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Introductory Botany in State Supported Institutions

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Introduction

One of the largest responsibilities of botanists to their science should be in the field of teaching. If the importance of botany in the curricula of colleges and universities is to be maintained then it is obligatory to study teaching problems critically, and to undertake periodic objective evaluations of teaching methods, practices, and procedures.

Graduate students are prospective teachers who will assume responsibility for providing basic training in plant science. Since many gain their first teaching experience as assistants, introductory botany should be well taught in order to imbue them with the proper attitudes and skills requisite to their profession.

For many college students, the introductory course affords the only contact with the science of botany. It is imperative that the experience be worthwhile and educationally enriching.

Thus, this study was undertaken by questionnaire to gain an insight into the problems of teaching introductory botany in state supported institutions by determining:

1. Objectives and obligations in the course.
2. Procedures followed in attaining such objectives and obligations.
3. Subject matter taught.
4. Responsibility for outlining the course.
5. Student groups for which the course was designed.
6. Evaluation devices employed.
7. Textbooks and laboratory manuals used.
8. Audio-visual aids used in teaching.
9. Average annual expenditures for supplies and equipment.
10. Weekly distribution of class time.
11. Enrollment for 1955-56.

From this study, it was hoped that teachers in introductory botany courses could be apprised of current practices. Such information should prove useful to those who desired improvement of teaching procedures in colleges and universities.

Literature

The modern era in the teaching of botany in America dates back to 1870, when Dr. C. E. Bessey initiated botanical teaching and research in Iowa State College. Use of the microscope was introduced, marking the origin of laboratory instruction (Melhus, 9).

The microscope served to open unexplored phases of botany. Consequently, botanical teaching rapidly became specialized by 1900 (Pool, 13).

Numerous problems in botanical teaching have arisen since the beginning of the 20th century, and much research has been conducted to find solutions. The Group Conference Method of laboratory instruction was introduced (Dietz, 2). In 1933 Victor (18) reported that success in general botany was more dependent on teaching methods used than on a student's natural ability. Kreutzer (6) demonstrated the importance of sectioning general botany classes for more efficient instruction according to scores on a botany pretest. In 1941 Bragonier (1) found the American Council of Education Psychological Examination was a more precise instrument for sectioning students in introductory botany. The first nation-wide study of botanical teaching problems was made by the Committee on the Teaching of Botany in American Colleges and Universities in 1938, under the sponsorship of the Botanical Society of America (17). In 1948 Packard (12) reported on the five best remembered plant facts. Quality of students classified in introductory botany was studied by Martin (8) in 1951. Simpson and Brown (15) reported higher mean total learning quality scores in classes taught by several instructors than in classes taught by one. In 1953 Mallinson (7) found that high school and college students made the same type of errors in a botany test. The most recent survey of botanical problems was made in 1955 by Miller (11).

It is apparent from the preceding that teachers of botany have always been interested in teaching problems. Although solutions are being sought through research and self-appraisal, much still remains to be accomplished.

Method of Procedure

Information used in this study was secured from a 33-item questionnaire prepared after investigating contents of several textbooks and curricula in introductory botany, and interviewing and consulting a number of authorities.

The questionnaire was sent to the state supported institutions, approved by the American Association of Land-Grant Colleges and Universities, which listed in their catalogues one or more courses in

introductory botany apart from courses in biology. It was addressed to the department head with the suggestion it be referred to the person in charge of the introductory course. A personal letter, to the department head, a self-addressed and stamped envelope and a promise to furnish tabulated results to those responding, accompanied each questionnaire.

Results and Discussion

The study surveyed 53 land-grant colleges and universities, and 25 other state supported institutions. A total of 66 or 84.6 per cent responded (Table 1). There were 61 usable questionnaires. Three of the 66 returns were unchecked because the schools did not offer introductory botany and two arrived too late to be included. Response from land-grant colleges was 12.67 per cent higher than other state supported institutions.

Table 1
Response of Colleges and Universities to Questionnaire on Introductory Botany

	Land-grant	Non-land-grant
Number of questionnaires sent	53	25
Number of questionnaires returned	47	19
Percentage of returns	88.67	76.0
Percentage of all questionnaires returned	84.6	

Course Objectives and Content

In the questionnaire, the departments were asked to rate the objectives and obligations as to importance in their introductory botany courses, assuming the students were beginners (Table 2).

Table 2
Rating of Objectives or Obligations in Introductory Botany

Obligation or Objective	Response in Percentage			
	Much Value	Moderate Value	Little Value	No Value
a. To stimulate sense of inquiry and observation	78.7	19.7	1.6	—
b. To provide basic training in plant science	63.9	36.1	—	—
c. To broaden horizons in science	55.0	36.7	8.3	—
d. To develop interest in nature	47.5	41.1	9.8	1.6
e. To understand the limitations of science	14.8	50.8	26.2	8.2
f. To teach subject matter, with applications	40.0	43.3	11.7	5.0
g. To select and train botany majors	21.9	48.4	23.4	6.3
h. To teach understanding of natural phenomena	59.3	32.2	6.8	1.7
i. To develop an understanding of and an ability to use the scientific method	45.0	41.7	13.3	—

Ninety-eight point four per cent of the schools indicated they were obligated to stimulate sense of inquiry and observation. All institu-

tions had the primary objective of providing basic training in plant science for students other than botany majors. In contrast, however, only 70 per cent said their objective was to select and train botany majors. Sixty-five point six per cent of the colleges and universities responded that it was their obligation to teach limitations of science. The importance of these objectives and obligations is shown by the uniformity with which they were checked as of much or moderate value.

The offering of an introductory botany course would be influenced by available textbooks, fields of specialization of the teachers, and by contents of advanced courses in the department. However, this study found much agreement (89.9 per cent) among institutions rating a list of topics generally treated in introductory botany textbooks (Table 3).

That only 30 per cent of the schools rated life cycles of the lower plants as being a major element in introductory botany is significant. Plant classification and evolution, also, were not rated as major elements in introductory botany. This is a trend away from known earlier practices, when these topics were considered the major elements in introductory botany courses (Melhus, 9). Sexual and vegetative reproduction are topics that should be accorded more than incidental reference in botany. Vegetative reproduction is of practical importance and sexual reproduction is necessary for the perpetuation of a species.

Table 3
Ratings Given Topics in Introductory Botany

Topic	Response in Percentage		
	Major Element	Minor Emphasis	Incidental Reference
a. Plants, importance and uses	63.9	26.2	9.9
b. The cell as the structural and functional basis of plant life	90.2	9.8	—
c. Photosynthesis	93.4	6.6	—
d. Plant-water relations	73.8	21.3	4.9
e. The root and the soil	74.6	19.6	5.8
f. Anatomy and morphology	83.6	16.4	—
g. Life cycles of lower plants	30.0	45.0	25.0
h. Growth and movement	60.7	31.1	8.2
i. Respiration	80.6	17.8	1.6
j. Plant classification	21.7	40.0	38.3
k. Plant evolution	29.5	41.0	29.5
l. Sexual reproduction (meiosis)	74.2	21.0	4.8
m. Vegetative reproduction (mitosis)	71.6	25.1	3.3

The considerable amount of attention devoted to the cell as the structural and functional basis of life, and the serious consideration given to photosynthesis denote the realism with which botany teachers approach their subject matter. The trend to humanize botany

and to teach it in relation to every day living should not be overlooked.

The diverse nature of present college populations and the varying needs of students, both individual and departmental, are factors that must be considered in designing a course. The mark of a progressive institution must be an ability to serve the needs of this heterogeneous population. Introductory botany courses were designed with this objective in mind (Table 4).

Table 4
Student Groups for Which Introductory Botany Course is Designed[a]

Group	Response in Percentage
a. For "elective" students, primarily	9.9
b. For "required" students, primarily	21.3
c. For "elective" students and "required" students	68.8

[a]Questionnaire item 4.

Sixty-eight point eight per cent of the schools designed their introductory botany courses for both "elective" and "required" students. This finding is in harmony with item b in Table 2, which stated that a major objective was to provide basic training in plant science for students other than botany majors. Nine point nine per cent of the schools designed their courses for "elective" students primarily, and 21.3 per cent for "required" students. This group may comprise agriculture students and botany majors, or students in a biology curriculum.

Curriculum Preparation

The responsibility for outlining introductory botany courses rested with instructors in these courses (Table 5). However, departmental chairmen or heads and committees also shouldered this responsibility.

Sixty point four per cent of colleges and universities considered it imperative that their courses be outlined by the instructor. This is definitely an outgrowth of modern educational philosophy. The enthusiasm which this practice should generate in introductory botany teachers is worth investigating.

Table 5
Responsibility for Course Outline[a]

Responsibility	Response in Percentage
a. Committee of botanists	22.4
b. Committee of biologists	1.7
c. Departmental chairman or head	12.1
d. Departmental curriculum committee	1.7
e. Instructors in the course	60.4
f. Committee of biologists and course instructors	1.7

[a]Questionnaire item 3.

Duration of courses will vary greatly between different students and their intended fields of specialization. Length of introductory botany courses is presented in Table 6.

Thirty-nine point three per cent of the schools designed their courses for one semester, and 8.1 per cent for one quarter. Forty-eight point four per cent designed them for two terms. Forty per cent of those colleges giving two-term courses said the second term was optional, 26.7 per cent reported it was required while 23.3 per cent indicated that the second term depended on the student's curriculum. Three point two per cent gave courses lasting three terms, but the third was optional.

Table 6
Duration of Courses in Introductory Botany[a]

Course Duration	Response in Percentage
a. One quarter	8.1
b. Two quarters	14.0
c. Three quarters (3rd term optional)	3.2
d. One semester	39.3
e. Two semesters	34.4
(1) If two term, second optional 40.0	
(2) If two term, second required 26.7	
(3) If two term, second depends on curriculum.. 23.3	
No response 10.0	

[a]Questionnaire item 5 modified.

A truly progressive department of botany or any subject field would need to revise its curriculum periodically. The frequency with which such periodic self appraisal occurred in land-grant and other state supported institutions is recorded in Table 7.

Course content revision every year was reported by 54.1 per cent of the institutions. That 18 per cent of the schools revised their course content once in four or six years is disheartening. The 21.3 per cent who listed other practices comprised those who revised a particular phase of their course only when felt necessary. The length of time before this necessity was felt was not stated. Others retained the basic plan and revised only the methods of presentation. Where more than one introductory course was given, revision depended upon objectives and contents. One institution stated that "the course was never given in the same way twice" and there was "no formal system of revision." Another college reported that it revised its laboratory manual every two years. The instructor in a course "used his discretion and when research showed an advance, the course also reflected it." Thus, course content revision was irregular or regular, informal or formal, depending on circumstances.

Teaching Practices

Course presentation in introductory botany varied from one institution to another. Also, when different individuals taught several

Table 7
Frequency of Course Content Revision[a]

Frequency of Revision	Response in Percentage
a. Every year	54.1
b. Every two years	6.6
c. Every four years	14.7
d. Every six years	3.3
e. Every eight years	0.0
f. Every ten years	0.0
g. Others	21.3

[a]Questionnaire item 6.

sections of a course in the same school, there would be varying emphasis on certain aspects of subject matter due to their backgrounds and fields of specialization or interest. Similarly, institutions having different objectives and obligations would not be uniform in teaching practices (Table 8).

Although laboratories may be given separately or in combination with lecture and discussion, they have become established practice in introductory botany. The trend harmonizes with an earlier finding (Miller, 11).

Table 8
Course Presentation in Introductory Botany[a]

Method	Response in Percentage
a. Lecture only	0.0
b. Lecture and laboratory only	47.0
c. Lecture and recitation only	0.0
d. Lecture, laboratory, and recitation combined (Socratic or group conference method) by:	
(1) One person for all three, no assistant	75.0
(2) One person for all three, with an assistant	25.0
e. Lecture, laboratory, and recitation separately	30.0
(1) One person for all three	40.0
(2) Different persons for each	35.0
(3) Same instructor for lecture and recitation, assistant for laboratory	25.0

[a]Questionnaire item 7.

This study has found that both undergraduate and graduate students were used as assistants. However, only 1.7 per cent used undergraduates exclusively, while graduate assistants were used exclusively by 23.3 per cent. Undergraduates had no teaching responsibility (Table 9).

Table 9
Use of Students as Assistants[a]

	Response in Percentage	
Degree of Use	Undergraduates	Graduates
a. No	63.9	26.6
b. To a limited extent	26.2	19.9
c. Frequently	8.2	26.6
d. Exclusively	1.7	23.3

[a]Questionnaire items 8 and 9.

Most schools did not use undergraduates. The contrast with graduate assistants is striking because more schools used them more exclusively or frequently. This is due, probably, to their better qualification.

Institutions employing graduate students as assistants in introductory botany required varying degrees of experience (Table 10). Twenty point four per cent did not delegate responsibility to graduate assistants regardless of their experience. Sixteen point three per cent reported other practices such as helping faculty members in laboratories by preparing materials prior to class meetings. Whether they taught or not depended on availability of personnel. Some schools gave graduate assistants partial responsibility for classes; in such cases they were briefed before each laboratory. One school reported that graduate assistants taught laboratory sections, but final responsibility rested with an instructor in charge of all class sections.

Table 10

Graduate Students' Experience and Responsibility[a]

Experience	Response in Percentage
a. No experience required	26.6
b. Assistant for one term	20.4
c. Assistant for two or three terms	16.3
d. Not given responsibility	20.4
e. Other practices	16.3

[a]Questionnaire item 10.

Few schools (3.3 per cent) reported classes larger than 50, and in such cases they were lecture sections only. Forty-one per cent reported classes less than 25. The majority of schools (55.7 per cent) had classes ranging from 25 to 50.

Effective instruction in introductory botany requires the aid of a good microscope. Ninety-five point one per cent of the institutions in this study provided individual students with microscopes during class meetings. Only 4.9 per cent reported that one microscope was used by two students in a class.

Kodachrome slides or color transparencies were often employed as teaching aids. Their ownership and maintenance differed from one school to another (Table 11).

Table 11

Ownership and Maintenance of Color Transparencies

Practice	Response in Percentage
a. Teacher-owned collection	26.7
b. Department-owned and maintained collection	48.3
c. Department-owned, teacher maintained collection	21.6
d. Teacher-owned, department maintained collection	1.7
e. Other practices	1.7

An adequate job of teaching could not be done without appropriate or pertinent materials; variations in sources of such materials was found in this study.

A combination of both teacher and commercially prepared material as source of supply was claimed by 67.3 per cent of the schools. Some used technicians as additional sources of teaching material. Three point three per cent mentioned that any interesting material was employed, regardless of its source. This allowed students to participate more enthusiastically because they were motivated by their own interests.

The importance of a greenhouse to a botany department cannot be overemphasized. Four point nine percent of the institutions had access to privately owned and managed greenhouses, while 82.0 per cent owned and managed their own greenhouses. Only 13.1 per cent reported lack of access to a greenhouse. All these institutions indicated a desire for such access (Table 12).

Table 12
Accessibility to Greenhouses

Accessibility	Response in Percentage
a. Access to privately owned and managed greenhouse..	4.9
b. Access to institution owned and managed greenhouse	82.0
c. No access to a greenhouse	13.1
(1) No access but would like access to a greenhouse 100.0	

Thus greenhouses were considered necessary for efficient teaching in introductory botany.

Twelve different textbooks in introductory botany were reported in this study (Table 13).

Table 13
Textbooks Used in Introductory Botany

Author	Title	Response in Percentage
1. Fuller and Tippo	College Botany	13.6
2. Carl L. Wilson	Botany	33.3
3. Transeau, Sampson and Tiffany	Textbook of Botany	9.0
4. Hill, Overholts, & Popp ..	Botany	4.5
5. Fuller, H. J.	The Plant World	10.7
6. Smith, Gilbert, et al.	A Textbook of General Botany.....	1.5
7. Weatherwax	Plant Biology	3.0
8. Robins and Wier	Botany	10.7
9. Haupt	Introduction to Botany	1.5
10. Northern, H. J.	Introductory Plant Science	6.2
11. Sinnot and Wilson	Botany	4.5
12. A combined reading list.....		1.5

The most popular textbook reported was Carl L. Wilson's "Botany" which was used by 33.3 per cent. "College Botany" by

Fuller and Tippo ranked next to Wilson, being mentioned by 13.6 per cent of the schools responding. The reverse was reported two years ago when the text by Fuller and Tippo was a favorite (Miller, 11).

Unlike textbooks, no one laboratory manual enjoyed great popularity. Most departments (44.7 per cent) prepared their own manuals or workbooks.

There was no uniformity in laboratory practices. Forty-three point four per cent of the schools in this study required their students to submit laboratory reports regularly, 35.0 per cent occasionally, and 17 per cent never made such demands (Table 14).

Table 14
Laboratory Procedures in Introductory Botany[a]

Item	Required to submit laboratory reports	Required to draw objects seen through miscroscope
	Percentage	Percentage
a. Regularly	43.4	47.2
b. Occasionally	35.0	33.9
c. Never	21.6	17.0
d. Rarely	—	1.9

[a]Questionnaire items 23, 24.

Weekly class schedules in introductory botany were as diverse as were the schools. This supports the 1938 findings of the committee on the teaching of botany in American Colleges and Universities (17). The reason for this diversity may be that each institution adhered to a practice that had been developed from experience and need.

Audio-Visual Aids

This study found that teachers frequently resorted to the use of audio-visual devices in botany to aid memory, to motivate interest or to present units that could only be comprehended through these media (Table 15).

Table 15
Use of Audio-Visual Aids in Introductory Botany[a]

	Response in Percentage		
	Living Plants	Motion Pictures	Color Transparencies
a. Often	98.4	23.3	47.5
b. Seldom	1.6	45.0	37.7
c. Never	—	31.7	14.8

[a]Questionnaire items 14, 15, 18.

Use of living plants in introductory botany is favored by most institutions. Ninety-eight point four per cent of the schools in this study used living plants often; however, 1.6 per cent rarely did.

Motion pictures can be used to advantage in presenting topics such as mitosis and meiosis. The 31.7 per cent who did not use them ought to be encouraged to avail themselves of the opportunity.

Forty-seven point five per cent of the schools frequently taught with color transparencies, 37.7 per cent reported seldom use, and 14.8 per cent refrained from their use. Considering the advantages of this medium there is no doubt that it should be used more often, although it should not be a substitute for live, fresh, plant specimens. Properly developed and handled, color transparencies could be a solution, at least partially, to the problem of increased enrollment and overcrowded classrooms and laboratories.

With the advent of television, many areas of academic discipline have ventured into using it as a teaching medium. Ninety-six point six per cent of the schools in this study reported they had not yet incorporated television in their botany program. Only 3.4 per cent had actually employed it as a medium of instruction. Sixty-three point four per cent reported they were undecided about its merits (Table 16). Since these schools are, apparently, uninformed, they may later become interested in educational television. One-third of those approving or disapproving made pertinent comments in defense of their positions.

Table 16
Opinions Regarding Television as a Botany Teaching Medium[a]

Opinion	Response in Percentage
a. Strongly approve	5.0
b. Approve	8.3
c. Undecided	63.4
d. Disapprove	10.0
e. Strongly disapprove	13.3

[a]Questionnaire item 30.

Those approving gave the following reasons:

1. The program is of scientific value.
2. Close circuit television should be useful in increasing direct observation.
3. It may be a solution to the problem of increased enrollments.
4. Continuous movement such as growth can be seen.
5. It has value. A good instructor can be used by many sections.
6. Large groups can be acquainted with unfamiliar material.
7. It may be used to supplement classroom teaching.

Reasons for disapproving were as follows:

1. It is not practical; it requires sponsors, and this will lead to commercials which can only appeal to a moronic audience.
2. There is no rapport between a class and a television image.
3. It offers no personal contact.
4. Students cannot handle plant material.

5. It is arm-chair education.
6. It lacks clarity concerning demonstrations.
7. It eliminates laboratory exercises and experiments.
8. It may be suitable for lectures, but not for laboratory.

Evaluation

Since quizzes and examinations are devices for evaluating achievement, an attempt was made to determine the frequency with which they were used (Table 17).

Table 17
Frequency of Quizzes and Examinations[a]

Frequency	Percentages
a. Daily quizzes	3.4
b. Weekly quizzes	55.9
c. Twice weekly quizzes	3.4
d. Once fortnightly quizzes	6.8
e. Occasional quizzes	11.9
f. Monthly quizzes	3.4
g. No quizzes	15.2
h. Mid-term examinations	77.2
i. No mid-term examinations	22.8
j. Final examinations	96.6
k. No final examination	3.4

[a]Questionnaire item 26 summarized.

Weekly quizzes were reported by 55.9 per cent of the schools, but 15.2 per cent did not give any. Seventy-seven point two per cent gave mid-term examinations while 22.8 per cent did not. Ninety-six point six per cent of the schools surveyed administered final examinations; only 3.4 per cent failed to do so.

For evaluating achievement, major periodic and final examinations were emphasized by a large majority of the institutions (Table 18).

Table 18
Emphasis Placed on Evaluation Devices

	1 Much emphasis	2 Moderate emphasis	3 Little emphasis	4 No emphasis
Item 27	Response in Percentage			
a. Laboratory experiments	21.4	37.5	23.2	17.9
b. Short quiz results	29.6	44.4	13.0	13.0
c. Periodic major test results	83.0	15.3	0.0	1.7
d. Performance on final examination	61.4	31.6	5.3	1.7
e. Teacher's judgment	12.2	28.6	26.5	32.7
f. Recitations	14.7	17.6	17.7	50.0

This is in agreement with the overwhelming majority of schools who reported use of final examinations (Table 18).

Sixty-seven point seven per cent of the institutions did not give much consideration to recitation in evaluating achievement. Fifty-nine point two per cent made no use of teacher's judgment. Although this may suggest an attempt to eliminate personal bias in evaluation, it may mean loss of accuracy insofar as small groups are concerned. Some schools used varying proportions and combinations of evaluation devices in measuring achievement.

Miscellaneous

Average annual expenditures for supplies and equipment in introductory botany varied greatly. Fifty-seven per cent of the schools spent less than $300 annually for supplies, but 18 per cent spent more than $500. Seventy-four point nine per cent spent less than $1,000 annually for equipment while 5.8 per cent expended more than $3,000.

The total enrollment of students in introductory botany in the school year 1955-56 was 26,240, ranging from a low of 15 to a high of 3,422. Thirteen or 22.4 per cent of the schools had enrollments less than 100, and 29 ranged between 100 and 500 students; but 4 schools or 6.9 per cent reported enrollments above 1,000. Sixteen schools, 27 per cent, reporting 16,383 students, accounted for almost two thirds (62 per cent) of the total enrollment (Table 19).

Table 19

Enrollment in Introductory Botany. 1955-56.[a]

Enrollment	No. of Schools	No. of Students
1. 15-25	3	55
2. 26-50	5	196
3. 51-100	5	428
4. 101-250	13	2,287
5. 251-500	16	6,891
6. 501-1000	12	9,297
7. 1001-3422	4	7,086
Total	58	26,240
Mean = 452		

[a]Questionnaire item 28.

Certain flaws in the questonnaire used in this study need to be mentioned. Various subdivisions of some items overlap.

It is obvious that "required" students may be majors or agriculture students. Lack of clarity and non-specificity of some questions may have affected responses. Despite limitations in the scope of the questionnaire, one could assume that situations were reported as they existed in the institutions sampled.

Many constructive comments and notations accompanied the returned inquiries. This may be construed as reflecting the timeliness of such a study. This assumption is supported by the fact that 91.8 per cent of the respondents expressed a desire for the tabulated results.

Representative Suggestions

It was assumed that the teaching of introductory botany would be improved if those who bore the burden of instruction were given the opportunity to make constructive suggestions and to air their opinions. To this end, the last item in the questionnaire for this study invited the various individuals concerned to suggest ways of attaining this goal.

These propositions, reflecting individual grievances and special interests are listed below:

1. Use essay examinations; enroll students from high score groups who can read and write intelligently.
2. Use more living plant material.
3. Allow students to acquire more practical experience by growing and experimenting with plants.
4. Allow students to construct and work with equipment in plant physiology portions of general botany.
5. Employ more good teachers who have the ability to stimulate student interest.
6. Teachers should show more enthusiasm for their subject.
7. Use a realistic point of view in teaching.
8. Let the administration realize that teaching is equally as important as research and extension.
9. Teachers must admit that they do not know all the answers.
10. Seize the opportunity to show how chemistry and physics can be applied to botany.
11. Stay out of the "ivory, ivy covered halls."
12. Provide funds to modernize laboratory and equipment.
13. Use summer and winter keys to identify plants.
14. Release excellent teachers from the obligation to publish papers.
15. Emphasize the relation of plants to human life.
16. Give teachers time to plan their work.
17. Staff the course vertically with teachers from all professional ranks representing all fields of botany.
18. Restrict class sizes to small numbers.
19. Make teaching ability one of the major criteria for advancement in rank and salary.
20. Let administrators emphasize the idea that a college education must be worked for.
21. Remember that the teacher is more important than the approach used, but he must believe in his approach.
22. The teacher must realize that the student is basically human and a scientist only in mind.
23. The teacher must place the student first.
24. Acquaint students with plants in their own backyards and lawns.
25. Force students to draw so as to understand structures.

26. Do not try to teach 4 years of botany in one semester.
27. Relate course content to students' interests.
28. Emphasize physiology and ecology.
29. Make *ALL* staff members realize that teaching is not a "second rate" activity.
30. Establish class contact between instructor and student.
31. Correct and return student's written work promptly.
32. Use more visual aids.
33. De-emphasize life cycles and emphasize human aspects.
34. Improve lecture rooms and enroll interested students only.
35. Quit treating the introductory course as a "departmental step child."
36. Incorporate the unusual whenever possible.
37. Pay less attention to taxonomy.
38. Make the course interesting to the non-major.
39. Sponsor field trips to motivate interest.
40. Do away with lectures and laboratory.
41. Make laboratory sessions less rigid so that students do not work as robots, just wading through exercises.
42. Dwell on understanding of principles rather than factual details.
43. Do not hire researchers to teach general botany if their major interest is research.
44. Employ teachers who have been trained as botanists, not as specialists.
45. Teach students to observe, garner facts and to think independently by correct use of facts.
46. Stress the impact of plants and plant products on history, commerce, agriculture, and industry.
47. Correlate subject matter whenever possible.
48. Introduce students to research activities of the department.
49. Use a dynamic approach in teaching.
50. Emphasize terminology.
51. Select textbooks wisely.

Summary

The purpose of this study was to obtain information relative to the teaching of introductory botany in state supported educational institutions.

Sixty-six responses were received from the 78 institutions surveyed. Sixty-one of these contained usable data which were tabulated and analyzed. The following constitute the findings:

1. Basic training in plant science for all students, irrespective of their curricula, was the primary objective of all schools.
2. Responsibility for course outline was delegated to the instructor in the course by 60.4 per cent of the schools.

3. Duration of introductory botany courses varied from one to three terms, a term being one quarter or one semester. Continuation for the second and third terms was dependent on curricula.
4. Curriculum revision once a year, at least, was reported by 54.1 per cent.
5. Introductory botany was not taught by lecture alone in any institution.
6. Use of undergraduate assistants was a practice with 36.1 per cent of the schools in contrast to 69.8 per cent which employed graduate assistants.
7. Previous experience was required, in varying degrees, by 73.4 per cent of the institutions employing graduate assistants to teach classes.
8. Use of individual microscopes during class meetings was reported by 95.1 per cent.
9. Ownership and maintenance of color transparencies varied. The most common practice, 48.3 per cent, was department-owned and maintained collections.
10. Teacher and commercially prepared materials were most commonly used for teaching.
11. Only 13.1 per cent of the schools in this study lacked access to greenhouses and they all desired such access.
12. The most frequently used textbook, "Botany," by Carl Wilson, was reported by 33.3 per cent.
13. Many departments, 44.7 per cent, prepared their own laboratory manuals.
14. Twenty-one point six per cent of the schools did not require laboratory reports, and 18.9 per cent rarely or never requested drawing of objects viewed under microscopes.
15. Weekly class schedules varied considerably.
16. Live plants were used in teaching by 98.4 per cent. Sixty-eight point three per cent used motion pictures, and 85.2 per cent employed color transparencies as teaching aids.
17. Only 3.4 per cent of the schools had ever used television in teaching introductory botany, but 63.4 per cent were undecided.
18. Weekly quizzes were given by 55.9 per cent, mid-term examinations by 77.2 per cent, and final examinations by 96.6 per cent.
19. Periodic major tests (83.0 per cent) and final examinations (61.4 per cent) comprised the major evaluation devices.
20. Fifty-seven per cent of the schools spent less than $300 annually for supplies, but 18 per cent spent more than $500.
21. Seventy-four and nine-tenths per cent used less than $1,000 annually for equipment while 5.8 per cent expended over $3,000.
22. Enrollment per school ranged from 15 to 3,422.

23. Thirteen or 22.4 per cent of the schools had enrollments less than 100; 16 schools or 27 per cent accounted for 62 per cent of the total enrollment.

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