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AUTHOR Enger, John; And Others
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ABSTRACT

Reported here is the development and evaluation of an extensive series of video-cassette presentations developed for introductory chemical education. In measures of course achievement, students instructed by the video-cassette-discussion format received higher average scores than those taught by live lecture methods. A survey showed that the video-cassette-discussion method was as well received as the live lecture method by the students and was preferred by the teaching assistants. The application of this format needs not to be restricted to this subject area. (Author/WBC)

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
Measurement and Research Division of the Office of Instructional Resources
307 Engineering Hall
333-3490

Teaching Introductory Chemistry With Videocassette Presentations

John Enger
Office of Instructional Resources

Anne Toms-Wood and Kim Cohn
Department of Chemistry

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In measures of course achievement, students instructed by the videocassette-discussion format received higher average scores than those taught by the traditional live lecture mode. In surveying students about these two modes of instruction, the videocassette-discussion format was received as well as the live lecture mode. A majority of the teaching assistants preferred this videocassette-discussion format.

Others interested in implementing videocassette presentations for all levels of instruction could benefit from the developmental experiences of this program. The Chemistry Department and Divisions of the Office of Instructional Resources jointly participated in developing and evaluating this videocassette-discussion format employed in introductory chemistry.

Charles J. McIntyre

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TEACHING INTRODUCTORY CHEMISTRY WITH VIDEOCASSETTE PRESENTATIONS

John Enger
Office of Instructional Resources

Anne Toms-Wood and Kim Cohn
Department of Chemistry

Since 1968 the University of Illinois at Urbana-Champaign (UIUC) has produced an extensive series of television tapes for courses in introductory chemistry. The materials are produced through a joint effort which combines both the academic interests and technical capabilities of the Chemistry Department and the Instructional Television Division of the Office of Instructional Resources at UIUC. This paper describes the evolution of the program, the outcomes of these efforts in the first semester course, and the evaluation of an ongoing professionally produced videocassettee-discussion teaching format currently employed in introductory chemistry.

Introduction

Education has used television to repetitively present the master teacher to large numbers of students (Dambrot, 1972; Hutton and Larsen, 1975; Leifer, 1976). Studies which measured student achievement when television has been used in the classroom showed it to be as effective as the live presentation (Chu and Schramm, 1967; Dubin and Hedley, 1969; Dubin and Taveggio, 1963; Los Angelos Community College District, Note 1; Shrigley, Alfke, Szabo and Welliver, 1975).

Replicability and capacity to reach large audiences are two advantages television offers to education. Leifer (1976) identified these and other advantages of television as: (a) the capture of uncommon and hard-to-duplicate material and phenomena, (b) the ability to easily present static and moving material, (c) the alteration of visual, auditory, and temporal characteristics of material and phenomena, and (d) the option to resort to animation.

The use of the televised presentation alone, as was done in many of the afore-mentioned studies, accentuates its limitations. It is difficult, if not impossible, to use this medium to: (a) respond to students as they are learning the lesson, (b) foster the practice of reading, writing, and speaking skills, (c) oversee students' learning through their own activity, and (d) take the uniqueness of each student into account (Leifer, 1976). These limitations can be overcome by coordinating televised material with live response.

The televised presentation in education has grown from simple black and white productions of an instructor lecturing to a class to the relatively elaborate videocassette productions which draw from both academic and media experiences. The videocassette is a product of the 1970's

(Business Management/Engineering, 1971) and was initially marketed in education (Gordon and Falk, 1973). Videocassettes can store information from three sources. (a) commercial or central distributors, (b) open-circuit or cable TV, and (c) original home-made TV or film production (Gordon and Falk, 1973). Presentations on videocassettes are relatively expensive to produce, yet relatively inexpensive to purchase or rent.

With little help from existing research, it has been the educator's responsibility to know the characteristics of the intended audience and the goals of the curriculum (Leifer, 1976) in order to coordinate televised and live work in the classroom. A number of evaluative studies have provided some guidelines to follow in making decisions on the use of televised presentations in the classroom (Coldevin, 1975; Cunningham, 1973; Dubin and Taveggio, 1968; Forrester and Zakia, 1972; McAnany, Hornik and Mayo, 1973; Wade, 1967; Warner, 1976; Wittich and Schuller, 1973).

Numerous studies have documented the efficiency of television in chemistry education. Humphreys and Tomlinson (1969) enumerated such applications as demonstrating technique, showing chemical applications in industry, producing time-compressed sequences, and viewing en masse that which could only be demonstrated individually in the traditional mode. Others have used television as a valuable resource when a department is faced with a lack of qualified teaching assistants (Pantaleo, 1975) and as an effective teaching aid in training teaching assistants (Garland, 1969). Some have found that television ensures better planning of instruction (Garland, 1971), is applicable to individualized instruction (Barnard, Bertant and O'Connor, 1968; Benet, 1976; Humphreys, 1971; Humphreys and Tomlinson, 1969; Jenkins, 1976; Nash & Nienhouse, 1975), effectively combines with live work and other media (Barnard et al., 1968; Barnard and O'Connor, 1968; Howell, Woodruff and Garraway, 1975; Humphreys, 1971; Jenkins, 1976; Myers, 1975; Shrigley et al., 1975), and yet can be relatively inexpensive (Humphreys and Tomlinson, 1969).

Measured student achievement in televised chemistry presentations has been reported to be similar to achievement in the traditional live lecture mode (Barnard et al., 1968; Garland, 1971; Humphreys, 1971; Levine, 1975; Pantaleo, 1975). Student responses indicated a negative acceptance to the televised mode in college chemistry in earlier studies (Barnard et al., 1968, Duffy and Walsh, 1969). More recent studies showed no significant difference in acceptance (Levine, 1975) or a definite positive student acceptance of the use of television in college chemistry courses (Howell et al., 1975; Humphreys, 1971; Myers, 1975; Nash and Nienhouse, 1975).

Development and Use of Televised Presentations

In 1966 Professor G. P. Haight[1] joined UIUC to head the coordination and teaching of introductory chemistry courses. In the spring of 1968 Professor Haight, his staff, and the media specialists from the Instructional Television Division produced their first televised chemistry lectures. The original television productions were black and white

and involved, essentially a professor giving lectures in the usual manner. Two faculty members from the Chemistry Department working with two cameramen and a television director were able to prepare about two 45-minute reel-to-reel black and white tapes a week. Rough scripts, little time allocated for rehearsals, and the lack of editing facilities severely restricted the nature and scope of the material which could be presented. The presentations, therefore, were chemistry lectures which made use of two blackboards, a small demonstration table, a rear-view projector, and a screen.

Initial Classroom Presentations

These televised lectures were introduced into the classroom in the fall of 1968. The class, which was divided into groups of about 200 students, and a faculty member associated with the television productions met in large rooms that had television sets along the wall. The acceptance of the programs, attendance in class, and scores on exams were comparable to lecture situations.

In the fall of 1969 classes of about 200 students met at regularly scheduled times to view the televised lectures. Teaching assistants (TAs), but no senior faculty members attended the large class meetings and were available to answer questions during separate discussion periods. When the television sets suffered breakdowns classes were dismissed until repairs could be made. The attendance for the television lectures, as well as student achievement on the hourly exams, dropped when compared with the attendance and achievement of about 350 students taking the same course in the traditional lecture mode.

These televised lectures were used in the same large class format through the spring of 1971. During this time exam results generally indicated that when students attended televised lectures they did as well on exams as students who attended live lectures. However, student resistance to the program was high and many students attended only approximately half of the televised lectures.

In the fall of 1971 when videocassette players became available, the reel-to-reel tapes were reproduced on videocassettes. Four TAs volunteered to take sections of about 25 students each and met with them four times a week to show and discuss the television tapes. These TAs could stop, rerun, and explain these tapes. In the small class situation, faculty members and TAs noted that student resistance to the use of televised lectures dropped and students performed better on the hourly exams than they had when they viewed the tapes in a large group setting during the previous semester. The development of a syllabus which released them from excessive note taking was appreciated by the students. They also found the availability of TAs for questioning during class time helpful. Professors and TAs received comments from students participating in the TV-based small classroom format which indicated many preferred this course to the large lecture situation.

On the basis of student reactions obtained in the fall of 1971, plans for the production of short color cassette television tapes began in the spring of 1972. Plans included the use of carefully written scripts that would allow for the inclusion of demonstrations, films, animated material, and computer graphics along with discussion of material. Production of this new series of tapes began in the spring of 1973 and is still being continued. A list of content titles and running times of the new tapes is given in Table 1. The faculty and staff involved in the production of the tapes has varied over the past several years.

Current Television Course

The current first semester course is designed as a first course in college chemistry for those who have had high school chemistry or a strong math and physics program in high school or both. Multiple sections of this format are offered throughout the day. The course serves between 1,800 and 2,500 students per year in all colleges at UIUC. The students are divided into groups of 25 and attend 50-minute class meetings four times a week. Each meeting devotes approximately 20 minutes to a televised presentation and 30 minutes to discussion.

The television tapes introduce new material. A variety of films, drawings, computer graphics, and bench-top demonstrations are incorporated into each presentation. Lecturing and problem solving are kept to a minimum in these taped presentations. The PLATO[2] computer-assisted instructional system is used to present graphic displays, to illustrate by animation how certain types of chemical reactions occur, and to present short mathematical derivations.

Students are strongly urged to ask questions that arise when tapes are being shown; and TAs can interrupt the tapes to explain difficult points, to replay important portions of the tape, and to supplement the material on the tapes. The videocassette-discussion format provides the opportunity for drill, asking questions, and having short quizzes to test progress. The sessions are designed also to provide expert help in the homework and clear up questions concerning the taped presentations and reading. Opportunities are also available under the supervision of a TA for students to review tapes during one day of each week.

A carefully scripted videocassette production presents material clearly and concisely. Because the TV presentation moves at a more rapid pace than a normal lecture, a syllabus is provided to relieve the student of the burden of taking detailed notes on all of the statements made, rules put forth, and figures drawn. Only minimal note taking is required.

The classroom instructor is perhaps the most important learning resource in this system. He or she is there to answer questions, to clarify concepts which are not fully understood, to explain in more detail the material presented on the TV tapes, to present material not

Table 1. Titles and Running Times of Color Videocassette Television Tapes Used in Introductory Chemistry at UIUC

Tape Number	Title	Running Time (Minutes:Seconds)
1	Introduction, Course Objectives	19:47
2	Stoichiometry	12:00
3	Early Ideas About the Composition of Matter	12:00
4	Electromagnetic Radiation	13:00
5	Subatomic Particles	12:00
6	Structure of the Atom	14:00
7	Electron Structure of Atoms	16:00
8	Periodic Classification of Elements	27:00
9	Periodic Properties of Atoms	19:07
10	Metal and Nonmetals	18:15
11	Ionic Structures	20:05
12	Chemical Processes of Metals	19:13
13	Electrochemistry of Metals	15:05
14	Nucleus I	13:25
15	Nucleus II	19:25
16	Abundance and Origin of Elements	15:10
17	Nonmetals, Share and Share Alike	9:35
18	Molecular Orbitals, Rules of the Road	12:34
19	Diatomic Molecules	13:40
20	Covalent Compounds	13:38
21	Hydrogen Chemistry	17:10
22	Elemental Hydrogen and Oxygen	12:15
23	Chemistry of Oxygen and Sulphur	24:10
24	Oxidation Reduction	19:55
25	Chemistry of Group V Elements	19:15
26	Natural Cycles of Nonmetal Elements	16:05
27	Halogen Chemistry	18:55
28	Acidic and Basic Solutions	16:00
29	PH and Indicators	22:06
30	Weak Acids and Bases	17:00
31	Theories and Titrations	16:03
32	Buffers	21:00
33	Theories of Acids and Bases	10:59
34	Three States of Matter	19:27
35	Behaviors of Gases	13:44
36	Molecular Speeds and the Nonideality of Gases	11.18
37	Liquids	13:50
38	Structure of Coordination Complexes	21:31
39	Electronic Properties of Coordination Complexes	17:39
40	Energy Changes	18:10

suited to TV (such as long derivations), and in general to assist the student in any way possible to learn chemistry. The TV tapes essentially set forth the basic outlines of what the student should know to do well in this chemistry course.

By using nine portable television units with one being kept in reserve, the Chemistry Department utilizes the videocassette-discussion teaching format in two introductory courses having a total of 70 sections for 2,000 students each semester. These portable units each contain the mobile utility cart, a 21-inch television set, a videocassette tape deck, and all tapes for the course. The portable units are stored in a secure area which also contains the videocassette library.

Evaluation of the Televised Presentations

Freshmen are placed into the introductory chemistry sequence at UIUC by their performance on three measures: (a) their high school chemistry background, (b) their score on the chemistry placement examination, and (c) their score on the mathematics placement examination. Those who perform poorly on these measures are recommended to enroll in Chemistry 100 to remove their deficiencies. Those who exhibit exceptional backgrounds are placed in Chemistry 107. Most students are advised to enroll in Chemistry 101.

In the fall semester of 1975 both the traditional lecture-discussion and videocassette-discussion teaching modes were used in Chemistry 101 (General Chemistry Lecture). At registration, sections were not identified by the teaching mode. A total of 1,066 entering freshman students completed Chemistry 101. During that semester 810 students enrolled in 43 sections which used the videocassette-discussion teaching format and 256 students enrolled in 14 sections taught in the traditional live lecture-discussion mode. There was little crossover after the initial registration with at most 14 students changing teaching modes only because of schedule conflicts. About 10% of the students registered dropped each teaching mode during the semester. Teaching assistants were randomly assigned to teaching modes, minimal changes in the initial assignment stemmed only from unforeseen schedule conflicts.

Both teaching modes used the same lecture topics, objectives, homework assignments, and order of presentations throughout the semester. Students in both groups were given the course syllabus to follow the lectures. Likewise, the same textbook ("Chemistry: A Conceptual Approach", Mortimer, 1975) was assigned to both groups. The live lecturer for the traditional mode of instruction had more than 10 years of experience teaching general chemistry and, based on student evaluations, was as well received as any previous lecturer in the same position over the past three years at UIUC.

At the conclusion of the semester, a 133-point objective comprehensive final examination was administered to both groups. The students in

both groups also responded to questionnaires which were designed to assess student perception of instruction. In addition, TAs associated with each mode of instruction were surveyed by questionnaire to ascertain their perceptions of the effectiveness of the two modes of presentation.

Cognitive Measures

On entry into Chemistry 101 the two groups of students, those being instructed by the live lecture-discussion (LL) mode and those viewing and discussing the videocassette (TV) presentations, differed significantly on only one of the cognitive variables investigated. Note Column 1 in Table 2 in which entry variables such as high school rank, ACT scores, placement test scores, and high school chemistry measures (Variables 3-8) yielded point biserial correlations with the group membership variable (Variable 1 where TV = 1 and LL = 0) which, with but the one exception (Variable 4, ACT Mathematics Score), were not significantly different than zero. Thus, the two groups were essentially the same on entry to the course. The exception is not regarded as serious, however, and an explanation is given after presenting one additional finding.

A significant difference between the two groups was found for the variable identified as final exam score (Variable 2). The correlation of .17 is significantly different from zero at the $\alpha = .01$ level of significance which implies there is a difference in the final exam score distributions between the two groups. The mean final exam score for the TV group was 112.9 and the corresponding mean for the LL group was 103.3. Standard deviations on these scores were 23.7 and 24.4, respectively. Thus on the average, higher scores on the final exam are accorded to the videocassette-discussion group. The inference is that the videocassette-discussion mode of instruction is having a favorable effect on the performance of students.

Although group averages on the ACT Mathematics variable were significantly different (with a mean and standard deviation of 30.1 and 2.82 for the TV group and 29.6 and 3.14 for the LL group), the relationship between group membership and final exam score when partialing out ACT Mathematics statistically reveals that the ACT Mathematics variable has a trivial effect on the relationship of interest. The partial correlation coefficient among these variables yielded a value of .15 which still represents a significant difference between the two groups on the final exam score even when the ACT Mathematics score is held constant.

Subsequent investigation of the final exam scores shows in Table 3 that student achievement was higher in the videocassette-discussion mode in each of six areas of instruction than in the live lecture-discussion mode. Thus, the general overall achievement index was indicative of achievement throughout the course and was not weighted by only one or two areas of instruction.

Table 2. Correlations and Sample Sizes of Cognitive Variables in Chemistry 101

Variable[a]	1	2	3	4	5	6	7	8
1		1,066	1,065	1,059	1,020	1,024	1,019	1,044
2	.17		1,065	1,059	1,020	1,024	1,019	1,044
3	-.03	.29		1,058	1,019	1,023	1,019	1,007
4	.08	.26	.19		1,020	1,024	1,019	1,043
5	.00	.31	.06	.35		.39	982	1,004
6	-.01	.30	.39	.17	.1?		.89	1,024
7	.01	.41	.24	.39	.39	.13		1,007
8	.03	.38	.09	.23	.22	.16	.13	
Mean	76	110.6	39.5	30.0	29.5	7.51	22.4	25.1
SD		24.22	18.05	2.91	3.44	1.59	5.43	6.73

[a]Variable Identification and Range:

Variable 1 - Group Membership (TV = 1, LL = 0)
Variable 2 - Final Exam Score [0, 150]
Variable 3 - High School Rank (as a percentile)
Variable 4 - ACT Mathematics Score [6, 36]
Variable 5 - ACT Natural Science Score [6, 36]
Variable 6 - Chemistry High School Grade (A = 5.0)
Variable 7 - Mathematics Placement Test Score [0, 40]
Variable 8 - Chemistry Placement Test Score [0, 60]

Table 3

Freshman Achievement by Subtest on the

Comprehensive Final Exam, TV vs. LL

Subtest	Total Points	TV (N=757)			LL (N=225)		
		Mean[a]	Mdn.	S.D.	Mean[a]	Mdn.	S.D.
Reading and Electronic Structure	40	24.6	24.9	6.58	22.2	21.8	7.07
Oxidation-Reduction & Electrochem.	20	13.3	13.7	3.83	11.9	12.2	4.35
Periodic Properties & Descriptive Chem.	30	19.7	19.7	4.70	18.6	18.7	4.69
Gases, Liquids, Solids & Solutions	25	15.2	15.2	4.71	13.3	13.5	4.31
Stoichiometry, Acids & Bases	41	28.6	28.9	7.77	21.4	21.4	7.54
Nuclear Chem., Energy, & Coor. Chem.	27	17.5	17.7	5.12	16.5	17.0	5.18
TOTAL	183	118.7	119.1	23.71	103.8	102.0	24.5

[a]A significant difference was noted between each set of means at the $p < .05$ level.

Affective Measures

At the conclusion of the semester, students in first semester chemistry were asked to evaluate the instruction they had received by responding to a series of items on a course evaluation questionnaire. Three different forms of this questionnaire were used in the course: the first for evaluation of the large group lectures given in the traditional mode, the second for the evaluation of the TA discussion sessions which were coordinated with the live lecture, and the third for the evaluation of the televised presentations and TA interaction with these presentations.

Tables 4 and 5 compare the average student responses to these questionnaires across items. Tests of significance were calculated with the t-test. Data presented in Table 4 strongly suggest the TAs were comparable in both the LL and TV modes of instruction when evaluated by the students. Although the responsibilities of the TAs were different

under the two instructional modes, students perceived the TAs as performing well.

Table 4. Student Perception of TA Effectiveness in Chemistry 101

Questionnaire Item	Scale Range[a]	Mean Response[b]	
		TV (N=217)	LL (N=259)
TA Holding Interest	Dull/Exciting	3.76	3.47
TA Encourages Discussion	Rare/Frequent	4.11	4.15
Preparation of TA	Disorganized/Well Prepared	4.06	4.05
Oral Delivery of TA	Awkward/Effective	3.73	3.69
Attitude of TA	Unfair/Fair	4.42	4.48
TA's Perception and Help	Unresponsive/Helpful	4.03	4.02
Availability of TA	Never/Excellent	4.34	4.13
TA's Ability to Explain	Unsatisfactory/Excellent	3.70	3.66
TA's Overall Performance	Very Poor/Excellent	4.05	4.22
Homework Grading	Slow/Prompt	3.86	3.99

[a]Scale Range was 1-5 with an optimal score of 5.

[b]No significant differences between these means were noted at the $p < .05$ level.

As was stated earlier, the televised material is clear and concise yet proceeds at a more rapid pace than does the live lecture. Students, however, in their perception of the instruction received, rated the pace of the live lectures as being faster and covering too much material. In a large group situation, it is possible that students are forced to follow a traditional 45-50 minute lecture without being offered the opportunity to ask questions. The videocassette-discussion format, although presenting material at a faster rate, can be stopped, rerun, and accompanied by explanations to suit the needs of the student.

The fair handling of grading requests was rated higher by the LL group. In the LL mode this procedure was the responsibility of the lecturer who met with the entire group. In the TV mode, the grading requests were handled by a faculty member who never met with the entire group of

students. Thus the LL mode handling of grading requests was less anonymous and may have been better accepted by the students.

Table 5. Student Perception of Instruction in Chemistry 101

Questionnaire Item	Scale Range[a]	Mean Response	
		TV (N=817)	LL (N=222)
Pace of Presentations	Too Slow/Too Fast	3.97**	4.15**
Level of Presentations	Too Low/Too High	3.41**	3.69**
Relevance of Exam Items	Poor/Excellent	3.10	3.24
Fair Handling of Grading Requests	Seldom/Always	3.60**	4.06**
Textbook	Unsatisfactory/Excellent	2.97*	3.16*
Level of Personal Effort	Low/High	4.05	4.09
Motivation to Learn	Adverse/Excellent	3.33	3.32
Insight and Understanding	Adverse/Excellent	3.31	3.17
Expected Letter Grade	Failure/Excellent	3.60	3.55

[a]Scale range was 1-5. Optimal score on the first two items was 3; on all other items the optimal score was 5.

*$p < .05$. A significant difference between this set of means was noted at the $p < .05$ level.

**$p < .01$. Significant differences between three pairs of means were noted at the $p < .01$ level.

The textbook used (Mortimer, 1975) also received a higher rating by the LL students. This group may have felt the need to rely more heavily on the textbook because they did not have the option to replay the lectures.

Expected letter grade has been found in other studies to relate to student ratings (Batista and Brandenburg, Note 2; Holmes, 1971, Kennedy, 1975). In these two modes of instruction the average student grade

expectations were almost identical. Students' motivation to learn about chemistry, the insight and understanding provided by the instruction, and their levels of personal effort were not perceived as being significantly different in the two groups.

In surveying the TAs associated with the Chemistry 101 course, 83% felt the videocassette-discussion mode gives the TA the better teaching experience. If given the opportunity to select their assignment, 74% of the TAs preferred the TV mode. Several of those TAs selecting the LL mode indicated the only reason was the opportunity to try something different. When asked, TAs preferred the TV mode because they had more frequent contact with the students and were solely responsible for classroom discussion.

On the average, the TAs perceived the total time per week for one section assignment in the TV mode as 14.4 hours. Those in the LL mode perceived their average time spent per week to be several hours less. This difference may be accounted for in the additional time spent by some TAs in previewing the videocassette presentations or possibly by the lack of attendance of some TAs in the biweekly live lectures.

TAs in the TV mode reported the TV presentations as average to above average in holding their interest, in explanations, and in technical quality. The TAs characterized the students' personal effort similar to what the students had perceived of themselves. To other items TAs responded that students relied heavily on the syllabus and they rated the reliability of the equipment as being good to excellent.

Efficiency of the TV Mode

These videocassette presentations represent a departmental consensus of what should be included in the introductory chemistry course. Much of this material is difficult to present in the live lecture mode. The department has strived to develop a curriculum which prepares students to meet the changing social and economic needs of society and, furthermore, enables students to move smoothly into new areas of chemistry.

This videocassette-discussion teaching format insures a consistency of material presented across sections taught by TAs. The Chemistry Department is assured that students are exposed to the topics and concepts considered important. Faculty members directing these courses exercise a constant, critical review of the material. Thus the department is kept aware of the course content and changing needs of the curriculum and coordinates these recommendations in revising and producing the videocassette presentations.

It is difficult to generalize about the costs of either television-discussion or lecture-discussion programs. Cost components are both time-specific and circumstantial; they vary greatly across institutions and within a particular institution over time. Developmental costs for

the television tapes have not been estimated in this study because (a) complete cost figures at various production stages were unavailable, (b) the costs are not likely to be generalizable to other institutions which may wish to adopt this teaching mode, and (c) such data are likely to be of only historical significance to the UIUC.

Individuals who wish to make judgments about gross cost estimates might consider the many factors which are subsumed under these broad categories: equipment (e.g., videotape recorders, monitors, film cameras), personnel (e.g. script writers, directors, artists, camera crew), facilities (e.g., control room, studio, overhead), and supplies and services (e.g., various types of tapes, dubbing, editing). Though the number of tapes produced for a series is likely to influence per tape cost, it is also quite likely that, for tapes of comparable content and quality, the cost of producing the first few tapes would exceed the cost of creating the last few. Certainly the amount and type of animation and art work contribute to differential tape production costs.

Summary and Discussion

The Chemistry Department at UIUC is continuing to develop and use the videocassette-discussion mode of instruction in introductory courses because: (a) it has proven to be an effective mode of instruction when effectiveness is measured by student achievement, (b) students, TAs, and faculty members are receptive to the program as shown by their participation in the development, use, and evaluation, and (c) the efficiency of the program has been demonstrated in its replicability, nature of the material presented, and consistency of instruction in the introductory sequence. Although the sets of videocassette presentations are expensive to produce, they are relatively inexpensive to use. Instructors, furthermore, are given full academic freedom in coordinating the televised material with the live work in the classroom.

Some applications of this teaching mode include: (a) individualized instruction, (b) industrial and educational in-service instruction, (c) health sciences education, (d) satellite programs, and (e) supplementary instruction at various academic levels. A current Chemistry Department proposal will document effective alternatives for coordinating televised and live work for varied applications.

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Footnotes

[1]Currently Professor Haight is professor of Chemistry and director of general chemistry at UIUC and chairperson of the Division of Chemical Education of the American Chemical Society.

[2]PLATO (Programmed Logic for Automatic Teaching Operation) is the interactive computer-based teaching system at UIUC on which talented programmers have generated graphics, animation, and titles on terminal screens. These in turn have been taped for inclusion on the videocassette productions in introductory chemistry.