cissell (1971) include the directional compass as a necessary tool for learning.

The need for knowledge of other types of equipment could be seen in the nature of learning experiences being discussed, even though there

may have been no specific mention made of the equipment. Clearly when collection of live specimens is part of the educational experience, the use of devices such as nets, traps, and other kinds of capture equipment is implicit. That such collections are a part of outdoor biology is evident by the discussion in the Billings (1971) report, as well as by the curriculum guide prepared by Colorado State University/Poudre School District R-1 (1970).

Also implicit in the discussion of activities involving equipment is the need for skill in acquiring such equipment, given the cost of such equipment and the limited budgets of many school districts to purchase it. An alternative to and/or compliment to such an ability is the knowledge of how to construct homemade versions of certain kinds of equipment.

Printed Material

Printed material was seen as another kind of tool of value to teachers of outdoor biology. As with equipment, the necessity of familiarity with printed material is often implied by the learning activities being discussed.

The ability to read maps of various kinds would be essential to teachers participating in instructional programs such as those described by the Soil Conservation Service (1969), or by the Michigan State Department of Natural Resources (1969). Major and Cissell (1971) also include it as part of their instructional program. In all of these programs, students would require the guidance of an instructor knowledgeable in this area.

The use of field guides and keying manuals would seem to be implied by the skill of identifying living organisms, mentioned earlier. The frequent appearance of this sort of activity in instructional programs surely points to this as a useful skill.

The importance of being able to locate appropriate printed curricular materials should not be overlooked, either. Lundstrom (1971) discusses the importance of being able to successfully locate resource materials through state and federal agencies. Stapp and Cox (1974) demonstrate the significance of this resource location by devoting most of the space in their book to a listing of curricular materials available to educators.

Data Treatment

The treatment of data collected in the field, and the approach to analysis of phenomena observed, make up the critical thinking portion of many outdoor biology situations. Because of this, frequent recognition was given in the literature to such skills as logical thinking, deductive reasoning, analysis, and use of the scientific method. Representative of this trend are the curricula described in the works of Warpinski (1971), and of Lee, Phelps, and Sommers (1970).

Aside from such general reference to problem-solving skills, more specific analytical competencies were sometimes discussed. Techniques used in population studies of wildlife species were cited as outdoor biology components by Warpinski (1971). The Billings (1971) report specifically mentioned the use of transect studies in the determination of plant population densities. Collection of numerical data was

obviously significant in the view of these authors, as was the collection of descriptive data, as cited in the activities discussed by Major and Cissell (1971).

Inasmuch as the studies of populations of organisms must lead to conclusions based on the data collected, it follows that skills related to methods of sampling and statistical analysis are implicit components of some of the learning activities, at least for older, more sophisticated students. Teacher skills to direct such learning would certainly be essential.

Human Relations

Whether it be in directing student learning, or in interacting with people in the community to enhance the educational program, the application of skills in human relations can be seen as an essential component of any program of outdoor biology instruction. The literature focused primarily on those skills involved with community relations, viewed as important because of the need for cooperation between school and community sources necessary in the organization of outdoor facilities. Educational Facilities Laboratories (1971) emphasizes the need for such school and community interaction, as do Helgesen et al. (1971).

These types of skills can also be seen to have importance in coordinating field experiences that require work outside of the physical school facility. This might involve communication with officials in parks, preserves, and governmental agencies where field trips, hikes, and other outdoor experiences take place. Lundstrom (1971) emphasizes the importance of making use of state and federal sources to enhance

the educational experiences of students. Conceivably, this might involve communications with business and industry sources in the community, as well.

The need for providing local experiences for students of outdoor biology, and the requisite skills needed by educators to supply such experiences are summarized by Stapp and Cox (1974, p. 21):

> Teachers and administrators need to be provided with first hand experiences regarding their local environment and its associated problems if they expect to effectively guide their students in a meaningful program. Discussion and planning are needed for ways to integrate community environmental studies into the school program.

Outdoor Laboratory

A skills area in which the human relations skills just discussed find application, and one of repeated concern in the literature, is that of establishment and maintenance of the school study site, or outdoor laboratory. Frequently, schools have set aside areas of land on or near their location as a part of outdoor biology instructional programs. These sites vary from a patch of lawn or a fenced corner of the schoolyard to many-acred preserves which may include lakes, streams, or even a school forest. Needless to say, these areas, in order to be complimentary to the curriculum, must be carefully planned. Such planning was a recurrent point of emphasis in the literature. The Soil Conservation Service (1972) recommends that such planning be done with the intended curriculum in mind, with an eye to producing

varied habitats for ecological studies. Busbee (1971) and Conway (1974) echo that concern, suggesting that design of outdoor laboratories should coincide with the needs of prospective users of the area. Busbee further suggests that students should be involved in the actual construction of those features of the study site, where possible, such as nature trails.

The discussion of the role of school study site tended to be limited to the planning of such laboratories, except for the trail construction skill mentioned above. Other specific skills involving the construction and management of these areas were given scant attention by the authors. It is possible to suggest some of these skills by re-examining some of the remarks about the planning phase. In order for specific habitat types to be constructed and maintained, special knowledge of plant materials and their uses is implicit. A similar set of skills would need to be applied to the resident animal populations for which such habitats are designed.

It is apparent from the literature that the availability of an outdoor laboratory of some kind is considered an asset to outdoor biology instruction, if carefully planned and constructed. A summary of the importance of the role played by such study sites by McGowan (1971, p. 4) states:

> ...it should be apparent that school sites play an important part in the environmental education program. It follows that site planning should deserve considerable attention if maximum educational benefits from school sites are to be realized.

Summary

It can be seen from the discussion of the findings and opinions of expert authors that outdoor biology instruction involves a set of skills covering a broad spectrum of knowledge. From the information provided by the writings of these experts, it is possible to categorize these skills into general areas of emphasis. It is upon the determination of the importance of such skills that this study is based, as well as upon the state of the preparedness of teachers to demonstrate these skills.

It is somewhat surprising that, given the degree of similarity between many of the programs reported in the literature, that a comprehensive list of objectives for teacher training was not found. Although training of teachers to participate in certain programs was mentioned, as in the report by Major and Cissell (1971), the major focus of discussion was in the form of objectives and activities to educate students. As a result, skills needed by teachers often must be determined from context.

Since the focus of this study is on cognitive issues, skills of a more affective nature have not been discussed. Skills dealing with attitudes, values clarification, and developing environmental awareness certainly have their place in outdoor biology instruction, as pointed out by Warpinski (1971), but are not the focus of this study.

Chapter 3

METHODS

Development of the Instrument

In order to identify those skills essential to outdoor biology instruction, it was decided to survey teachers participating in such programs. A preliminary survey instrument, consisting of thirty-eight items, was constructed. The items were organized under seven major headings. The first six such headings coincide with the six general skills categories from the literature. The seventh heading was for several miscellaneous skills which did not readily lend themselves to inclusion in any other skills area.

This preliminary survey was submitted, with a cover letter of explanation, to a panel of six experienced outdoor biology teachers. Copies of the preliminary survey and cover letter appear in Appendix A. The members of the panel were asked to criticize and make comments to improve the validity of the instrument. Based on their responses and criticisms a revision of the survey was constructed to serve as the primary sampling instrument of the study.

Revision of the survey was relatively minor and consisted of re-phrasing some items and adding some others. The additions were the result of expanding some skills areas for the sake of clarity. This

resulted in an increase of the number of survey items to forty-five, with these items still grouped under the original seven major headings used in the early draft. Otherwise, the form of the original survey was preserved intact. A copy of the final version and cover letter are included in Appendix B.

The survey was designed to indicate two factors pertaining to each item, measured on two separate scales. The first factor, measured on a five point scale, asked to what degree the respondents felt the listed skill was either necessary or unnecessary to the teaching of outdoor biology. The scale was constructed with possible responses ranging from a high of 5 for skills which were judged very necessary, to a low of 1 for those skills which were thought to be unnecessary. It was originally thought that considerable latitude for description was required of the scale for judging the necessity of skills.

The second factor to be measured was the respondents' assessment of teaching competence with respect to each of the skills listed in the survey. In this case, it was felt that a less cumbersome three point scale was adequate to allow for teachers to express opinions, while keeping the instrument as concise as possible.

Population Sample

The target population of the study was to be those teachers in the state of Kansas who, at the time, were active in outdoor biology instruction. As such, it was necessary to identify a representative sample of those professionals. This proved to be difficult, since there was, at the time, no directory of any kind containing such information. As a

result of conversations with early participants in the study, it was eventually possible to locate several school districts where programs existed, and to identify a sample of thirty-six participants. It is not clear what portion of the population that this sample represents. The likelihood that the sample is a fairly limited one should lead to cautious use of any conclusions drawn from the study.

Once the participants were identified, they were mailed the survey and cover letter. The cover letter contained a guarantee of anonymity to each participating individual and institution. Included with each survey and letter was a self-addressed, stamped envelope to insure return of the completed surveys.

Validity and Reliability of the Survey Instrument

The validity of the survey instrument is based on the experience of the panel of experts who assisted in its construction. Due to the high percentage of items judged "necessary" on the returned surveys, it would seem reasonable to conclude that this panel had indeed produced a valid list of skills to be examined.

No effort was made to establish reliability in this study. It is a factor that needs attention in any future studies, but was not dealt with in this study due to time limitations.

Chapter 4

RESULTS AND ANALYSIS

Procedures for Discussion of Results

The results of this study can be determined by examinination and discussion of the tabulated survey data. There are two parts to this discussion. The first describes the techniques used to identify those skills found to have priority for preservice and/or inservice teacher training. The second part is a discussion of the survey results for each of the seven major divisions of the survey. In order to facilitate the discussion, the data are interspersed throughout the text in Tables 1 through 7.

Identification of Priority Skills

The goal of this study was to identify those skills or competencies which teachers of outdoor biology felt were important, and to gather self report data regarding the adequacy of their preparation with respect to those skills. In the survey, then, this goal was realized by scrutiny of those skills which respondents indicated were necessary for successful outdoor biology instruction, and/or for which training may have been inadequate.

The scale and descriptors used to determine a skill's necessity in teaching outdoor biology were:

5 -- Necessary for nearly all teachers,

4 -- Needed by most teachers,

3 -- Needed by many, but not of the highest priority,

2 -- Has some value, but not for many teachers, and

1 -- Unnecessary for nearly all teachers.

The scale used to assess respondents' adequacy or training with respect to each skill was:

3 -- I am competent in this area,

2 -- I am not certain of my competence in this area, and

1 -- I need to become more competent in this area.

In terms of these two scales, attention was first directed to those skills which were identified as "necessary" by respondents. The researcher arbitrarily set the criterion for such designation as a plurality of responses of 4 or 5 on the first scale. The thirty-five items which were so judged are identified in Tables 1 through 7 by an asterisk placed at the left of the item number. This group of items consists of those skills which this study would recommend for consideration as part of preservice preparation for prospective outdoor biology teachers.

In order to identify items for which the sample population of practicing teachers indicated a need for further preparation, a technique similar to that used for labeling the "necessary" items was used. It was recognized, however, that objectivity may be somewhat more elusive

when describing one's competency to perform some aspect of one's professional responsibilities. Therefore, in order to insure that some important skill was not overlooked, it was decided that uncertain or ambivalent responses should be included as indicators of need for further training. So, to identify such skills, a plurality of responses of 1 or 2 on the second scale was set as the criterion. The items previously labeled "necessary" were reexamined to find which might also have been classified as "I need," using this criterion.

This technique produced a group of eight priority items which provides information about the status of specific skills being used in outdoor biology instruction. This second group of items contains the skills which this study views as needed components of inservice training, and is the focus of the discussion in the remainder of this chapter. These items must surely be viewed as having the higher priority, since they are expressed as needs by those who confront the challenges of outdoor biology instruction each school day, and are identified in the tables by addition of a second asterisk next to the item number.

Treatment of the data in this study has been based on the assumption that the information gathered is of ordinal or lower order. The tabulation and discussion in the remaining portion of this chapter are designed to follow this assumption.

Survey Returns

Of the 36 surveys mailed, 29 were completed and returned. The data and discussion which follow were drawn from the responses of the participants contained in these returned surveys.

Discussion of Items and Responses

Those items identified as having higher priority in the data represent a diverse set of skills. Following is a discussion of each of the items so designated. The items are organized according to the order in which they appeared in the survey. It is hoped that discussion of these items will lead to some suggestion as to how to meet the needs expressed by the respondents. To add perspective, discussion will attempt to uncover reasons for the prioritization of the skills so designated in the data (Tables 1-7).

Living Organisms

None of the items under this heading in the survey were judged to be of higher priority by the respondents. The apparent reason for this was that teachers found themselves confident of their abilities in this area, as judged by the plurality of responses in column 3 of the second scale for each item (see Table 1).

Equipment

While weather phenomena may not be a biological study concern in the strictest sense, the participants in the survey thought it valuable enough to indicate item 11, "Use of weather data equipment," a higher priority skill (Table 2).

This is perhaps an instance that points to the need for specialized types of teacher training for outdoor biology instruction. The fact that weather patterns are important variables in ecological studies, as

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Table 1

Tabulation of Responses to Survey for Items

Related to Living Organisms

Item	Necessity Scale					Competence Scale		
	5	4	3	2	1	3	2	1
1. Animal capture	3	7	(14)	3	2	(16)	6	7
*2. Wildlife observation	(19)	6	3	1	0	(21)	5	3
*3. Culturing and keeping living organisms	(17)	9	3	0	0	(13)	9	7
*4. Identification of specimens in the field (keying)	(14)	6	9	0	0	(16)	8	5
*5. Methods of preserving plant and animal specimens	(10)	9	9	1	0	(20)	6	3

Note. Numbers in parentheses indicate the most common response. One asterisk beside the item number means the item has priority for the necessity scale only.

Table 2

Tabulation of Responses to Survey for Items

Related to Use of Equipment

Item	Necessity Scale 5	4	3	2	1	Competence Scale 3	2	1
*6. Building cages and traps for animal capture	6	(9)	7	5	2	(13)	11	5
*7. Use of soil testing kits	7	(10)	(10)	2	0	(16)	9	4
*8. Use of water testing kits	(9)	(9)	(9)	2	0	(18)	7	4
9. Use of camping equipment	3	5	(12)	4	5	(19)	7	3
*10. Use of micro-scopes	(24)	3	1	1	0	(27)	1	1
**11. Use of weather data equipment	4	(11)	9	4	1	(10)	(10)	8
*12. Techniques for construction of equipment for field use	(14)	5	5	5	0	(12)	10	7
*13. Knowledge of sources for equipment loan	(15)	8	4	2	0	(12)	10	7
*14. Use of camera and related photographic equipment	8	(9)	5	7	0	(13)	6	10

Table 2 (Continued)

Item	Necessity Scale 5	4	3	2	1	Competence Scale 3	2	1
15. Use of a compass for navigation	2	3	(12)	9	3	(14)	7	8
*16. Use of audio-visual equipment	(20)	5	1	3	0	(27)	2	0

Note. Numbers in parentheses indicate the most common response. One asterisk beside the item number means the item has priority for the necessity scale only; two asterisks mean the item has priority for both scales.

well as in determining conditions for outdoor instruction, does not guarantee its inclusion in teacher education programs.

Although no other item under the heading "Equipment" was judged to have higher priority, eight of the remaining ten items were thought to be "necessary," indicating an area where preservice preparation might be focused. The two items most strongly emphasized, numbers 10 and 16, dealt with the use of microscopes and audio-visual equipment, respectively. These two items were also the two most strongly indicative of high competence by teachers.

Printed Material

As discussed previously in the literature review, access to resource material is a recurrent theme in environmental education. The respondents to the survey seemed to concur, by identifying item 20, "Use of community resource centers," as a higher priority skill (Table 3). The response to this item may indicate a lack of certainty among teachers as to how to make use of those resources which might be open to them in the community.

A further interpretation might be that participants in the study see a need for enriching their curricula, but are frustrated by the means available to do so in their communities. Future inquiries in this area would need to determine if the difficulty being expressed here is one of not knowing where to go for information, or if it is rather a case of difficulty in communicating with the located sources of information.

Table 3

Tabulation of Responses to Survey for Items

Related to Printed Material

Item	Necessity Scale 5	4	3	2	1	Competence Scale 3	2	1
*17. Determining topography and terrain from contour maps	2	(11)	8	5	3	(17)	5	7
18. Navigating from a map	2	6	(12)	6	3	(16)	6	7
*19. Familiarity with resource centers for printed information within the community	(14)	11	2	1	0	(13)	11	4
**20. Use of community resource centers	11	(14)	3	1	0	(13)	(13)	3
*21. Familiarity with common outdoor periodical literature	10	(12)	6	1	0	(14)	7	8
*22. Familiarity with identification manuals for animals and plants	(18)	7	3	1	0	(17)	10	2

Table 3 (Continued)

Item	Necessity Scale 5	4	3	2	1	Competence Scale 3	2	1
**23. Identifying and evaluating curricular materials applicable to outdoor education	(12)	5	10	2	0	10	(15)	4

Note. Numbers in parentheses indicate the most common response. One asterisk beside the item number means the item has prioroty for the necessity scale only; two asterisks mean the item has priority for both scales.

A second higher priority item under this heading was 24, "Identifying and evaluating curricular materials applicable to outdoor education" (Table 3). This item is closely related to the discussion of the previous one. Closer research will need to be performed to determine whether "identifying" or "evaluating" is the more significant. It is enough to say that participants in the study have expressed difficulty in locating curricular materials and/or in applying such materials to their instructional programs in outdoor biology.

Data Treatment

As a result of respondents' apparent confidence in this skills area, only one survey item was judged both "necessary" and "I need." That item, number 26, "Conducting statistical tests," is one that is somewhat surprising to find as lacking among a group of professionals whose discipline has been shown in the literature to include activities centered around population studies. It is not surprising that such an item should be found to be valuable in outdoor biology instruction. What is surprising is that experienced teachers in this field expressed a feeling of inadequacy in preparation to teach it. Certainly this skill deserves some attention in inservice training, based on these findings (see Table 4).

Again, as in previous cases, most of the items (four out of six) in this general skills category were judged "necessary" for outdoor biology instruction. There are no particular surprises among these. There is a surprising omission, however. Item 28, "Computer skills," was viewed unenthusiastically by the respondents. Surely this is a

Table 4

Tabulation of Responses to Survey for Items Related to Data Treatment

Item	Necessity Scale 5	4	3	2	1	Competence Scale 3	2	1
*24. Methods of recording data in the field	(17)	8	3	2	0	(15)	10	4
*25. Qualitative data collection (sketching, verbal description)	(13)	8	5	3	0	(17)	8	4
**26. Conducting statistical tests	7	(11)	8	3	0	6	(16)	7
27. Use of mathematical models	3	5	(15)	4	2	5	(18)	6
28. Computer skills	1	4	(10)	8	6	5	(12)	(12)
*29. Sampling methods	(14)	6	5	1	1	(17)	6	5

Note. Numbers in parentheses indicate the most common response. One asterisk beside the item number means the item has priority for the necessity scale only; two asterisks mean the item has priority for both scales.

reflection of the fact that, at the time the survey data were gathered, the migration of the microcomputer into schools was in its very early stages.

Human Relations

Interestingly enough, more higher priority items occurred under this heading than any other in the survey. Three items were judged to fit the criteria for such designation, two of which echo concerns expressed earlier about resource location (see Table 5).

Item 33, "Locating resource people within the community," probably is included in the higher priority group for many of the same reasons cited previously for Item 20. Beyond that, a question that needs to be asked is whether teachers are in need of experts to direct them to curricular materials, or rather are in need of participation in some more direct way by such people. Because of the general wording of the item, this is unanswerable at this time. It is likely that future research might find some need for both kinds of assistance.

Continuing this theme, Item 34, "Locating and making arrangements with industries, parks, agencies, and other field trip sites," narrows the focus of community relations to dealings with organizations that might directly lead to enhancement of the study of outdoor biology by providing alternative learning opportunities. The value of being able to add variety to educational experiences through such channels was obviously recognized by respondents.

The final issue which received a higher priority ranking under the heading of "Human Relations" was that of the last item in the group, 36,

Table 5

Tabulation of Responses to Survey for Items of a Human Relations Nature

Item	Necessity Scale 5	4	3	2	1	Competence Scale 3	2	1
*30. Relating verbally the subject matter to the surroundings	(16)	8	5	0	0	(20)	8	1
*31. Student control (discipline)	(24)	4	1	0	0	(24)	4	1
*32. Speaking ability (delivery)	(17)	6	5	0	1	(21)	7	1
**33. Locating resource people within the community	10	(15)	3	1	0	12	(15)	2
**34. Locating and making arrangements with industries, parks, agencies, and other field trip sites	9	(10)	7	3	0	(13)	(13)	3
*35. Developing and maintaining community support for a school outdoor laboratory	(17)	7	2	3	0	(13)	9	0

Table 5 (Continued)

Item	Necessity Scale 5	4	3	2	1	Competence Scale 3	2	1
**36. Conversing on local and national issues of ecological concern	(12)	8	7	2	0	11	(13)	5

Note. Numbers in parentheses indicate the most common response. One asterisk beside the item number means the item has priority for the necessity scale only; two asterisks mean the item has priority for both scales.

"Conversing on local and national issues of ecological concern." The problem that teachers encounter in this area centers on the issues to be discussed, since "conversing" would seem to be excluded by confidence expressed about speaking ability in Item 32. It therefore can be seen to be a problem of becoming informed or at least brought up to date on such issues. Again, this would seem to be a problem easily remedied by inservice instruction. In point of fact, respondents may be indicating a need for information, and not necessarily the skill for using such information.

All other items in this section of the survey were judged necessary, but not inadequate in terms of teacher competence. The data seem to agree with the importance assigned to community relations found in the literature, and adds emphasis to the idea human relations skills are essential to successful outdoor biology instruction.

Outdoor Laboratory

One item from this section of the survey emerged as having higher priority. Item 38, "Horticultural techniques," was so designated; however, the data show the plurality of responses in the 4 column was by the barest of margins. Even so, it is clear that teachers are at least unsure of their competence in this marginally necessary skill (see Table 6). The application of the skill will vary among teachers and among different kinds of school study sites. Establishment and maintenance of the desired kinds of vegetation are essential to fulfilling the design concepts of the outdoor laboratory. Since much of this translates into habitat improvement, it is curious that Item 39,

Table 6

Tabulation of Responses to Survey for Items

Related to the Outdoor Laboratory

Item	Necessity Scale 5	4	3	2	1	Competence Scale 3	2	1
37. Landscaping techniques	6	4	(10)	7	2	9	(10)	(10)
**38. Horticultural techniques	6	(8)	7	7	1	8	(11)	10
*39. Habitat improvement	(11)	10	8	0	0	(13)	10	6
40. Animal population control techniques	8	9	(11)	1	0	10	(14)	4
41. Construction techniques (fences, outbuildings, etc.)	4	8	(9)	7	1	(13)	9	7

Note. Numbers in parentheses indicate the most common response. One asterisk beside the item number means the item has priority for the necessity scale only; two asterisks mean the item has priority for both scales.

dealing with that issue specifically, reflected a higher degree of competence. This skill deserves further attention in any future studies. In fact, the ambivalence that permeates the response data for many of the items concerning the outdoor laboratory points to the need for clarification of such skills.

Miscellaneous

Due to the nature of the data for this group of items, the discussion shall be brief. No items in the group were judged to be of higher priority, perhaps because of the considerable confidence expressed in their own abilities, as indicated by the respondents. Three of the four items were seen as necessary components of outdoor biology instruction, with teachers feeling well prepared in those skills.

It may be that the lack of support for the item concerned with transportation (42) is a result of vagueness in wording. A more advisable approach may have been to specify skills such as "Hiking skills" or "Canoeing techniques." For some kinds of field trips such skills would surely prove valuable.

Table 7

Tabulation of Responses to Survey for Items of Miscellaneous Description

Item	Necessity Scale 5	4	3	2	1	Competence Scale 3	2	1
42. Familiarity with various means of transportation	4	8	(14)	1	2	(19)	7	3
*43. Knowledge of first aid and emergency techniques	(21)	6	0	2	0	(18)	8	3
*44. Knowledge of safety rules for equipment	(19)	7	3	0	0	(21)	7	1
*45. Personal physical fitness	(12)	(12)	4	1	0	(23)	5	1

Note. Numbers in parentheses indicate the most common response. One asterisk beside the item number means the item has priority for the necessity scale only.

Chapter 5

SUMMARY AND CONCLUSIONS

Restatement of the Problem

This study asked questions about the skills needed by teachers of outdoor biology. It sought to identify those skills which are necessary, according to teachers with experience in this area of instruction. Further, this study attempted to separate these selected competencies into groups, with one applying to prospective teachers, and the other to practicing teachers.

In order to fulfill its intended purpose, the research was based on two assumptions. First was the assumption that there were identifiable skills in outdoor biology instruction for which adequate training opportunities may not have existed. Second, the assumption was made that experienced outdoor biology teachers could identify the skills for which such needs existed. On the basis of these assumptions a sample population was identified and surveyed, in an attempt to answer the questions raised by the study.

Findings

Conclusions were reached during the course of this study which bear out the assumptions upon which it was based. These findings include:

1. it is possible to determine which skills are necessary to outdoor biology instruction, based on agreement among practicing teachers;
2. it is further possible to decide which of the necessary skills are needed by practicing teachers, and which are needed as part of preservice teacher training; and
3. the general area of greatest need among practicing teachers concerns skills in human relations, primarily in the area of communication within the community.

The analysis and discussion of the survey data, carried out in Chapter 4, demonstrate that the questions being asked have validity, however tenuous. The data indicate that there are indeed some skills essential to outdoor biology instruction, and some for which adequate training has not been provided. These determinations, as expressed by experienced professionals, in the form of survey responses, demonstrate how a beginning step can be taken toward the improvement of the teaching of outdoor biology in Kansas.

Future Considerations

The items in the survey instrument used in this study were general enough in nature that any future studies might divide them into more narrowly defined skills. The logical outgrowth of this study and any that may follow is the creation of courses and/or workshops to attempt to meet the needs expressed by the participants in the study. The exact design of such additions to existing teacher education programs needs to be carefully examined.

Whatever form future training efforts for teachers of outdoor biology may take, it is clear that such efforts are warranted, as suggested by Major and Cissell (1971):

> We believe that no teacher should take children into any outdoor area unless that teacher knows the area and the subject material to be presented. In order to make sure of this, we believe that all teachers involved must be trained.

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APPENDICES

APPENDIX A

Preliminary Cover Letter

Dear Biology Teacher:

Due to the rising trend in conducting high school biology classes outdoors, it has been felt necessary to direct some attention to the special kinds of skills pertinent to this area. Your cooperation in helping to define these skills and the extent to which they are needed will be greatly appreciated. Would you please help to accomplish this by completing the enclosed form.

Hopefully, the development of instructional programs for pre-service and in-service biology teachers will be the result of this study.

All data collected will be anonymous. No teacher's name or school district will be mentioned in future publications resulting from this survey.

Sincerely,

Tom Heintz
Graduate Student
Kansas State University

APPENDIX A

Preliminary Survey

AREAS OF COMPETENCY IN TEACHING BIOLOGY OUTDOORS SURVEY

Circle the number best describing your feelings about each area according to the following scale:

5. Necessary for nearly all teachers;
4. Needed by most teachers;
3. Needed by many, but not of highest priority;
2. Has some value but not for many teachers;
1. Unnecessary for nearly all teachers.

Also please indicate on the scale farthest to the right of each question your feelings about your own preparation in this area, following this rating system:

3. I am competent in this area;
2. I am not certain of my competency in this area;
1. I need to become more competent in this area.

Area	Necessary-----Unnecessary	OK-----I Need
Living Organisms:		
1. Animal capture	5 4 3 2 1	3 2 1
2. Wildlife observation	5 4 3 2 1	3 2 1
3. Culturing and keeping living organisms	5 4 3 2 1	3 2 1
4. Building cages and traps for animal capture	5 4 3 2 1	3 2 1
5. Identification of specimens in the field (keying)	5 4 3 2 1	3 2 1
6. Wildlife habitat improvement	5 4 3 2 1	3 2 1

Area	Necessary-----Unnecessary	OK-----I Need
Equipment:		
7. Use of soil testing kits	5 4 3 2 1	3 2 1
8. Use of water testing kits	5 4 3 2 1	3 2 1
9. Use of camping equipment	5 4 3 2 1	3 2 1
10. Making equipment for field use	5 4 3 2 1	3 2 1
11. Knowledge of sources of equipment for loan	5 4 3 2 1	3 2 1
12. Use of camera and other photographic equipment	5 4 3 2 1	3 2 1
13. Use of a compass for navigation	5 4 3 2 1	3 2 1
Printed Material:		
14. Determining topography and terrain from contour maps	5 4 3 2 1	3 2 1
15. Navigation from a map	5 4 3 2 1	3 2 1
16. Locating resource centers for printed information within the community	5 4 3 2 1	3 2 1
17. Use of community resource centers	5 4 3 2 1	3 2 1
18. Familiarity with common outdoor periodical literature	5 4 3 2 1	3 2 1
Data Treatment:		
19. Methods of recording data in the field	5 4 3 2 1	3 2 1
20. Qualitative data collection (sketching, verbal description)	5 4 3 2 1	3 2 1

Area	Necessary-----Unnecessary	OK-----I Need
21. Conducting statistical tests	5 4 3 2 1	3 2 1
22. Use of mathematical models	5 4 3 2 1	3 2 1
23. Computer skills	5 4 3 2 1	3 2 1
Dealing With People:		
24. Relating verbally the subject matter to the surroundings	5 4 3 2 1	3 2 1
25. Student control	5 4 3 2 1	3 2 1
26. Speaking ability (delivery)	5 4 3 2 1	3 2 1
27. Locating resource people within the community	5 4 3 2 1	3 2 1
28. Identifying helping agencies	5 4 3 2 1	3 2 1
29. Ability to converse on local and national issues of ecological concern	5 4 3 2 1	3 2 1
Outdoor Laboratory Maintenance:		
30. Landscaping techniques	5 4 3 2 1	3 2 1
31. Horticultural techniques	5 4 3 2 1	3 2 1
32. Habitat improvement	5 4 3 2 1	3 2 1
33. Animal population control techniques	5 4 3 2 1	3 2 1
34. Knowledge of construction techniques (fences, out-buildings)	5 4 3 2 1	3 2 1

Area	Necessary-----Unnecessary	OK-----I Need
Miscellaneous:		
35. Familiarity with various means of transportation	5 4 3 2 1	3 2 1
36. Knowledge of first aid and emergency techniques	5 4 3 2 1	3 2 1
37. Knowledge of safety rules for equipment	5 4 3 2 1	3 2 1
38. Maintaining good physical condition	5 4 3 2 1	3 2 1

(rough draft only)

ADDITIONAL AREAS WHICH I WOULD LIKE TO SEE INCLUDED IN THE SURVEY:

FURTHER COMMENTS:

SUGGESTED IDEAS FOR EQUIPMENT PERTINENT TO TEACHING BIOLOGY OUTDOORS WHICH SHOULD BE INCLUDED ON ANY SURVEY OF EQUIPMENT AVAILABILITY:

KANSAS STATE UNIVERSITY

Department of Curriculum and Instruction

College of Education
Bluemont Hall
Manhattan, Kansas 66506
913-532-5550

APPENDIX B

Revised Cover Letter

Dear

Due to the rising trend in outdoor biology education, it is seen as necessary to direct some attention to special skills pertinent to this area. This survey is designed to identify these skills, the degree to which a representative teacher population feels they are necessary, and the degree to which each teacher feels competent in each area.

The results of this study will be useful in identifying pertinent teacher skills for schools contemplating initiating programs in outdoor science education. It also will provide suggestions for improvement in pre-existing programs. Most importantly, the survey results will point out areas to be emphasized in the development of future programs of pre- and in-service teacher education.

Your cooperation in helping to identify outdoor instructional skills in biology and the extent to which they are needed will be greatly appreciated.

All data collected will be kept strictly anonymous. No individual teacher's name or school district will be mentioned in future publications resulting from this survey.

A stamped envelope is provided for your convenience in returning the completed survey form by May 20, 1975. Once again, your time and cooperation are greatly appreciated.

Sincerely,

Tom Heintz
Graduate Student, Environmental Education

Robert K. James
Associate Professor of Curriculum and Instruction

APPENDIX B

Revised Survey

AREAS OF COMPETENCY IN TEACHING BIOLOGY OUTDOORS
-SURVEY-

Circle the number best describing your feelings about each area according to the following scale:

5. Necessary for nearly all teachers;
4. Needed by most teachers;
3. Needed by many, but not of the highest priority;
2. Has some value but not for many teachers;
1. Unnecessary for nearly all teachers.

Please indicate on the scale farthest to the right of each question your feelings about your own preparation in this area, according to the following scale:

3. I am competent in this area;
2. I am not certain of my competency in this area;
1. I need to become more competent in this area.

Area	Necessary-----Unnecessary	OK-----I Need
Living Organisms:		
1. Animal capture	5 4 3 2 1	3 2 1
2. Wildlife observation	5 4 3 2 1	3 2 1
3. Culturing and keeping living organisms	5 4 3 2 1	3 2 1
4. Identification of specimens in the field (keying)	5 4 3 2 1	3 2 1
5. Methods of preserving plant and animal specimens	5 4 3 2 1	3 2 1
Equipment:		
6. Building cages and traps for animal capture	5 4 3 2 1	3 2 1
7. Use of soil testing kits	5 4 3 2 1	3 2 1

Area	Necessary-----Unnecessary	OK-----I Need
8. Use of water testing kits	5 4 3 2 1	3 2 1
9. Use of camping equipment	5 4 3 2 1	3 2 1
10. Use of microscopes	5 4 3 2 1	3 2 1
11. Use of weather data equipment	5 4 3 2 1	3 2 1
12. Techniques for construction of equipment for field use	5 4 3 2 1	3 2 1
13. Knowledge of sources for equipment loan	5 4 3 2 1	3 2 1
14. Use of camera and related photographic equipment	5 4 3 2 1	3 2 1
15. Use of a compass for navigation	5 4 3 2 1	3 2 1
16. Use of audio-visual equipment	5 4 3 2 1	3 2 1
Printed Material:		
17. Determining topography and terrain from contour maps	5 4 3 2 1	3 2 1
18. Navigating from a map	5 4 3 2 1	3 2 1
19. Familiarity with resource centers for printed information within the community	5 4 3 2 1	3 2 1
20. Use of community resource centers	5 4 3 2 1	3 2 1
21. Familiarity with common outdoor periodical literature	5 4 3 2 1	3 2 1
22. Familiarity with identification manuals for animals and plants	5 4 3 2 1	3 2 1
23. Identifying and evaluating curricular materials applicable to outdoor education	5 4 3 2 1	3 2 1

Area	Necessary-----Unnecessary	OK-----I Need
Data Treatment:		
24. Methods of recording data in the field	5 4 3 2 1	3 2 1
25. Qualitative data collection (sketching, verbal description)	5 4 3 2 1	3 2 1
26. Conducting statistical tests	5 4 3 2 1	3 2 1
27. Use of mathematical models	5 4 3 2 1	3 2 1
28. Computer skills	5 4 3 2 1	3 2 1
29. Sampling methods	5 4 3 2 1	3 2 1
Dealing With People:		
30. Relating verbally the subject matter to the surroundings	5 4 3 2 1	3 2 1
31. Student control	5 4 3 2 1	3 2 1
32. Speaking ability (delivery)	5 4 3 2 1	3 2 1
33. Locating resource people within the community	5 4 3 2 1	3 2 1
34. Locating and making arrangements with industries, parks, agencies, and other field trip sites	5 4 3 2 1	3 2 1
35. Developing and maintaining community support for a school outdoor laboratory	5 4 3 2 1	3 2 1
36. Conversing on local and national issues of ecological concern	5 4 3 2 1	3 2 1

Area	Necessary-----Unnecessary	OK-----I Need
Outdoor Laboratory:		
37. Landscaping techniques	5 4 3 2 1	3 2 1
38. Horticultural techniques	5 4 3 2 1	3 2 1
39. Habitat improvement	5 4 3 2 1	3 2 1
40. Animal population control techniques	5 4 3 2 1	3 2 1
41. Construction techniques (fences, outbuildings, etc.)	5 4 3 2 1	3 2 1
Miscellaneous:		
42. Familiarity with various means of transportation	5 4 3 2 1	3 2 1
43. Knowledge of first aid and emergency techniques	5 4 3 2 1	3 2 1
44. Knowledge of safety rules for equipment	5 4 3 2 1	3 2 1
45. Personal fitness	5 4 3 2 1	3 2 1

Additional Comments:

A STUDY OF THE TEACHING SKILLS NEEDED FOR OUTDOOR BIOLOGY INSTRUCTION

by

THOMAS R. HEINTZ

B.S., Kansas State University, 1974

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Curriculum and Instruction

KANSAS STATE UNIVERSITY

Manhattan, Kansas

1983

This study centered on the development of a group of priority teaching skills, or competencies, for outdoor biology instruction. After a review of past studies was completed, a survey instrument was constructed with the aid of a panel of six experienced outdoor biology teachers. The survey was subsequently submitted to a sample population of 36 Kansas teachers of outdoor biology. On the basis of the survey responses, two groups of priority skills were obtained: one identified as "necessary" for outdoor biology instruction containing 35 items, and the other a group of eight items for which practicing teachers expressed feelings of inadequacy or ambivalence in preparedness. The skills groups thus obtained were in general agreement with skills viewed as essential by authors of previous studies, and were diverse in nature. The study concluded that skills necessary to outdoor biology instruction can be agreed upon by practicing teachers. Further, it concluded that agreement can be made upon which skills practicing teachers feel a need for further preparation, and that the general area of greatest need concerns skills in human relations. These conclusions may provide an initial step in improving biology instruction in Kansas.