1-1-1974

The feasibility of an audio-cassette research review subscription service for high school chemistry teachers.

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THE FEASIBILITY OF AN AUDIO-CASSETTE RESEARCH REVIEW SUBSCRIPTION SERVICE FOR HIGH SCHOOL CHEMISTRY TEACHERS

A Dissertation Presented

By

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Submitted to the Graduate School of the
University of Massachusetts in partial
fulfillment of the requirements for the degree of

DOCTOR OF EDUCATION

April 1974

Major Subject: Science Education

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April 1974

ABSTRACT

THE FEASIBILITY OF AN AUDIO-CASSETTE RESEARCH REVIEW SUBSCRIPTION SERVICE FOR HIGH SCHOOL CHEMISTRY TEACHERS

A random sample of fifty high school chemistry teachers of the New England Chemistry Teachers Association were sent audio-cassette tapes containing abstracts of nine chemical and eight educational research studies. The author contends that the improvement in cassette technology and the information explosion will support a linkage system of researcher to teacher via the cassette. Eleven chemistry journals and ten educational research journals, not generally read, were systematically searched for new and appropriate information. The data obtained after two tapes were reviewed indicated that abstracts on cassettes were positively received (sixty-six per cent positive verbal response on an eighty-five per cent return), but that the feasibility of a subscription service was not warranted (only four per cent put forth money for continuation). The data also indicate that the high school chemistry teacher subscribes to three monthly journals: Journal of Chemical Education, Chemistry, and one other professional journal. The author recommends a longer trial period to familiarize the teacher with the benefits of an audio subscription service and to develop listening habits.

A PERSONAL TESTIMONIAL

Let me begin this small contribution to human knowledge with a few personal statements about my feelings and dedication to the field of education. First, I believe that continuous training of teachers is by far the most important single factor that determines the quality of a child's education; and, second, the quality of education is the most important single factor that determines the quality of life in our culture. Therefore, for somewhat selfish reasons, my professional life is dedicated to the continuous training of teachers. Every day I meet and work with teachers burdened with the details of their daily task, both in school and in their community. To break into this routine with the goal of changing behavior is a challenge and frustration in my life. This research study is one attempt to relieve the tension.

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JUSTIFICATION OF THE HYPOTHESES

1. Summary

A set of hypotheses are submitted to determine the feasibility of a monthly review of chemical and educational research via cassette audio tapes.

Literature review and professional experience are submitted to justify the hypotheses. The goals of continuous in-service training, the knowledge explosion, the problems associated with research utilization, the criteria for research dissemination proposals, the advances in cassette technology in the past decade, the needs of the high school chemistry teachers, and a brief preliminary study are described in support of these hypotheses.

2. Dimensions of the goal

This research study attempts to provide sufficient evidence for the acceptance and use of a specific technique in the continuous training of teachers; taped reviews of research studies distributed monthly to a select group of high school chemistry teachers. This goal is part of the larger task of teacher preparation.

One model of a teacher preparation program follows through four chronological stages:

1. Career identification--a secondary school/ parent influence with early college years narrowing the range of choices.
2. Career preparation--the college responsibility for the content and general methodology.
3. An internship--a joint effort of the college and participating school.
4. Continuous career preparation--
   - 4.1 An in-service training program in which the goals of the specific employee are met.
   - 4.2 A self-initiated program in which the teacher assumes responsibility of selection and management of the program, either formal or informal.

Not every teacher preparation follows this pattern, nor is there any implication that this should be the pattern to follow. A group of teachers could survey its own needs and request school system support for an in-service program in which the selection, management, and evaluation were the responsibility of the group. Other cross phases are possible and in practice.

This study focuses on the self-initiated phase of the continuous career preparation. The basic assumption of this study is that every teacher realizes the need for continuous up-dating in both information and methodology. Every teacher is engaged in some formal or informal program designed to meet the demands of a successful teaching experience. The degree to which every teacher participates is the variable. Some teachers read no periodicals, avoid all workshops or conferences, yet truly believe that by informal conversations with colleagues they are keeping in touch with modern techniques. Other teachers will devote summers to a study program and read professional journals regularly. Both groups of teachers generally realize the importance of continuous up-dating.

Self-initiated continuous training can be of a formal type (college degree programs) or of an informal type (attending conferences). Formal programs are usually college designed and are offered to attending teachers with a specific degree earned on completion. It is the informal self-initiated continuous career preparation that this study will focus on. The informal programs are designed to meet the needs of the specific school system or of the teacher.

For the purpose of clarity, the informal programs will be classified in the following ways:

1. Staff organization--Team teaching, use of student teachers, use of specialized teachers, and the management of released time for visitations are some examples of ways that administration creates an environment that enables the teacher to continuously up-date skills. Sinclair recognizes seven factors from the school environment that influence the behavior of students.[1] A parallel inquiry to find the factors within the chemistry teacher's environment that promote self-motivated acquisition of professional knowledge is an effort of this study. Sinclair points out that an environment rated high in "awareness"[2] and "scholarship"[3] would likely produce a teacher behavior high in continuous training.

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[1]Robert Sinclair, "Elementary School Environments: Towards Schools That Are Responsive to Students," The National Elementary Principal, 49:5 (April, 1970), 53.

[2]Awareness is within the context of interest in current problems and happenings with lots of community contact. This school environment would be recognized by a wide range of opportunities for creative involvement.

[3]Scholarship refers to academic scholarship in knowledge and theories. Emphasis on high academic achievement would characterize this environment.

2. Curriculum analysis--Salesmen and supervisors provide a means of supplying materials for teacher review. The selection of these teaching aids involves discussion with colleagues, feedback from class use, and personal involvement. The result is an exposure to new methods and new learning theory. It is the author's experience that this curriculum analysis coupled with in-service support is the most effective method for up-dating the teacher. The reality of "use this material with your class tomorrow" is highly motivating and encourages the teacher to work toward greater effectiveness.
3. Conferences--These have long been a successful method of transmitting new information. The conference provides a personal linkage of the researcher with the user of the knowledge. Lewis found this method an effective means to push for a specific innovation when the specialist's interest and training were most similar to the receiver's. He also reported that conferences are time-consuming and costly.[1]

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[1]Phillip Lewis, "Schoolmen Will Hear a Lot from Cassettes," Nation's Schools, 83:1 (December, 1968), 34.

4. Periodicals--Both professional journals and general subscriptions provide the major portion of information dissemination. Sharon, in a survey of 3500 adults, found that seven out of ten read (at least look at) some form of subscription for one-half hour each day to obtain information.[1] Data from professional journal studies is not as encouraging. Duffey surveyed elementary school teachers' reading habits and concluded that the teachers revealed a disregard for one of their highest professional obligations--to read.[2] Yet the growth of ERIC and Chemical Abstracts indicates that the flow of information through the journals is still considered the best method of dissemination.
5. Specialized media--Computers, television, microfiche, audio tapes, and other specialized audio-visual technology are available to the teacher. Piele identifies four major technical

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[1]Amiel Sharon, "Reading Activities of American Adults," Paper presented to American Educational Research Association (July, 1972), 7.

[2]Robert Duffey, "Elementary School Teachers' Reading," (unpublished Ph.D. dissertation, Maryland University, 1967), 7.

information media that have reached into school information systems: the ERIC system of USOE; the National Referral Center of NSF which provides persons to contact for specialized information; Education Products, a monthly guide on hardware; and SRIS, a Phi Delta Kappa service which provides abstracts on request.[1] This list is not too impressive compared to the computerized network of information retrieval systems in physical sciences or even the commercial airline reservation systems.

Each of these five categories of information dissemination is available to the teacher for up-dating teaching skills. The responsibility for using the information is completely with the teacher. This study is concerned with a specialized medium within the framework of the informal self-initiated continuous teacher preparation.

3. Knowledge explosion

What is the worth of research information? Carter

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[1]Phillip Piele and Eidell Terry, "How to Plug Into School Information Systems," Nations Schools, 84:4 (October, 1969), 68.

reports the expenditure of over fifteen billion dollars a year in support of research in all areas.[1] This represents only about two per cent of the gross national product, but still a large sum. Information is considered a national resource; large amounts of monies are devoted to its production. The number of primary journals devoted to its dissemination as well as the numbers of professional subscribers attest to the importance of this natural resource. Yet, as Wolfe summarizes, "There is no well-defined and respected communication channel that exists to effectively diffuse new knowledge to appropiate target audiences."[2] Presently about a third of a million articles are published annually in technical journals. Every fifty years the number of publications has increased ten-fold, as Barnard's data indicates.[3]

Year	1850	1900	1950
Number of Scientific Journals	1,000	10,000	100,000

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[1] L. F. Carter, From Research to Development to Use (Santa Monica, Calif.: System Development Corp., 1966), p. 18.

[2] W. C. Wolfe, ed., On Diffusing and Utilizing Knowledge (Amherst: University of Massachusetts, 1971), p. 7.

[3] W. Robert Barnard, "Teaching Aids: Microforms in Chemical Education," Journal of Chemical Education, 46:4 (April, 1969), 254.

Herschman makes reference to a quotation of Lord Rayleigh: "What has been once published, even if in the Russian language, is spoken of as a known, and it is too often forgotten that the rediscovery in the library may be more difficult and an uncertain process than the first discovery in the laboratory."[1] The reader has probably felt this overwhelming frustration in a literature search.

The volume of chemical knowledge generated by this research process requires over 12,000 periodicals on a world basis.[2] Chemical Abstracts list between five and six thousand titles per week, making the task of just reading the titles beyond the capacity of the chemist. The basic problem of primary information is that the material to be published grows more rapidly than the number of people or institutions interested in buying it. The American Chemical Society's growth is illustrated with the following ten year comparison.[3]

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[1]Arthur Herschman, "The Primary Journal; Past, Present, and Future," Journal of Chemical Documentation, X (February, 1970), 37.

[2]R. T. Bottle, The Use of Chemical Literature (London: Butterworth & Co., 1969), p. 45.

[3]David Gushee, "Primary Literature: Problems," Journal of Chemical Documentation, 10:2 (1970), 30.

TABLE 1-1

TEN YEAR GROWTH OF PUBLICATIONS

	1958	1968
Number of publications	7	19
People employed by ACS to publish	40	95
Number of papers submitted	6,700	11,360
Number of papers published	4,800	7,600
Cost to publish (in millions)	$2.1	$4.7
Member subscriptions	47,622	86,445
Per cent of members subscribing	35%	37%

This data represents about a two-fold increase in ten years and is typical of other scientific areas.[1] A five to nine per cent growth rate per year is expected to continue.[2] The American Chemical Society has one objective: to promote and increase the diffusion of chemical knowledge. It handles about fifteen per cent of the world's chemical information. The information seeking pattern of a chemist within the university

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[1]American Institute of Physics, The AIP Program for Physics Information: a National Informational System for Physics and Astronomy (New York: American Institute of Physics, 1971), p. 3.

[2]A Five Year Plan for Information Programs: 1971-1975, Informational Systems Plan (Washington, D.C.: American Chemical Society, 1970), p. 24.

environment suggests an average of sixteen hours per week for scientific communication. This average chemist spends ten hours with equipment, three hours with data treatment, and two hours for thinking and planning.[1] The priority for receiving and sending information is three times that of the creative processes. The collection of data supports the need for a continuous improvement of chemical information dissemination mechanisms.

The knowledge explosion is no less in education than in the scientific professions. In 1967 Educational Research Information Centers (ERIC) published 1,700 titles per year, but by 1973 ERIC was publishing 1,200 titles per month. The nineteen ERIC clearing-houses dispersed throughout the United States are a tribute to the need for an information dissemination system. Carter claims a behavior scientist must read 3,000 characters per minute for thirteen hours a day to keep up fully with the scholarly literature of his specialization.[2]

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[1]Louis Vagianos, "Information Patterns of Chemists," Journal of Chemical Documentation, 11:2 (1971),

[2]Carter, Research, p. 35.

The problem is not with the production of new knowledge, but with the utilization: specifically, dissemination of the knowledge to specific users. The average American school lags twenty-five years behind the research.[1] This problem is not confined to the United States. Anders, in a review of the research in Germany on information dissemination, claims that the literature dealt quite extensively with systems for storage and retrieval, but found a widespread lack of attention to overall goals of a target group of users.[2] Mackie reports that research on learning processes represents the largest sincle area of investigation presently being pursued by experimental psychologists, yet there has been no systematic effort to direct the findings to practical application. Within the educational field, research utilization in special education

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[1] Everett M. Rogers, Diffusion of Innovations (New York: The Free Press of Glencoe, 1962), p. 2.

[2] W. H. Anders and A. Draxler, "Towards a Model for Information Dissemination in Education Technology Response to Users" (speech given to E.U.D.I.S.E.D. in West Germany, April 28, 1971), p. 5.

[3] R. R. Mackie and P. E. Christensen, Translation and Application of Psychological Research, Technical Report 716-6 (California: Santa Barbara Research Park, 1967), p. 11.

and driver education have produced the greatest application. This is the result of USOE mandating an "application" aspect on all findings in special education.[1]

The basis for research support is that the new knowledge generated will be useful. At the present rate of knowledge generation, the typical library will have two hundred million volumes with a card file of three-quarter million drawers occupying eight acres before the middle of the next century.[2] Clearly, new information systems are needed. Guba concludes: "It is a well-known fact that research results are not being utilized to any great degree in education. Experience from industry indicates that to implement the knowledge generated from basic research requires from five to ten times the original expenditure."[3] In a ten year study, Havelock was disappointed to find only 7.4 per cent of research

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[1]Gordon Hoke, Linking Research into Practice; Personal Observation on an Old Theme (Urbana, Illinois: Center for Instructional Research and Curriculum Evaluation, Illinois University, November, 1970), p. 4.

[2]George Mouly, The Science of Educational Research (New York: Van Nostrand, Reinhold, Inc., 1970), p. 418.

[3]Egon Guba, Chapter Three in Utilization of Applicable Research and Demonstration Results, ed. by E. M. Glasser (Los Angeles: Human Interaction Research Institute, 1967), p. 51.

studies in education to have a utilization component within the design.[1] The need in education is the utilization of the new knowledge. One thinks of the Maine farmer who was asked what he did with all the publications the agricultural department had sent him. His traditional answer was: "I'm not farming half as well as I know already." The problem in education is how to help the reader learn to discriminate and then put into practice the research findings that are valid for him.

4. Research utilization

Research dissemination is viewed as a two-way interaction process:

Researcher $\rightleftharpoons$ Linkage System $\rightleftharpoons$ User

Effective dissemination requires careful consideration for each of these elements of the process. The criteria by which the researcher chooses to select the data and results of his experimentation may be the most critical of the process. The criteria are a result of feedback with the potential user via a linkage system. Linkage systems include the media by which the information is

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[1]Ronald Havelock, et al. A Comparative Study of the Literature on the Dissemination and Utilization of Scientific Knowledge (Ann Arbor, Michigan: Center for Research on Utilization of Scientific Knowledge, Michigan University, July, 1969), p. 507.

transferred. Conferences and periodicals are the most frequently used of the formal linkage systems; telephone conversations with a colleague are considered the most effective of the informal linkage systems. The user's needs and interests must be considered: the coloring of autumn leaves may not be of interest to chemistry teachers during May. Havelock considers the entire process as a unit with feedback among the researcher, linkage system, and user being essential for effective communication. The conference and telephone conversation offer the best feedback system, since personal interaction can clarify new concepts for both researcher and user.[1] These have a limited use, however, due to the volume of new knowledge previously discussed here.

In a comprehensive review of studies in the area of research utilization, Havelock identified 2,823 studies over a ten year span. Classification of these studies is found in Table 1-2.[2]

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[1] Ibid., p. iv.

[2] Ibid., p. 19.

TABLE 1-2

CLASSIFICATION OF RESEARCH UTILIZATION STUDIES

By the Process		By Discipline	
Why of utilization	6%	Technical	58%
Who transfers information	15%	Education	17%
What kind of information	11%	Agriculture	12%
By what channel	22%	Basic science	7%
To whom	36%	Medical	6%
To what effect	10%		

Havelock's 1969 data and classification system points out that the 1960's recognized the need of a new field of research; that of knowledge utilization. At the present time there is only a small scattering of scholars in a few centers (ERIC, Michigan University, University of California at Berkeley, Stanford University) who are concerned with a systematic study of the dissemination in education. There are two forces in our society which lend an urgency to the development of a science of research utilization: the knowledge explosion and expectation of the part of the sponsors that our storehouse of knowledge should be useful to man. It is just good energy conservation of our human resources to fully utilize the knowledge produced.

The percentage of the knowledge-producing workforce in the United States has increased from 10.7 per

cent in 1900 to 31.6 per cent in 1960.[1] Traditionally the discoverer of new knowledge has received the support and encouragement of our society. The evidence now demonstrates the need for research utilization, specifically in three areas:[2]

1. What kind of information--Needed are publications which periodically consolidate the information presented in original reports. Abstracting, discussing trends, reviewing the field for some period of time, assimilating into patterns and conceptualizing a reorganization are part of this consolidating process.[3]
2. By what channel--Needed are improved linkage systems. Publications, testimonials, correspondence, inter-university, conferences, computer systems, commercial media, visitations, group research projects, clinics, retailer's

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[1]William Paisley, Perspectives on Utilization of Research (California: Institute for Communication Research, Stanford University, February 6, 1969), p. 2.

[2]Robert Overs and Ann Trotter, Dissemination and Using Research Reports (Washington, D.C.: Education Resources Information Center, n.d.), p. 8.

[3]Ibid., p. 77

sales people, and promotion by associations are identified by Havelock.[1]

3. To whom--Needed are improved systems to match information with user requirements. Little is known about the reading, listening, or other receptor skills; the motivation, library skills, available time, or other factors that make up a user profile.

What is clearly needed is two-way communication systems among the researcher, linkage system, and the user: a feedback system of implementing and stimulating further research in a continuous spiral of increasing sophistication.[2] The scientist and the practitioner need each other. The linkage system permits the practitioner productive use of the knowledge, and the researcher with feedback to reorient himself towards the problems of significance to society.

5. Linkage systems

Barnard identifies six characteristics of a good linkage system:

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[1]Havelock, Scientific Knowledge, p. 17.

[2]Mouly, Educational Research, p. 418.

1. Indexed with present systems.
2. Maximum storage density.
3. Graphic, photographic, and alphanumeric information stored with equal ease.
4. Retrieval with ease.
5. Interfaced with electronic data processing.
6. Encourages use of information.[1]

The modern computerized storage and retrieval systems meet these criteria and handle a tremendous volume and diversity of information. Of those studies dealing with linkage systems nearly all deal with computer systems. Computerized retrieval systems are being developed by major professional organizations for specific research goals. This researcher forsees problems resulting when a researcher needs information from another discipline. Problems related to the computer language and user profile will inhibit easy access between professional groups. The chemistry teacher is such an example. The American Chemical Society and Chemical Abstracts information systems do not consider review articles, thus making the stored information too numerous and too advanced for usage by teachers. Similarly, the educational indexes such as ERIC do not fit the user

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[1]Barnard, "Teaching Aids," p. 256

profile or feedback systems to serve the chemist. In order to be most effective, both chemist and teacher need to receive feedback to establish criteria to judge what information is worth seeking.

The computer retrieval at this time in technology development is primarily at title retrieval, an awareness stage. No feedback system has been developed to meet the visions of the planners. The vision is that the researcher will type his report into a console, the computer will convert to computer language and transmit to central storage. A print-out of the information will be obtained when called by the user. This ideal is being developed by Lockheed Corporation, ERIC, and four universities in the Washington, D.C. area, under the sponsorship of the Office of Education. The completion goal is 1975.[1] ERIC/DIALOG is impressive and leaves me with the feeling: "Why have I been spending so much time in the damn library when this is available?" The reality of the cost, which is expected to be $35,000 per year for twenty hours per week, sends me back into the library.

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[1]Charles Hoover, private interview at U. S. Office of Education, ERIC Central Office, Washington, D.C., January 27, 1972.

The primary journal is still the prime linkage system, as it has been since the publication of the 1665 Philosophical Transactions of the Royal Society. This researcher has identified the following as potential linkage systems:

1. Printed communication--Periodicals, letters, single articles, and abstracting services.
2. Conferences--Formal and informal.
3. Computer services--Abstracts or complete print-outs.
4. Protocols--Audio and visual mailings.
5. Traveling specialists--Lecturing and interviewing.
6. Telephone--An extension of conferences with potential of storage system.
7. Microfiche and microfilm--Library service material.

Let me assume that the reader is familiar with #1 and #2, and that the previous discussing extended the knowledge of computer systems. Education libraries disseminate lectures and new techniques via video tapes or audio tapes. The microteaching video tapes of Dwight Allen at the University of Massachusetts are an example of protocols being used to disseminate research. The Department of Agriculture has sent teams of specialists

into farming regions to disseminate information for many years. In fact, it is difficult to find an information utilization study before 1950 which was not related to either agriculture or rehabilitation. The United States Congress requires that both these specialties include a marketing mechanism in all research proposals. The departments of communication in most land grant colleges are a result of this emphasis on research dissemination.[1] The rural setting of farmers makes the traveling specialist more effective than other linkage systems. The American Chemical Society supports the traveling specialist among member colleges and industries. The traveling specialist provides the best feedback mechanism of the seven systems. Protocols, television, and telephone are part of the future linkage systems as technology catches up to develop a feedback system.

Contrary to the technical linkage model of Barnard and Havelock is the model of LeCorbeiller:

> ...three elements of communication. There is first what a man thinks, there is then the medium through which he communicates what he thinks, there is then thirdly the person to whom he is trying to commu-

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[1]K. S. Louis and S. D. Sieber, "Field Agents Role in Education" in Pilot State Dissemination Project (New York: Columbia University, 1970), p. 43.

> nicate, through this medium what he thinks. Each of these elements has its own special importance. In relation to the first two, which I will call for brevity, the thought and the medium of expression, there is one problem which needs just to be mentioned. This is, in short, the question of the mutual effect on each other which the thought and the medium of expression have.
>
> Philosophers and literary critics have argued about the extent to which the medium determines what might be called the shape of thought, and they have argued about the degree of completeness or incompleteness which the thought itself may be held to have until it comes to complete expression in the chosen medium. But for our purposes it is perhaps legitimate to regard the two as separate, or at least as separable....This third element in the situation, the recipient of the communication, is very important. It is always important to know beforehand what the audience is going to be....
> Another means of communication is talking. Talking, not on a platform, but in the most informal way conceivable; talking across a coffee table, at a bar, while going for a swim, etc. It is only by personal talk between scientists that unformed ideas can travel from one mind to another, and that the motivation for different lines of attack can be communicated and discussed. It is only by talking that the scientist can discover which point of his approach, seemingly so clear to himself, others find particularly hard to swallow. But there are dangers...of dishonesty, of taking advantage in unequal sharing, of time, of criticizing an idea.[1]

It is this humanistic input to a linkage system that seems to be most important for effective communication. Linkage systems using recirculating audio media have the potential of the person-to-person talk. The mutual effect of each other on their thought development

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[1]Philippe LeCorbeiller, ed., The Language of Science: A Survey of Techniques of Communication (New York: Basic Books Inc., 1963), p. 6

is only excelled by the telephone conversation. Reliance on a human network provides more than the raw information. It provides judgment and suggestions of more feasible approaches to the problems being considered.[1] A feedback system with a cassette tape has the potential of personalizing the communication, of meeting each other's needs, and understanding the environment within which the research information can be used. Probably the most important message for the present scientific society lies in finding that the research literature has no consistent relation to society's structure or informal communication systems.[2] A strong and perhaps indefensible conclusion is made by Allen, but it is illustrative of the linkage systems without feedback. Landou takes this one more step in claiming that the responsibility of the researcher is to take an active role in educating potential users of new information.[3] Who can better direct implementation of new

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[1]P. H. Abelson, "Custodians of Knowledge," Science, 159 (1968), 582.

[2]Thomas Allen, Annual Review of Informational Science and Technology, ed. by Carlos Cuadra (Chicago: Encyclopedia Britannica Inc., 1969), p. 18.

[3]John Landou, Chapter Eight, Annual Review of Information Science and Technology, ed. by Carlos Cuadra and Ann Luke (Chicago: Encyclopedia Britannica Inc., 1971), p. 235.

information than the discoverer; that person has control of who will gain the information and how it might be used. The scientist discovering a new "fundamental particle" is obligated to the chemistry teacher to show how the new particle fits into present theory and to help him transmit this new theory to the student. The obligation is based on the researcher's own need to clarify relationships and on society's demand for more efficient use of knowledge.

6. Audio technology

At this present time the audio technology is ripe for the development of a potential linkage system with feedback. Glass refers to a study where eighty per cent of American Education Research Association (AERA) members owned or had immediate access to a cassette tape recorder, and that twenty per cent of its members commute more than twenty miles each day, which suggests the potential market.[1] Barnard claims the cassette tape recorders in sales volume make the cassette tape an attractive communication device.[2] An examination of the

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[1]Gene Glass, "Educational Product Evaluation: A Prototype Format Applied," Educational Researcher, I (January, 1972) 7.

[2]W. Robert Barnard, "Teaching Aids: Audio Tapes and Cassette Tape Recorders," Journal of Chemical Education, 48:2 (February, 1972), 136.

of the popular and professional magazines will indicate the number of new uses that cassettes are being produced for: as Nobel prize lectures, weight reducing exercise programs, how to sell insurance, etc. AERA put its 1971 conference reports on cassette tapes, contrary to the advice from ERIC officials, and are now reporting successful sales.[1] Hanford describes the novelty and acceptance of audio tapes for communication within the Olin Corporation. Cassette tapes were made by research specialists within the company and distributed to in-house staff as a continuing education program. Olin, being in the business of information generation, justifies the $600 per tape ($225 in labor costs, $1 per tape, and $250 for equipment) as a quick and convenient method of in-house sharing of information. Olin expanded this internal service in 1972 to include reporting on developments in other companies. Hanford concludes: "Another area where great utility for audio tapes is forseen, both in and out of the company, is the rapid reporting of research results."[2] Another

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[1]Charles Hoover, interview.

[2]W. E. Hanford, R. E. Maizell, and M. Chernoff, "Chemical News Via Audio Tapes: Chemical Industry News," Journal of Chemical Documentation, 12:2 (1971), pp. 3-4.

example is the commercial production of reel tapes serving a subscription of surgeons. For $150 per year the surgeon will receive a monthly tape on the developments within his profession.

Projections indicate that the National Science Foundation will support improvements in communication services with one hundred million dollars over the next eight to ten years.[1] ERIC reported in 1971 in a monogram, "Review of More Unconventional Information Retrieval Systems," on fifth-three services like ERIC, yet the non-conventional means did not include any audio systems. It would seem that the general needs of an improved linkage system and the few isolated but successful experiments with audio tapes would lead to a more systematic study of dissemination by audio methods.

7. Criteria for a research utilization study

This researcher concludes that a feasibility study into a linkage system via the route of cassette tapes is justified on the basis of the knowledge explosion, the feedback potential, and modern cassette tape technology. Lipetz has established six objectives of studying information needs and uses of a select audience:

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[1] Douglas Knight and E. Shepley Nourse, eds., Libraries at Large (New York: R. R. Bowker, 1969), p. 14.

1. An explanation of observed information need and usage.
2. The prediction of instances of information needs and usage.
3. The control and thereby the improvement of the utilization of information.
4. The description of observed information usage.
5. The definition of concepts dealing with information usage.
6. The theorizing of causal and quantitative relationships between information and utilization.

Lipetz identifies three criteria for studying a new media in information dissemination:

1. Very easy to learn to use.
2. Very convenient and inexpensive.
3. Very rewarding in terms of specificity, pertinence, and accuracy.[1]

A cassette tape with abstracts of both chemical and educational research information distributed to a select group of chemistry teachers can meet the requirements of Lipetz.

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[1]Ben-Ami Lipetz, Chapter 1, Annual Review of Information Science and Technology, ed. Carlos Cuadra and Ann Luke (Chicago: Encyclopedia Britannica Inc., 1970), p. 3

Specifically, objectives dealing with prediction of what kind of information is needed, improvement of the form of the information, and a description of information used will be met by this study. This study will yield a prediction factor to the question: "Will chemistry teachers subscribe to a cassette abstracting service?" In reference to the expansion of the number of journals each year, Gushee makes the point that the problem is knowing when to start the next journal. That is, how to determine which segment of the chemical population is now large enough, productive enough, and funded enough to support the new journal.[1] The purpose of this study will be to help discover if high school chemistry teachers meet these requirements. It is intended that the cassette tape will be returned with comments on how the information was used or not used. This feedback will increase potential utilization by providing relevant information to the abstractor. A trust relationship can develop between the user and the disseminator of research that can, over a period of time, become the channel for rapid, effective, and efficient transfer of knowledge. A checklist will be part of this study to obtain a description of what kind of infor-

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[1]Gushee, "Primary Literature," p. 30.

mation the chemistry teacher is using so that an attempt may be made to develop a user profile for future studies.

The criteria of Lipetz (ease, convenience, and rewarding), are easily met with cassette tapes. Cassette recorders are generally available, easy to use, and potentially as rewarding as any media in which the user is submitted the contents. "Rewarding" is in large part a factor of personal involvement with researcher and linkage system. Conferences and traveling specialists thrive upon personal involvement and exchange, but the effect is short-lived due to the transitory group. The cassette tape can be a way of talking to a large audience with feedback. Reward can also be attained by meeting the classroom needs of the teacher. The expertise of this researcher will aid in the selection of useful information.

Two studies support the contention that a specialist can select a set of abstracts relevant to a user profile. Both Lesk and Troller reported on a study measuring the differences in a specialist and a selected panel of users selecting abstracts from a large collection (1,268). Both selection procedures produced listed abstracts that were not significantly dif-

ferent.[1] A selection process is submitted as part of this study that is justified on both reliability and appropriateness to a user profile, and at the same time potentially rewarding to the chemistry teacher.

8. The issue of visual versus aural techniques

This study does not choose to settle the issue of whether aural or visual communication is the better system. The research in learning theory is mixed with no conclusion that can be generalized to a group of adult teachers operating within their speciality. Glass summarizes the intent of this kind of study:

> The relative efficiency of learning through visual and aural modes has been disputed in the history of psychology at least since 1894. As with most comparative studies, the findings have been largely inconsistent and non-generalizable. Relative efficiency seems to be dependent on such factors as; meaningfulness, age, reading speed, intelligence, difficulty of material, and whether retention is measured immediately or delayed.[2]

The goal of this research is to determine if chemistry teachers will use this medium. If they do use it, research from twenty-one periodicals will be disseminated. The question for further research might be to de-

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[1] M. E. Lesk and G. Salton, "Relevance Assessments and Retrieval System Evaluation, Information Storage and Retrieval, 4:4 (December, 1968, 343-348.

[2] Glass, "Product Evaluation," p. 10.

termine the characteristics of the population that finds aural methods more effective than visual, but that is for later consideration.

9. Chemistry teachers' information need

The chemistry teacher is a potential user of chemical research and education research. The high school chemistry teacher needs to keep abreast of recent knowledge in chemistry as well as research in learning theory and science curriculum. The burden of obtaining and reading the journals in both chemistry and education is beyond the capabilities of the chemistry teacher. Presently, in English, there is not a single suitable periodical that even attempts to bring both kinds of knowledge to the chemistry teacher. The Russian journal, Khimiyav Shkole, is directed toward up-dating the Russian teacher in both chemistry and education, but its translation is not available or likely to be consistent with the American chemistry teacher's needs.[1] The researcher has some reason to believe that the Journal of Chemical Education is not designed to meet the needs of the high school teacher. In private interviews, both Mr. Paul

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[1]Paul Van Tauch, private interview, Library of Congress, Chemical Abstracts Office, Washington, D. C., January 28, 1972.

Van Tauch[1] and Mr. Moses Passer agreed that there was a need for a review periodical, a kind of "state of the art," directed toward the specialist requiring a background in a new area. The chemistry teacher fits this requirement: he needs to know, for example, the state of the art in Nobel gas chemistry and in simulation game methodology.

10. Preliminary study

Previous to initiating this formal study, this researcher sent out ten tapes to professional friends in teaching and supervision roles. The tapes abstracted educational journals and covered the area of science teaching from kindergarten through college: information that could be used by teachers, supervisors, and science methods professors. The feedback was as mixed as the audience. One order of continuance was received from seven returns. The general impression was that a cassette tape review service needs to be directed to a specific group of educators. This researcher is most familiar with the needs/uses of the chemistry teacher,

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[1] Ibid.

[2] Moses Passer, private interview, American Chemican Society, Washington, D. C., January 27, 1972.

the specific user group for this study. This research focuses on one linkage system for one group of users and represents a small part of the total research utilization process and a small part of the teacher training process.

11. The hypotheses

Before stating the hypotheses, the process to which the chemistry teacher will be treated is described for perspective. Details of this treatment are found in the chapter, "Treatment." The chemistry teacher will recieve by mail a sixty minute cassette tape abstracting the research findings in chemistry and related educational methodology. The procedure for selecting the research studies is detailed in the Appendix. The teacher is expected to listen to the tape while commuting to work or at some other convenient time. The information is chosen to be useful to the teacher. The questionnaire (see Appendix) is designed to determine what kind of information was used and to what extent the information was used. The data from the questionnaire will serve to test the hypotheses.

The following hypotheses comprize the statistical aspects of this study. Their justification is based on the previous stated arguments and the preliminary study.

1. Twenty per cent or more of a randomly selected group of fifty high school chemistry teachers of New England Association of Chemistry Teachers will voluntarily choose to subscribe to this chemical education research review on cassette tapes after receiving two free tapes (#1, #2) and questionnaries. (Subscribing refers to a purchase order or payment for at least an additional one month's tape service.)
2. A group of fifty randomly selected high school chemistry teachers of NEACT after reviewing tape #1 will exhibit significantly more verbalization of information usage on the questionnaire than a control group of the same size.
3. As measured on the questionnaire, the experimental group will indicate using new chemical information more frequently than using methodology information.
4. Teachers who indicate on the questionnarie using at least four studies will record at least two minutes of their reactions and criticisms on the returned tape.
5. The number of articles reported used as indicated on the questionnaire will be signifi-

cantly greater than for those teachers indicating:

5.1. Age group of 25-35.

5.2. Degree of B. S. in chemistry.

5.3. Teaching in a school of over 1,000 students.

5.4. Teach with at least two other chemistry teachers.

5.5. Own their own cassette tape recorder.

5.6. Reading two professional journals monthly.

5.7. Relying on periodicals "slightly."

C H A P T E R II

POPULATION AND SAMPLE POPULATION

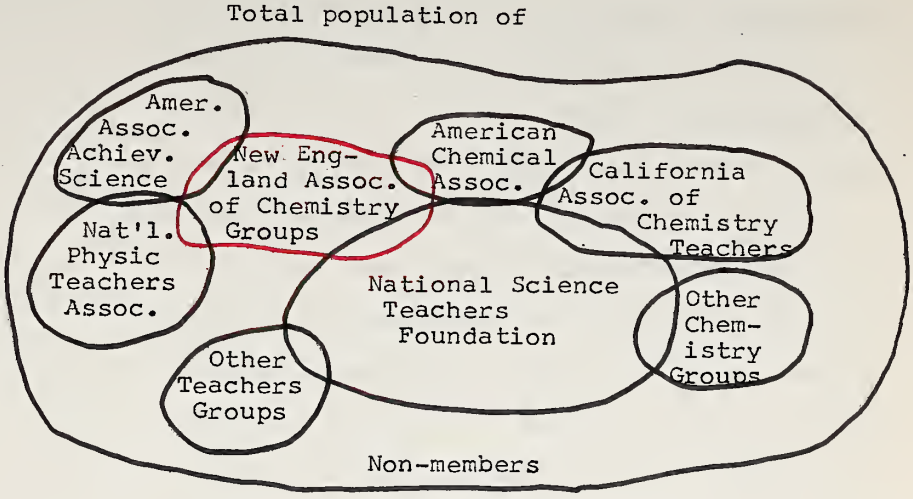
1. Summary

The data from this study indicate that the high school chemistry teachers of the NEACT are somewhat dependent on three monthly journals for continuous updating of chemical and methodology information. The average teacher is reviewing the association's Journal of Chemical Education, the American Chemical Society's journal for secondary schools, Chemistry, and one other professional journal from a wide range of choices. This average teacher dependends upon the subscribed journals rather than any systematic review in a professional library.

The sample population was taken from the membership list of the New England Association of Chemistry Teachers; therefore, generalizations are limited to this sub-set of the total population of chemistry teachers. The following sections describe the sampled population. Inferences are substantiated that indicate an expanded study to the whole population is likely to find similar teacher characteristics.

2. Total population of chemistry teachers

1. Population schematic



2. Characteristics of chemistry teachers--The sampled chemistry teacher of NEACT indicated by their reading habits that multiple membership in professional organizations is likely. The above diagram was designed from inference of reported periodicals read and is used to illustrate the sub-set of NEACT within the total population of chemistry teachers. There are two active associations with full activities of monthly meetings, separate newsletters, summer conferences that are specific for both

high school and college chemistry teachers: New England Chemistry Teachers Association and California Chemistry Teachers Association. Both have membership extending to mid- and southern United States. Both of these groups are affiliated with American Chemical Association (A.C.S.) and its Division of Chemical Education. Qualitative data obtained from examining the membership cards of NEACT indicate that it is unlikely that a high school teacher will join the A.C.S., but very likely that the college professor within the NEACT will join the A.C.S. The high school teacher is likely to have overlapping membership in the National Science Teachers Association. This is also evident from the forty per cent (sixteen control and fourteen experimental groups) claiming the use of Science Teacher, the NSTA journal, as one of the journals regularly reviewed. Table 2.1 lists the other journals and the associated professional journal as reported on the questionnaire. It is not inferred that teachers of this study do in fact belong to these parent associations, as the journal could be purchased or obtained by non-members.

It is inferred from this survey that chemistry teachers do have membership in other professional associations as evidenced by the list of journals reported on regular review.

TABLE 2-1

PERIODICALS REPORTED REVIEWED THAT HAVE PROFESSIONAL ASSOCIATION SPONSORSHIP

Periodical and Association	Frequency Reporting
Journal of Chemical Education	95%
New England Chemistry Teachers Association or Div. of Chem. Ed. of A.C.S.	
Chemistry	66%
New England Chemical Teachers Assn. or A.C.S.	
Science Teacher	40%
National Science Teachers Assn.	
Chemical & Engineering News	20%
American Chemical Society	
Science	21%
Assn. for Advancement of Science	
Physics Teacher	11%
National Assn. of Physics Teachers	
Today's Teacher	4%
National Education Assn.	

3. Comparison of Mills, D'Agostino, and this study

It is difficult to generalize about the characteristics of the total population of 21,000 chemistry teachers in the United States, since only a fraction have been sampled.[1] Mills sampled to determine academic Preparation of chemistry teachers by geographic region, and his results are shown in Table 2-2.[2] The data from Mills' study has two inferences for this study. The sample of chemistry teachers in this study is similar of those in Mills' study and is similar of the total population of chemistry teachers with regard to academic preparation. This inference is made from the data that sixty percent of the teachers in both this study and Mills' study had a B.S. or a B.A. in Chemistry and forty-three per cent of the teachers has a M.S. or M.S.T. in Chemistry. The data from Mills also indicate that the North East region from which this study's sample was taken is similar of chemistry teachers in the United States. D'Agostino's study(see

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[1]Brother C. Joseph D'Agostino, "Differences in Aims of High School and College Teachers" (unpublished Ph.D. Dissertation, New York University, 1966), p.131.

[2]Thomas Mills, Secondary School Science Teacher: Characteristics and Service Loads (Washington, D.C.: National Science Teachers Assn., 1963), p.36.

TABLE 2-2

MILLS' STUDY OF CHEMISTRY TEACHERS:
PREPARATION OF CHEMISTRY TEACHERS
BY REGIONS (1963)

Undergrad. hours in chemistry	North East	South East	North Cent.	West	Av.	This Study
less than 9	16%	19%	15%	14%	16%	
9-17	17%	23%	28%	23%	23%	
18-29	34%	36%	29%	28%	31%	63%
30+	33%	27%	28%	35%	29%	
M.S. or M.S.T. in chemistry	54%	39%	40%	42%	43%	43%
chem. + physics (9+ hours)	21%	20%	17%	23%		
chem. + biology	10%	9%	11%	14%		
chem. + gen. sci.	9%	14%	6%	3%		
chem. + other	14%	34%	34%	25%		
chem. + no other	46%	23%	32%	35%		
Number in Sample (3,957) of total 142,377	104	90	142	65		100

Table 2-3), as did Mills' study, substantiates the inference that the sample population of this study is typical of the total population of chemistry teachers. The teachers sampled by D'Agostino and in this study are of the same sex ratio; join similar memberships; have similar degrees; and, with some consideration for consolidation of smaller schools in the past six years, are distributed in similar size schools.

TABLE 2-3

PROFILE OF CHEMISTRY TEACHERS

CRITERIA	D'AGOSTINO STUDY (1960)	THIS STUDY (1972)
Sex:		
Male	79%	76%
Female	21%	24%
Size of School:		
Less than 500	30%	16%*
500-1000	20%	21%
over 1000	47%	63%
Membership in:		
N.S.T.A.	37%	40%
A.C.S.	17%	20%
B.A. or B.S. (+24 credits) in Chemistry	67%	63%
Number in study:	3,874 in random selection 7 states.	100 of New England Chemistry Teachers

*Possibly due to consolidation of smaller schools in past six years.

4. Characteristics of chemistry teachers of NEACT

The questionnaire sent with the ACCESS tape was designed to identify sub-populations of chemistry teachers who would accept ACCESS tapes. A summary of this data is contained in Table 3-1.

TABLE 2-4

SUMMARY OF QUESTIONNAIRE:
PERSONAL DATA

1. Age:

	20-25	26-35	36-45	46-55	56+
Per cent response:	2%	35%	25%	30%	8%

2. Degree: B.S. or B.A. degree in

Chemistry	Education	Chem.Ed.	Other Sci.	Other
63%	9%	4%	9%	15%

M.S. or M.A. or M.S.T. in

Chemistry	Education	Other Sci.	No Masters
43%	33%	13%	11%

3. Size of school now teaching in:

less than 500	500-1000	over 1000
16%	21%	63%

4. Number of other chemistry teachers in the school:

No. of chem. teachers:	0	1	2	3	4	over 4
Per cent response:	14%	24%	22%	17%	6%	17%

5. Reliance on monthly journals to up-date yourself:

Descriptor choice:	heavily	moderately	slightly
Per cent response:	26%	49%	25%

6. Ten journals most frequently listed as reviewed monthly:

Journal of Chemistry Education (95%)
Chemistry (66%)
Science Teacher (40%)
Scientific American (28%)
Science (20%)
Chemical & Engineering News (20%)
Physics Teacher (11%)
Science News Letter (7%)

7. Number of journals listed as reviewed monthly:

No. of journals reported:	0	1	2	3	4	5	over 5
Per cent response for that no.	2%	7%	25%	22%	22%	14%	8%

The data from this survey indicate that the average high school chemistry teacher of the NEACT is likely to be aged thirty to fifty; with a B.S., M.S., or M.S.T. in Chemistry; teaching in a school of over 1000 students with at least one other chemistry teacher; review monthly two to four periodicals, and express the view that these journals are "moderately" relied upon for up-dating information. The average high school chemistry teacher cannot be described in terms of his interests and needs in up-dating his information.

Table 2-5 indicates the more frequent interests and topics requested to be included on the ACCESS tapes. D'Agostino's research on chemistry teacher's topics of importance is included in the table for comparison.[1] The comparison indicates the teachers of this study viewed the role of ACCESS tapes as extending their basic responsibilities into the fringe topics; those topics not part of every course but useful to keep the course relevant and effective.

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[1]D'Agostino, "Differences," p. 130.

TABLE 2-5

TOPICS OF INTEREST TO CHEMISTRY TEACHERS*

THIS STUDY		D'AGOSTINO'S STUDY
Chemical Topics	Education Methods	Chemistry Topics
Basic Concepts	Curriculum Developments	Electron Theory
Ecological Relations	Teacher Effectiveness	Descriptive Chemistry
Current Advances	Computer Technology	Nature of Chemistry
History and Philosophy	New Audio-visual	Chemical Properties
Structure of Molecules	Evaluation Techniques	Scientific Attitudes
Bonding Theory	Individualized Instruction	States of Matter
Nuclear Radiation	College Board Requirement	Chemical Definitions
Organic	Demonstration Ideas	Ionization Theory
Thermodynamics	Open-ended Experiments	Uses of Chemical Principles
Equilibrium	Grading Systems	Chemical Mathematics
Electrochemistry	Low Achiever Chemistry	Periodic Relationships
Uses of Instruments	New Laboratory Methods	Kinetic Molecular Theory

*listed in rank order of importance by high school teachers.

It is inferred from Table 2-5 that chemistry teachers of this study have the same professional interests as those found by D'Agostino. The context of the ACCESS tape survey framed the request for "what topics are important" in reference to an up-dating process for the teacher. Other studies have framed the request in reference to the content of the course for the students. This study indicates, however, that teachers request information with the student's needs foremost. The teachers requesting information sought for immediate use in the classroom, not just information to bring the teacher to the frontier of knowledge.

5. Reading behavior of chemistry teachers

An attempt is made to describe the reading and listening habits of chemistry teachers. This is difficult, as inferences must be made from science teachers in general and from chemists. It is an assumption of this study that the information requirement of chemistry teachers is a combination of that information required by the chemist to keep abreast of developments in the broad area of chemistry, and the information required by the science teacher for curriculum and methodology.

Sharon finds that the socio-economic status of the reader is the most predictable factor in determining the

reading habits of adults.[1] It is therefore an assumption of this study that the socio-economic status of chemistry teachers is nearly uniform and that the reading habits are also nearly uniform. Fornoff concludes from his survey of high school chemistry teachers that "the similarity of the chemistry course content requires a common need for information. Fornoff finds essentially the same five fundamental concepts (bonding, ionic, kinetic, redox, periodic) taught and finds that similar text books are being used (Dull, 63%; Chem. Study, 21%; Baker, Browlee, C. B. A.; Garrett).[2] ACCESS tapes were designed to fit this common information need.

The need for a different but common set of information for chemists has been established by Gushee:

> When I accepted the invitation to speak to you today (A.C.S. national meeting, 1968), I asked Encyclopedia Britannica to survey all the information in the sociological literature on the subject, "The Importance of chemical literature to chemical technology." It took them thirteen weeks to make the search. What they returned was a great surprise to me, because it showed no reference from the social sciences at all. How narrow are the reading habits of chemists.[3]

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[1]Sharon, "Reading Activities," p. 7.

[2]Frank Fornoff, A Survey of the Teaching of Chemistry in Secondary Schools (Princeton, New Jersey: Educational Testing Service, May, 1969), p. 15.

[3]David Gushee, "Reading Habits of Chemists, Journal of Chemical Documentation, 8:4 (November, 1968), 193.

Gushee is claiming from his study that chemists are bound by tradition to two systems of information: one, the highly computerized retrieval system; and two, the traditional primary journal. Both of these are professionally oriented.

Vagianos reports that the average university chemist spends sixteen and a half hours per week in scientific communication, most of which is reading within the area of specialization.[1] Dulin supports the inference that the professional reader has passed through the mastery of finely detailed and specific factual information and now reads to make on-going decisions involving the "big picture." To keep up with the big ideas he reads at five hundred to six hundred words per minute.[2]

A more detailed study of the reading habits of chemists was made by Kuney who sampled one hundred fifty organic chemists receiving the Journal of Organic Chemistry. He found that twenty-five per cent read or looked at the journal within a week of receipt, and the average claimed to read fourteen of eighty-one articles

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[1]Vagianos, "Information Patterns," p. 86.

[2]Kenneth Dulin, "The Professionally Oriented Reader" (paper presented to the National Reading Conference, Tampa, Florida, December, 1971), p. 6.

with seventy-five per cent of the articles read by about ten per cent of the sample.[1]

Kuney claims that the average reader of the Journal of Organic Chemistry uses seventeen per cent of the articles. This study finds that twenty-six per cent of the abstracts were reported used. The extent of use and type of user rules out any generalization, but the data do fall within the realm of comparison. Users of an information source can relate effectively to only a part of the total set of abstracts. Their information needs are specific to their professional needs, and their reading habits are directed to those needs. The chemistry teacher is first of all an adult, then a teacher and a chemist, and his/her reading habits will be a reflection of that individuality.

6. Listening versus reading for effectiveness

The past data that attempt to resolve the effectiveness of reading versus listening has provided no solution. Reading is faster (six hundred words per minute compared to two hundred words per minute for listening), and reading provides for scanning and re-

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[1]Joseph Kuney and William Weisgerber, "Systems Requirement for Primary Information Systems," Journal of Chemical Documentation, X (August, 1970), 150.

reading for specific information retrieval. Young found that when he controlled for rate of presentation and re-reading and tested one week later, no difference in recall of ideas or facts presented to readers or listeners was evident.[1] It is not the purpose of this study to resolve the effectiveness of methods but to point out that the listening process is an important information dissemination resource. Hanford reports that Olin Corporation is using audio tapes regularly for the internal communication of chemical news to its employees. The authors indicate that audio tapes have the advantages of:

1. Novelty-attracting attention,
2. Use during spare or otherwise wasted time,
3. The tone and style of the announcer can give emphasis and special meaning, and
4. It is a potential saver of cost in the dissemination procedure.[2]

This author as well as most users of audio techniques recognizes that visual clues are necessary for chemical formulas, diagrams, and schematic representations. The American Chemical Society's cassette lec-

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[1]Robert Q. Young, "An Experimental Investigation of Reading and Listening Comprehension and the Use of Readability Formulas as Measures of Listenability," Dissertation Abstracts International, 33:2 (August, 1972), 776A.

[2]Hanford, Maizell, and Chernoff, "Audio Tapes," p. 3.

ture series has a pamphlet to supply the visuals necessary for understanding. Passer explains that the accompanying pamphlet should not contain so much information that the chemist does not listen to the tape.[1] The bibliography accompanying the ACCESS tape did have formula and data, but kept to a minimum, to help bridge this need for some visuals. Not one of the listeners to ACCESS tapes made reference to these visuals, nor did they request additional visuals. If the ACCESS tapes are to be acceptable, both author and listener will need to develop skills for using supplementary visuals.

Paisley, director of one of the three centers of communication research in this country, lists ten phases of a message being accepted:

1. Penetrate to awareness
2. Achieve attention
3. Exposure to message
4. Comprehension of idea
5. Retention of message
6. Motivation to use
7. Pretrial evaluation (in mind)
8. Trial of idea
9. Post-trial evaluation
10. Complete adaption to behavior.[2]

ACCESS tapes are designed to incorporate seven of these ten phases. The tapes are designed to penetrate

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[1]Passer, interview.

[2]Paisley, Perspectives, p. 23.

the awareness and achieve motivation to use the message or, in this case, the abstracted information. The tapes are not designed to provide retention, post-trial evaluation, and adaption of the message. The chemistry teacher is expected to comprehend the idea and either continue to develop some use for the information or discard it as irrelevant material. An audio input by its message emphasis and enthusiasm can penetrate the awareness, attention, exposure, and motivation better than a printed message, but the final behavior change of the teacher may require a visual input. This research study does not resolve the issue.

Glass points out that reading is more versatile than listening. One can read in many positions, places, amid various distractions, while listening requires equipment that is not as versatile.[1] Many teachers of this survey suggested or directly confirmed the statement on the inconvenience of the recorder. Five of twelve who had borrowed a recorder for the first tape did not do so for the second tape. It is still an untested hypothesis of this study that listening time can be arranged and that listening has at least an equal chance in message reception and use.

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[1]Glass, "Product Evaluation," p. 11.

C H A P T E R III

THE TREATMENT

1. Summary

The treatment consists of mailing ACCESS tapes #1 and #2, personal data sheet, bibliography, checklist, and introductory letter to the sample population. The following nine sets of data and arguments support the reliability and validity of the treatment variable. Operationally defined procedures and random selecting and ordering of articles on ACCESS tapes provides for replication of the experiment. Data flow and data analysis provide statistical support.

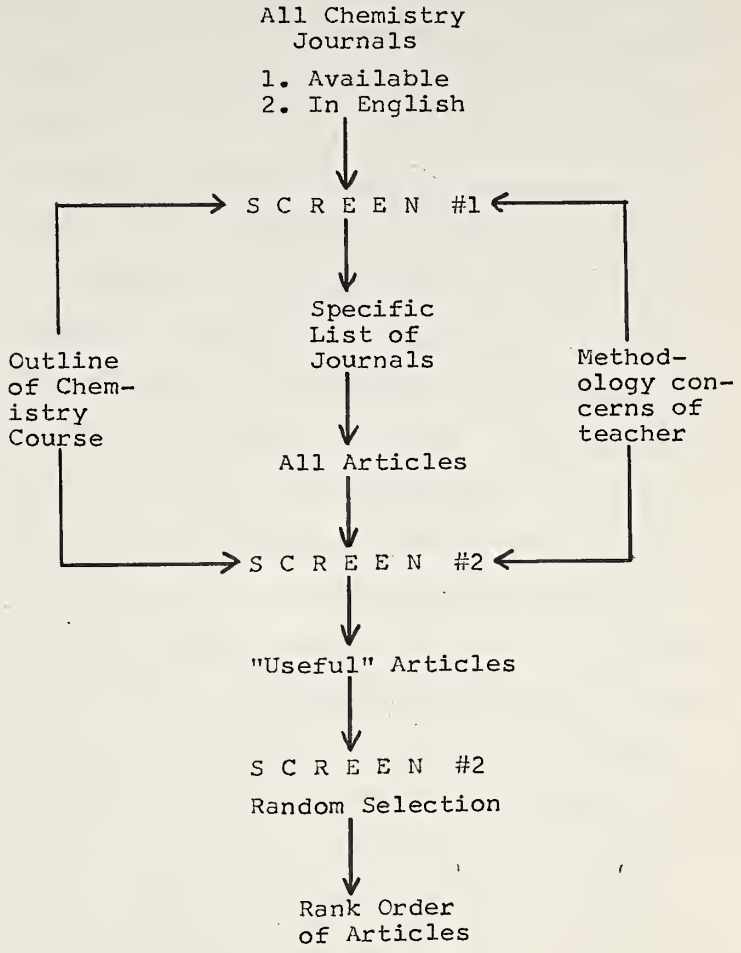
2. Selection of articles for ACCESS tapes

1. The procedure to select the articles is detailed as part of Appendix I. The procedure is standardized to provide replication of the treatment. Standardization involves two screens in the time order of:

   1.1 Articles from a specific list of journals are screened on a set of criteria operationally defined and based upon the potential usage to the chemistry teacher.

1.2 Random rank ordering of these articles for inclusion on the tape.

2. A flow diagram illustrates this procedure



3. Comments

The most difficult part of this study was the procedure for selecting the articles. It was first thought to ramdomly select from Chemical Abstracts and then filter through a criteria screen. This procedure method netted about one article in a hundred that could be stretched into fitting the usefulness criteria for high school chemistry teachers. The search for a systematic procedure took me to the American Chemical Society, the Library of Congress (Scientific Referral Center), and to librarians at the University of Massachusetts, Springfield College, American International, Smith College, and Massachusetts Institute of Technology. Some nine hundred chemical journals have been scanned to find a consistent source of information appropriate to the chemistry teacher. Periodicals listed as "reviews of" are misleading (especially the American journals) as they are for the most part reporting original knowledge on a very specific topic. Bottle's review of chemical literature was mostly unsuccessful in locating journals with the intent of publishing "state of

the art" articles.[1] Reed, in his January, 1972, editorial of Chemical Engineering and Development, states the need for review articles on the basis that scientists need to catch up in other areas when developing new research proposals. The Chemical Rubber Company within the last two years has started twelve review periodicals to serve this need. The trend seems to include more review-type articles and this research used "state of the art" articles in abstracting information for the chemistry teacher. An underlying assumption is that editors of the journals were wise in selecting articles and the standardized procedure for selection is based on usefulness to the high school teacher.

3. Recording procedure for ACCESS tapes

1. Details of the procedure are part of Appendix II. The procedure recommended by the American Chemical Society modified by Barnard[2] and local conditions was followed. The details are

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[1]Bottle, Chemical Literature, p. 45.

[2]Barnard, "Teaching Aids," p. 137.

sufficient for replication of the experiment. The new Springfield College library with a professional recording room was used to record the master tape. Each master tape took about eight hours of continuous labor. The researcher scheduled the recording studio after all articles were read and outlined for abstract content. The abstract for each article was spontaneously recorded from these notes, then listened to for clarity and general quality. Usually the second or third take was considered worthy of ACCESS tape inclusion. A few frustrating experiences are remembered with eight or so takes for a single abstract.

2. Considerable attention was given to the issue of voice tone, control, presentation, and appeal qualities. It is recognized that a separate research design could be administered to determine which of many variables would be most effective: male/female, one/two/three voices per take, radio announcer/teacher are some examples considered. Tapes from the American Chemical Society's lecture series, tapes from the United Church lecture series, sensitivity sessions by Carl Rogers via cas-

settes, business seminars of tapes of Nation's Business Sound Seminar, and salesmen's techniques on cassette of The Executive Voice were listened to for voice control and pace. The conclusion to this search was that either of two methods were effective:

2.1 A second voice, preferably a female, used alternately and for special comments would offer a change of pace; with the effect of holding greater attention of the listener.

2.2 The same voice used throughout has the advantage in a series of tapes as the listener can begin to identify "my friend."

The cost to hire and train a second voice for ACCESS tapes prevented that option. The intent of this research was to provide a continuing service to fellow chemistry teachers and so the second option prevailed.

3. Supportive data was obtained from experimental group returning the second set of data. The lead letter (see Appendix IV) made reference to the issue of clarity and appropriateness of the researcher's voice. The chemistry teachers were asked to comment on the delivery.

3.1 Only four of twenty-four with exposure to both tapes responded to this invitation--three preferred researcher's voice.

3.2 Only fourteen of seventy-six with exposure to either tape #1 or #2 commented on quality of delivery, with eight making positive statements.

4. The researcher concludes that voice control and delivery was not an issue and did not effect the treatment variable. This is supported by the fact that ninety-five of one hundred teachers chose not to subscribe to the service, and these ninety-five did not claim tape quality as a reason for not subscribing. It is the opinion of the researcher that poor tape quality would have been an easy excuse if there were any possibility of the tapes being considered of poor quality.

4. Validation of receipt of treatment

1. In an effort to validate receipt of the tape and questionnaires, a post card was enclosed in the mailing. The post card was preferred to the "return receipt" of the Postal Service. The additional cost (six cents versus ninety

cents) was a partial reason, but the inconvenience to the teacher of having to make a trip to the post office, should he not have been at home when the tape was delivered, was the major reason for the post card. It was thought that hostile feelings might result if the chemistry teacher had to make a special trip to pick up an unsolicited package.

2. Data: forty-two postcards of fifty sent to the experimental group were returned. Thirty-eight were returned within two weeks; the rest within a month.
3. The data support the statement that the treatment was received by the experimental group.

5. Data flow: summary
   1. Experimental group
      5.1 Mailed: fifty letters and tapes on March 23, 1972.
      5.2 Returned: forty-five replies by June 13, 1972, for a ninety per cent return. (Thirty-three had complete and usable data, six were retiring from teaching, two prevented from participation by sickness, one wanted no part of the program,

three gave no reason but just returned the mailing.)

5.3 Mailed: thirty-eight letters and tape #2 after April 28, 1972.

5.4 Returned: twenty-six replies by August sixteenth, for a sixty-eight per cent return. (Twenty had complete and usable data, two were retiring and had no need of the service, one was "turned off" by the "gimmick" idea to sell tapes, and three gave no reasons.)

5.5 Three subscriptions were received: two for two dollars and one at twelve dollars.

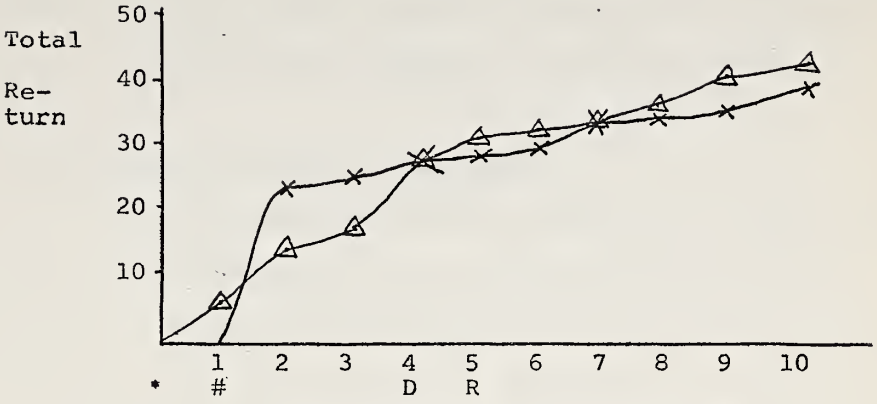
6. Control for history effect

1. It is essential to the experiment that both the experimental and control groups are responding to the same questionnaire over the same time span. An event, such as a special article in the Journal of Chemical Education, might have affected one group more than the other. The graph shown in Table 3-1 is submitted to show data flow with control and experimental groups.

2. Data flow

TABLE 3-1

DATA #1: HISTORY EFFECT



* Mailed tapes to experimental group (△)
\# Mailed questionnaire to control group (X)
D Due date (suggested)
R Reminder sent to both groups

3. The data flow indicates that the experimental and control groups responded to the checklist over the same time span. The control group, although delayed one week in anticipation of earlier return, did meet the suggested return date with the same number of replies. An additional week delay would have been even better as an event occurring during the second week might have affected a few of the sample.

7. Test for reliability of data

1. The split-half data analysis is a typical test for reliability of the measuring instrument. For this experiment the data obtained during the first month is compared to the data in the second month. This analysis serves two purposes: to determine if the instrument is reliable and if the total data can be used in comparisons. A t-test for the difference between mean usage was performed.

2. Data analysis

The number of articles "used" as reported on the checklist sent the teacher was determined. Those teachers responding by suggested due date (#1) and those responding after the

suggested due date (#2) composed two independent sets of data.

$N_1=23$ $\bar{X}_1=4.$ $X_1^2=440$ $(X_1)^2=8649$ $t=0.24$

$N_2=10$ $\bar{X}_2=3.8$ $X_2^2=330$ $(X_2)^2=1444$ not significant at 0.1

3. The t-test indicated no significant difference between the two groups of data. Two implications are inferred from this data. The data spread over two month's time can be used in tests of the hypothesis. Second, the data supports the previous conclusion that no event occurred during the experiment to significantly affect the data.

8. Determination of listening

1. Although returned mailing indicated receipt of ACCESS tape, validation that the tape was actually listened to is necessary to determine that the experimental group was in fact affected by the treatment. A code number (six) was mentioned two-thirds through the first side of tape one. The listener was asked to make note of this number, and a slot was included on the questionnaire for recording this number. A problem occurred because the tape

also had a code number to identify the teacher in case no identification was returned. Many returning data sheets included this number. In lieu of this, the comments were examined by the researcher to verify that listening occurred.

2. Data

Number using code number	12
Specific commments indicating listening	17
No direct evidence of listening	4
Number returning usable data	33

3. The data and general feeling of the researcher indicate that the ACCESS tape was listened to.

4. Letters introducing the ACCESS tape to the chemistry teachers suggested "listening while driving." A premise to ACCESS tape usage was that different kinds of time would be found. Teachers were asked to comment on how the tape was listened to, but too few (four out of fifty-nine teachers) answered this question. Driving time was mentioned as helpful ("efficient") and not helpful ("car too noisy"). The researcher felt that ACCESS tapes were being listened to during potential reading

time and the uniqueness of other possible time was not considered. The tapes were primarily listened to individually, with some response indicating that they were audienced in groups of fellow teachers.

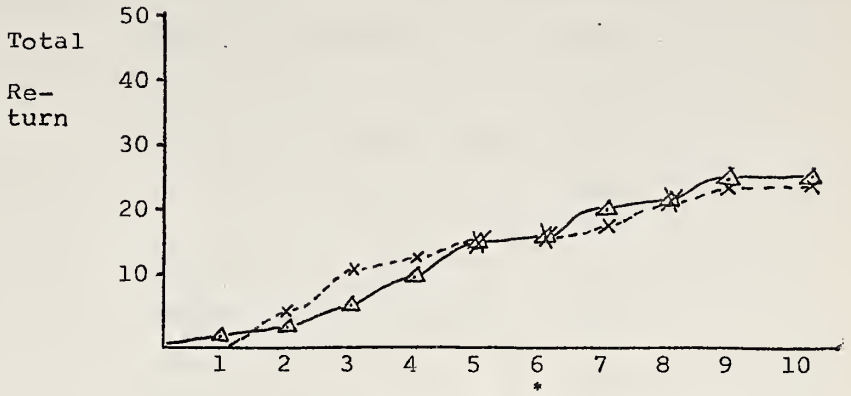
9. Reliability and validity of ACCESS tape #2

1. Data flow analysis of ACCESS tape #2 is much more difficult to assess for reliability and validity than tape #1. Tape #2 was sent to teachers "wanting the tape," which adds a bias and removes the representative aspect of the total population of NEACT teachers. Tape #2 was also sent out on receipt of a request for it, which meant it was mailed out all during the second month of the experiment.

2. Data flow

TABLE 3-2

DATA #2: HISTORY EFFECT



(△) Experimental group
(×) Control group
* Reminder sent

3. The data again indicate control for history effect between the control and experimental groups.

4. The data also illustrate the number remaining from the original sample of fifty teachers after two cycles of data and ACCESS tapes. The

response of usable data from the experimental group of fifty per cent and from the control group of forty-eight per cent is within the acceptablility of survey data. Following is a summary of data flow:

Cycle #1	Experimental	Control
Number in sample	50	50
Number return	45	40
Number with usable data	42	40
Per cent return	84%	80%
Cycle #2		
Number wanting #2 tape	30	32
Number return	25	24
Number with usable data	25	24
Per cent return	50%	48%

10. Comparison of tape #1 and tape #2

1. Data analysis for hypotheses testing implies that tape #1 is not significantly different from tape #2. Hypothesis three (chemical information used more than methodology information) is an example where total usage is measured over both tapes. Teachers were asked to respond to "which tape did you prefer."

2. Data

Preference	Number	Comments
Tape #1	4	better variety, better mechanically, applicable.
Tape #2	5	more chemical content, voice control better.
Equal	4	
No data	8	
Total	21	

3. The data indicate no verbal preference for one tape, which suggests that both tapes were sufficiently equal so no bias developed.

4. Additional comparison can be made on analysis of the number of articles claimed as "previous knowledge of."

5. Data

	Tape #1	Tape #2
Number of responses claiming previous knowledge of a particular article recorded on bibliography/checklist	10	13
Total number possible responses (17 articles x number of teachers)	561	663

6. The data indicate no significant difference in the number of responses in which the

teachers claimed that "they had obtained the information from another source." Both tapes contained articles that were not familiar to the sample population.

C H A P T E R IV

RESULTS OF THE EXPERIMENT

1. Summary

The treatment, sending abstracts of seventeen articles on cassette tapes, was effective. The experimental group recorded significantly more usage of the articles than the control group.

Both control and experimental groups expressed positive approval, but acceptance was insufficient to purchase the service on a continuing basis. Lack of time and cost were the most frequent reasons for not continuing.

An effort was made to predict what measurable factors would lead to ACCESS tape acceptability. An examination of the catagories of age, college degree, size of school, and the number of journals reviewed revealed no predictable factor. Ownership of a cassette recorder, the number of other chemistry teachers in the school, and teachers perceiving themselves as using periodical literature "moderately" or "heavily" have predictability for ACCESS tape usage.

2. Hypothesis #1

Twenty percent or more of the chemistry teachers of NEACT would voluntarily choose to subscribe to this chemical education research review on cassette tapes if they received two free tapes (#1,#2) and questionnaires. (Subscribing refers to a purchase order or payment for at least an additional one month's tape service.)

1. Data

Subscribers from experimental group: 2

Population of experimental group: 50

Test for significance of a proportion:

Resulting: $p = .04$

Desired: $p = .20$

$$Z = \frac{P - P}{\frac{P(1-P)}{N}} = 2.82 \quad \text{(significant at .01)}$$

2. Results

The two subscribing teachers of the fifty in the sample are significantly fewer than the twenty percent required of the hypothesis. Therefore, hypothesis #1 is rejected.

3. Comments

Written responses to the question, "list a few adjectives that express your reaction to the service," were significantly positive.

19 responded with positive descriptions
4 responded with negative descriptions
6 no data; e.g. "retired from teaching"
11 no data; personal reasons (illness, time)
5 no data; not returning mailings
5 no judgment, but asked to continue
30 of the 45 returning tape #1 and questionnaire asked for the second free tape

The acceptability of the second tape audio-subscription of an abstracting service could be motivated by:

1. The novelty, gimmicky, "let's give it a try" attitude which persisted and influenced the positive response.
2. The idea of another "free tape" influenced the positive response.
3. The genuine interest and acceptability of the cassette abstracting service influenced the positive response.

All three motives could be present, but with thirty of forty-five asking for a second tape involving another hour of their time, this would indicate a genuine acceptability of the concept if not this ACCESS tape service.

3. Hypothesis #2

After receiving tape #1, a group of fifty randomly selected high school chemistry teachers of NEACT will exhibit significantly more verbalization of information usage on the questionnaire than a control group of the same size.

1. Data

Experimental		Control	
Teacher	No. of uses	Teacher	No. of uses
1	1	1	0
2	2	2	2
3	6	3	1
4	2	4	0
5	5	5	1
6	3	6	1
7	3	7	0
8	4	8	3
9	8	9	1
10	5	10	5
11	8	11	1
12	0	12	5
13	0	13	1
14	8	14	0
15	0	15	2
16	6	16	0
17	3	17	1
18	4	18	3
19	4	19	0
20	2	20	0
21	5	21	2
22	3	22	4
23	2	23	0
24	0	24	0
25	4	25	0
26	1	26	0
27	2	27	1
28	2		
29	2		
30	4		
31	2		
32	5		
33	16*		

*hypothesis significantly supported at .01 even if this is excluded.

$N_e=33$ $\Sigma X_e=122$ $\bar{X}_e=3.70$

$(\Sigma X_e)^2=14,884$ $\Sigma X_e 2=670$

$N_c=27$ $\Sigma X_c=34$ $\bar{X}_c=1.26$

$(\Sigma X_c)^2=1,156$ $\Sigma X_c{}^2=104$

t=4.21 significant difference at .01 level

2. Report of usage

Criteria	Control	Experimental
Used information with class	19	29*
Used method with class	10	2*
Used information from another source		30
Do not know of this article	421	
Wrote for or obtained original	5	30*
Discussed article with colleague	17	70*
Expect to use later	15	84
Just interesting information	13	180
Information of no use	10	50

(*considered "used" in hypothesis testing)

3. Results

Hypothesis #2 is accepted as treatment effect of sending the tape resulted in more usage. This is the most significant hypothesis

in the study: no significant difference would have negated the study. The selection of articles abstracted were sufficiently removed from the sample population, yet they were of concern to these chemistry teachers. Therefore, cassette tape #1 did have a treatment effect. Chemistry teachers receiving the tape did report the use of the information with their classes or in discussing with colleagues.

4. Comments

The data obtained on the checklist, although reported via a questionnaire rather than direct observation, indicates usage. The format of the questionnaire makes it easy to report "just interesting information," which many checked. The responses indicating usage for specific articles required commitment on the part of the teacher. Many such comments were made, such as: "I expect to use this"; "It's now part of my knowledge"; and "One-to-one correspondence for direct usage is difficult." This kind of response was not considered as usage. One can only guess that more information was eventually used than directly reported.

4. Hypothesis #3

As measured on the questionnaire the experimental group will indicate using new chemical information more frequently than methodology information.

1. Data: Experimental group with tape #1

T=teacher C=chemical M=methodology

T	C	M	T	C	M
1	1	0	18	2	2
2	0	2	19	2	2
3	3	3	20	1	1
4	0	2	21	4	1
5	2	3	22	2	1
6	3	0	23	1	1
7	1	2	24	0	0
8	1	3	25	1	3
9	4	4	26	0	1
10	4	2	27	1	1
11	4	4	28	0	1
12	0	0	29	2	0
13	0	0	30	3	1
14	6	3	31	2	0
15	0	0	32	3	1
16	2	4	33	8	8
17	1	2			

$N_m=33$ $\Sigma X=68$ $\Sigma X^2=236$ $\bar{X}=2.06$ $(\Sigma X)^2=4,624$

$N_c=33$ $\Sigma X=58$ $\Sigma X^2=194$ $\bar{X}=1.76$ $(\Sigma X)^2=3,364$

$t=.71$ not significant at .1 level

2. Results

No significant difference is found between usage of chemical information or methodology information as reported on the checklist.

Thus the hypothesis is rejected. Seventeen articles were abstracted; eight chemical and nine educational methodology. Placement on the tape was by random assignment. The experience of the researcher as a chemistry teacher had led to the hypothesis that chemistry teachers would accept and use new chemical information more easily than they would accept changing their style of teaching. That idea is rejected with this data.

3. Additional data

Examination of the data from tape #2 with the experimental and control groups confirm the data of tape #1. (Experimental group: #2 tape, chemical/method, t=.19. Control group: tape #2, chemical/method, t=.12.) Tape #2 contained a similar format of seventeen articles, eight chemical and nine methodology, randomly ordered. The data indicate an acceptance and implied need for both chemical and methodology information.

5. Hypothesis #4

Teachers who indicate on the questionnaire using at least four studies per tape will record at least two

minutes of their reactions and criticism on the returned tape.

1. Data

35 indicated four or more articles used and returned tape (both groups)

4 Actually taped comments

Test of significance

Actual: p=.11

Expected: P=1.00

Z=5.94 significant at .1 level

2. Results

The number recording their comments on the returned tape were significantly fewer than expected, thus the hypothesis is rejected.

3. Comments

This is disappointing to the researcher because acceptance of the audio-cassette idea would have meant usage of that media for returning data. The written media is traditionally acceptable. It is easier to check the data sheet than to record information on the tape with present conditions of acceptability and technology. Some responses indicated that "didn't leave sufficient room to record message," indicating some responsibility for not

"damaging the tape." This reason and others similar to it may have deterred tape usage, but not to the extent that only four in one hundred tapes were returned with recorded messages.

6. Hypothesis #5

The number of articles reported used as indicated on the questionnaire will be significantly greater for those teachers indicating: (1) age group of 26-35, (2) degree of B.S. in Chemistry, (3) teaching in school of over one thousand students, (4) teaching with two other chemistry teachers, (5) own their own recorders, (6) reading two journals per month, and (7) relying on periodicals "slightly."

1. Age as a factor

Age	No. of "used" responses/teacher	No. of Teachers	No. of Responses
20-25	8	1	8
26-35	2 3 3 4 3 1 5 0 4 2 5 2 4 2 4 4 6 8 2 6 7	21	77
36-45	11 9 3 6 5 2 3 8 6 3 2 2 10 2	14	72
46-55	6 5 0 3 5 2 6 3 4 8 0 3 4 1 8 8 1	17	67
55+	4 5 8 2	4	19

Source	ss	df	ms	F	p
Total	385	56			
Between groups	25	4	8.50	1.26	.1 level
Within groups	361	52	6.75		

No significant differences

2. Results

Age is not a factor in predicting usage of information recorded on ACCESS tapes. Data indicate no significant differences (at ten per cent level) between age groups and usage of abstracted information.

3. College degree as a factor

Degree	No. of "used" responses/teacher	No. of Teachers	No. of Responses
B.S. in Chem.	8 0 6 3 4 4 2 8 1 8 8 8 2 7 5 4 11 9 2 3 3 0 5 3 4 3 3 5 3 3 4 8 5	33	148
Ed.	8 2 10 6	4	26
Chem. Ed.	5 3 2	3	10
Other Science	8 6 1 2 6	5	23
Other	6 2 0 0 5 7 6	7	26

Source	ss	df	ms	F	p
Total	386	51			
Between groups	25	4	6.25	.81	.10
Within groups	361	47	7.68		

4. Results

College degree is not a factor in predicting usage of information from ACCESS tapes. It is interesting to note the characteristics

of the sample population: nearly two-thirds have a degree in chemistry.

5. School size as a factor

School Size	No. of "used" responses/teacher	No. of Teachers	No. of Responses
0-500	6 5 8 3 5 3 8 2 2	9	42
500-1000	9 2 3 6 4 0 0 3 4 1 8 2	12	42
over 1000	3 2 8 10 8 6 7 2 4 1 2 2 4 4 4 11 3 0 6 5 4 3 5 1 2 2 3 8 5 8 0 6 8 4 2 5	37	164

Source	ss	df	ms	F	p
Total	416	57			
Between groups	10	2	5.0	.68	.10
Within groups	406	55	7.38		

6. Results

School size is not a factor in predicting usage of information from ACCESS tapes.

7. Number other chemistry teachers as a factor

No. of others	No. of "used" responses/ teacher	Mean	No. of teachers	No. of Responses
0	6 5 3 4 8 1 2 2	3.9	8	31
1	2 3 5 0 0 3 2 8 6 5 8 3 4 3	3.7	14	54
2	2 8 0 4 2 10 2 6 9 2 3 1 2	3.9	13	51
3	1 4 3 8 2 0 5 5 4 4	3.6	10	36
4	8 8 3	6.3*	3	19
4+	8 6 5 7 4 11 6 2 4 6	5.9*	10	59

*significantly different means

Source	ss	df	ms	F	p
Total	1527	57			
Between groups	51	5	10.2	3.59	.10 level
Within groups	1476	52	2.83		

Analysis by t-test at .10 level yields mean critical difference of 1.3 responses per teacher.

8. Results

Data indicate a significant difference between number of other teachers in school and the number of "used" responses. Analysis by t-test indicates that four or more than four chemistry teachers within the school may be a factor in predicting ACCESS tape usage. Based on this information, a factor in predicting acceptability of ACCESS tape service would be the number of teachers in the school, with preference to those with at least four other chemistry teachers. It was predicted that at least two teachers were needed for interaction and motivation for accepting a new method of communication. The cell size of three and ten teachers is insufficient to make any generalizations and is only suggestive of examination.

9. Recorder ownership as a factor

Own	No. of "used" responses per teacher	No. of teachers	No. of Responses	X
Yes	2 6 3 8 5 8 6 4 4 5 8 10 8 2 7 1 2 2 4 6 5 11 9 3 0 6 5 4 3 5 1	32	159	4.96
No	3 2 8 1 8 6 2 4 2 2 4 8 2 4 3 3 3 2 5 3 4 0 0 8 0 3 2	27	92	3.31

Source	ss	df	ms	F	p
Total	417	58			
Between groups	35	1	35.0	5.22	.10 level
Within groups	382	57	6.70		

10. Results

Owning a cassette tape recorder is a factor in predicting use of ACCESS tapes. The F of 5.22 is significant at the .10 level with more usage reported by owners of the tape recorder. This is a predicted and acceptable factor. Owning a recorder allows for more favorable listening conditions, both in attitudes of acceptance and reality of conditions. If it is a burden to borrow the recorder, then the attitude for positive acceptance may be lost. If borrowing requires adverse listening conditions and limitations on time, then these become a deterrent to ACCESS tape usage.

11. Number of journals reviewed as a factor

No. of journals	Number of "used" responses per teacher	No. of teachers	No. of responses	X
0	1	1	1	*1.0
1	2 3 2 2	4	9	*2.2
2	0 8 0 3 6 2 4 3 0 3 5 4 1 2 4	15	45	3.0
3	5 8 8 8 5 0 8 4 2 6 8 5 3	13	70	5.4
4	6 3 3 10 8 6 5 7 3 2 2 4 6	13	65	5.0
5	1 4 8 2 4 2 6 4	8	31	3.9
5+	2 5 11 9 3	5	30	*6.0

*Significantly different by F statistic

Source	ss	df	ms	F	p
Total	413	58			
Between groups	100	6	16.7	2.77	.10
Within groups	313	52	6.02		

Critical difference between means of at least 2.0 is required by t-test analysis.

12. Results

Statistical data analysis by F-test and t-test indicates a significant difference in subsets of "0", "1", and "5+" journals reviewed monthly; but cell size of "1", "4", and "5" is insufficient to base predictions on total population. Bruning and Kinitz suggest cell size of ten for predictive properties.[1]

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[1]Fred Kerlinger, Foundations of Behavioral Research (New York: Holt, Reinhart, and Winston, Inc., 1966), p. 445.

Trend analysis indicates three journals per month is better predictive of ACCESS tape usage than any other number of journals per month. Thus the conflicting statistical analysis rejects the hypothesis and demonstrates that the number of journals reviewed monthly is not a predictive property.

13. Additional data

Data examination suggests that the number of journals reviewed may not be as predictive as which journals were reviewed. Analysis post-survey is impossible, since it cannot be determined which journal is most significant among the sets of two to five journals reported per teacher. If the teachers had rank-ordered their journals, then analysis could be made. Lacking this data, but noting that most teachers read the Journal of Chemical Education, Chemistry, and a third journal, the following sets of three were examined.

Journal of Chemical Education, Chemistry, and	No. of "used" responses	$\bar{X}$	N	
Science Teacher	6 3 4 5 8 0 8 1 10 6 7 5 4 11 5	5.5	15	83
Chemistry and Engineering News	2 3 3 8 4 2 7 5 4 6 5 3	4.3	12	52
Science	2 8 10 6 2 5 5 9 3 11	6.1	10	61
Scientific American	5 8 3 8 2.5 5 4 3 6	4.9	10	49

14. No significant difference was found between sets of journals with cell size of ten. This confirms the intuitive conclusion made on the number of journals reviewed. The data indicate that neither the number or any specific journal can be used to predict ACCESS tape usage. It is recognized that sixty usable data spread over thirty-eight different journals represents insufficient sample size. For statistical study on the influence of other reading, a sample size ten times that used in the study would be needed. A sample size of five hundred was beyond the means of this researcher.

15. Reliance on periodicals for up-dating self

Relies	No. of "used" responses	No. of teachers	No. of Responses	X
Slightly	4 2 2 3 0 3 1 6 2 3 1 4 0	14	33	2.4
Moderately	4 8 4 2 6 2 2 3 2 1 4 2 4 6 5 8 2 3 6 5 5 3 5 10 8 8 6 3	28	127	4.5
Slightly	6 4 11 9 4 3 2 5 8 3 8 8 0 7 5	15	83	5.5

Source	ss	df	ms	F	p
Total	385	56			
Between groups	77	2	38.5	6.75	.10
Within groups	308	54	5.70		

Critical difference between means of at least 1.8 is required for significance as determined by t-test analysis.

16. Results

The data indicate that teachers reporting "slight" use of periodicals to up-date their information will not use ACCESS tapes. Significant difference is found for "slight" reliance, but the usage of ACCESS tape is less than reported "moderate" and "heavy" reliance on periodicals.

17. Additional data

An effort was made to determine a quantitative measure of "slight," "moderate," and "heavy" use of periodicals.

18. Number of periodicals listed as reviewed

Reliance	1	2	3	4	5	5+	N	$\bar{X}$
Slightly	5	11	3	2	2	1	24	2.5
Moderately	0	8	12	10	4	3	37	3.5
Heavily	0	1	6	4	3	4	18	4.2

Source	ss	df	ms	F	p
Total	151	79			
Between groups	29	2	14.5	9.2	.10 level
Within groups	122	77	1.53		

Critical difference between means of at least 0.6 is required for significance by t-test analysis.

19. The term "slightly" has a quantitative meaning of 2.5 periodicals. The data indicate predictable non-use of ACCESS tapes by teachers claiming two or three periodicals used monthly. This is the opposite to the prediction of the hypothesis. The data would indicate more usage of ACCESS tape information by teachers reporting either moderate or heavy reliance on periodicals.

7. Periodicals reported reviewed monthly by both groups

Periodical	No. of responses
J. of Chem. Education	72
Chemistry	50
Science Teacher	30
Scientific American	22
Science*	16
Chem. & Eng. News	15
Physics Teacher	8
Physics Today	5
Science News	5
Smithsonian	5
Today's Educ. (NEA)	3
Biology Teacher	2
Environ. Science & Technology	2
Home Economics Journal	2
Mass. Teacher	2
National Geographic	2
Nature	2
School Science & Math*	2
Science Digest	2
American Druggist	1
American Scientist*	1
College Board R.	1
Chemical Technology	1
Drug & Cosmetic	1
Ecology Today	1
Educ. in Chem.*	1
Endeavour*	1
Kappan	1
N.Y.C. Board of Ed.	1
J. Research in Sc. Tech.	1
Saturday Review	1
Science & Children	1
Science World	1
Sea Frontiers	1
Soap, Detergent S.	1
Technology Review	1
The Oceans	1

*Among ACCESS tape periodicals

1. The purpose of ACCESS tapes was to bring to the chemistry teachers information not regularly reviewed. Only Science was reported by more than

two teachers as regularly reviewed. The sample population reported nineteen different journals reviewed by at least two teachers. The ACCESS tape articles were randomly selected from twenty-one periodicals. With an overlap of only one periodical, data indicate the purpose of bringing new information, not easily accessible to the chemistry teacher, was achieved.

8. Experimental group response to tape #2

Positive Responses	Number
Great idea	10
Interesting (very)	9
Useful, constructive, helpful	8
Novel	4
Liked editorial (comments)	6
Convenient	3
Informative (enlightening)	3
OK while driving	3
Time saving	2
Promote individual study	2
Like to see it developed	2
OK	1
Up-dating	1
Motivating	1
Comprehensive	1
Pace and delivery OK	1
Teachers need to listen, too	1
Media excellent	1
Satisfactory selection	1
Good for student term paper	1
Effective method	1
Timely	1
Fine for rural teacher	1

Negative responses	Number
Takes great deal of time	3
Be more concise	2
Get to point quicker	2
Be clearer	1
Mispronounced words	1
Articles of little value	1
Too many personal opinions	3
Short time to respond	1
Not appropriate to higher ed.	1
Just another journal over desk	1
I'd rather read	1
Give more details	1
Inconclusive abstracts	1
Poor tape quality	1
Too broad, too brief	1
Follow course guidelines	1
Better organization needed	1
Make more pleasurable	1
Scatter gun approach not good	1

1. Comments on response data

The lists are not proportional to the acceptance of the tape. Of the forty-five returning data, only four chose not to receive tape #2 because of a negative response to tape #1. The general feeling was positive, but frequently followed by some statement that would benefit construction of the next tape. Example: "A great idea, like to see it developed, but give more details." The responses requested on these items were intended to help improve the cassette tape. The data received was inconclusive because the statements given were in many respects contradictory. Example: "Like

editorial comments" (six) and "too many personal opinions" (three). The random selection of articles did not help with reactions to format and style. General suggestions would lead to a tape with one side devoted to chemical information and the other side devoted to methodology in some sequential form.

9. Summary of results

Hypothesis		Accepted	Statist. Different	Comment
1.	20% subscribing	no	yes	only 4%
2.	More "usage" by exp. group	yes	yes	treatment effective
3.	Used chemical vs. methods info.	no	no	equally received
4.	Will tape reactions	no	yes	only 11% recorded
5.	ACCESS info. used more by:			
	1. 26-25 yrs.	no	no	age and factor
	2. B.S. in Chem.	no	no	degree and factor
	3. School size 1000+	no	no	no factor
	4. Teach with 2+ others	no	yes	maybe 4+
	5. Own recorder	yes	yes	expected
	6. Review 2 Periodicals	no	yes	cell size may effect
	7. Rely on periodicals "slightly"	no	yes	indicates non-use

C H A P T E R V

DISCUSSION AND RECOMMENDATIONS

1. Summary

The technical aspects of the literature search, abstracting procedure, and the editing of ACCESS tapes indicate that cassette tapes have potential as a linkage system. The treatment of sending cassette tapes to selected chemistry teachers was effective in that both experimental and control groups indicated positive verbal usage of the information. The acceptability of the ACCESS tapes was limited to a verbal expression of merit, but was insufficient for payment into the service. It is recommended that a trial period of one year be undertaken to evaluate two controlling factors:

1. Change habits of reading to listening beyond the novelty aspect of this study.
2. Establish means of group interaction and feedback.

2. Abstracting procedure

The variables associated with abstracting were not part of this study, but were a factor of the expertise of the researcher. The procedures outlined in the ap-

pendix are an attempt to control these variables so that any other experienced abstractor would extract the same kind of information. An outline of the typical chemistry course served to identify what was important enough to be included in an abstract. Lesk's and Troller's data indicate that an expert can select content appropriate to a select audience. Troller found no significant difference in the information that he or a panel selected.[1] It is this data and the limitation of funds that determined that the content of the abstract would not be a variable studied. Data received from this study indicate that the content of the abstract was not a limiting issue.

Burman identifies three types of common abstracts:

1. An index--an entry consisting of bibliographic data.
2. An information abstract--an entry that gives all essential data, methods, variables, results, and conclusions in sufficient detail to enable the reader to acquire salient information without reading the article.
3. An indicative abstract--an entry that outlines the scope in general terms, the author's pur-

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[1]Lesk and Salton, "System Evaluation," pp. 343-348.

> pose, the methods, and the results, with the the function to suggest whether the original is worth the time to pursue.[1]

The abstracts used with this study were both indicative and informational. In some cases the intent was to get the teacher to read or obtain the original article, but in most cases sufficient information was provided so that the information could be used in class.

The author believes that a study of the variables associated with the kind of abstracted information acceptable to the high school chemistry teacher would be justified and necessary for the refinement of a linkage system. Variables that might enable predictability of an audio abstract service are: time available to audience, length of abstract, use of data within the abstract to support conclusions, and the kind of research article that requires an indicative abstract.

Chemical Abstracts reported on an experiment to distribute abstracts to a selected audience of forty chemists with a matched profile of interests. Only twenty per cent of the abstracts were of interest to the

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[1] C. R. Burman, How to Find Out in Chemistry (New York: Pergamon Press, 1965), p. 72.

group.[1] This study finds that twenty-one per cent of the articles were used (three or four aritcles per teacher), with "use" being a stricter criterion than the interest criterion of Chemical Abstracts, and with a random selection of teachers being more difficult to please than a selected profile. It is the opinion of this researcher that the abstracts were not a deterrent to the results.

3. Literature reviewed

The variables associated with the selection of the periodicals were not a part of this study. The expertise of the researcher, advisors, and the librarians were used to select the journals. The selection was based on the chemistry and education needs as outlined in the appendix. The premise of ACCESS tapes was that teachers needed current information from sources not readily available. The expertise of the researcher in selecting periodicals is substantiated in that only Science was reported by participants as a periodical read by more than two teachers on the list of twenty-one periodicals used in this study.

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[1]Carlos Caudra and Ann Luke, Annual Review of Informational Science and Technology, Vol. XV (Chicago: Encyclopedia Britannica Inc., 1970), p. 280.

Most revealing was the lack of educational research periodicals reported as reviewed by the sampled teachers. Science Teacher came closest to meeting the methodology criterion, yet it is more scientific and deals with curriculum studies rather than educational research. Only one teacher reported reviewing Journal of Research in Science Teaching, a publication whose editors feel should be in every science department's library. None of the ten educational research reporting journals used in this study were mentioned as a source of information. This study did not consider why chemistry teachers do not regularly review educational research journals. It is the hypothesis of this researcher that chemistry teachers place little value on educational research. Boyer supports this statement:

> In 1972, 33,000 doctorates of original and extended research are worthy of publication but Dissertation Abstracts is usually overlooked in reports of English language abstracting and indexing service.[1]

This study indicates that the primary journal is not used as a source of information by the chemistry teacher. Secondary sources containing review articles as found in the journals accompanying membership in chemistry teachers professional associations are re-

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[1]Calvin Boyer, "The Ph.D. Dissertation: An Analysis of the Doctoral Dissertation as Information Source," Dissertation Abstracts International (August, 1972), p. 13.

viewed. It is recommended that a user profile study be initiated to include factors involved in the non-selection of original chemical and educational research. Such a study would involve funding beyond the capacities of this doctoral student. That type of study should focus on the adequacies and inadequacies of the chemistry teacher, rather than the literature or reporting systems. It may be that the teacher is insufficiently prepared to understand primary research studies, or it may be that the teacher's perception of the job does not include a need for this information. This study supplies no information to warrant hypotheses along these variables, but simply points out the specific periodicals used by the sample population and makes the inference that those periodicals judged by experts as appropriate primary sources are not reported as being reviewed regularly by the sample population.

4. Acceptability of ACCESS tapes

The sampled chemistry teachers did not subscribe to ACCESS tapes. This fact stands out clearly and is the most important finding as defined by the stated hypotheses of this study. Only four per cent returned a sum of money to continue the service. Four per cent of the potential chemistry teachers who had received one or

two free tapes and considerable mailings does not warrant sufficient profit in time and money to continue the abstracting service. The profit margin (one dollar per tape) requires about two hundred subscribers to justify the twenty hours of professional time needed to produce the tapes. The advertising cost (three dollars per school) to yield two hundred subscribers with a four per cent return is not feasible. The hypothesis was set for a twenty per cent return, realizing that an experimental group would be more likely to respond than a random solicitation to all chemistry teachers.

The feasibility of ACCESS tapes rested on hard data of sending money for the representation of acceptibility to the abstracting service. This is a strict criterion for a research hypothesis. Contrast the four per cent subscribing with the sixty-six per cent (thirty of forty-five teachers) responding to ACCESS tape #1 with sufficient positive verbalism to request a second tape. It would have been another level of commitment to have tested the feasibility of ACCESS tapes on the basis that twenty per cent listened to tape #1 and would volunteer their time and concern to listen to tape #2.

Three studies report reliance on soft data from questionnaires relative to abstracting services:

1. Roberts reports on a project designed for free

distribution of abstracts to members of the Linguistic Society of America. Publicity in the association's journal, ERIC, and two other magazines plus 1500 handouts resulted in only twenty-five requests for the service. A follow-up next year to the 5000 members resulted in two hundred returns of a pre-addressed envelope. The project was abandoned for lack of interest (only four per cent).[1]

2. Kuney reports on a project of the American Chemical to publish a single article service. One thousand members of the American Chemical Society were sent listings of titles from fifteen A. C. S. journals, from which they could select a free copy. Forty-two per cent requested one or more articles with a mean of 5.8 articles per user. The American Chemical Society launched the service as twenty-five per cent claimed they would definitely subscribe.[2]

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[1]A. H. Roberts and A. G. Woyna, Experiment in Fast Dissemination of Research in Selected Fields in Linguistics (Arlington, Vt.: Center for Applied Linguistics, August, 1972), p. 26.

[2]Kuney and Weisgerber, "Primary Information," p.150.

3. Wooster reports on a survey of microfiche users. Attitudes toward microfiche use of government reports were measured on a scale of: like it (25%), like it with reservations (25%), and despise it (50%).[1]

One of the above studies uses commitment of a returning pre-addressed envelope; another of a written commitment; and the third with a fuzzy term of "like it". This study sought to present hard data with a survey questionnaire. The hard data indicated poor acceptance to ACCESS tapes, while the soft data indicated an acceptance.

The information collected in this study indicates that ACCESS tapes were not acceptable to chemistry teachers for many reasons. The following reasons were directly stated or implied from the data and are proposed for future research into why an audio cassette abstracting service to chemistry teachers was or is not acceptable.

1. Technical rejections--A list of responses includes items that could have been improved up-

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[1]Harold Wooster, "User Attitudes Towards Microfiche of Government Reports and Other Documents (paper presented at 158 American Chemical Society's national meeting, New York, September 8-11, 1969), p. 9.

on to make the service more acceptable under the technological criterion. The ability to locate article number five or any other specific information could have been done with a high frequency beep, recognized only on fast forward or rewind. Recent studies with word listening rates indicate that tapes can be condensed without loss of comprehension. Tapes recorded at two hundred words per minute (ACCESS tape and average conversation) are speeded up to three hundred or three hundred fifty words per minute with this new technology and still retain clarity.[1] The use of two or three voices elevates the monotony; better on/off switches; improved recording equipment for low noise; all could have been a factor in acceptance of the tapes, but limitations of this study prevented their examination.

2. Information inappropriate--A list of rejections could be based upon a set of reasons within the theme that the abstracted information was

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[1]Robert Jones and Joline Jones, The Effect of Multiple Channel Auditory Presentation on Learning (Worchester, Mass.: Worchester State College, April, 1972), p. 13.

not of use to the chemistry teachers. The ease or difficulty of understanding the information is lacking from this study. The negative responses recorded in Chapter IV do not indicate information inappropriate, yet it is the hypothesis of this researcher that the information is inappropriate to the chemistry teacher's present learning habits. Obtaining information from a primary journal is not within the tradition of the average teacher. An examination of periodicals read by the group indicates the difference in the scientist's and the teacher's use of recent research information.

3. Intergroup reflections--Examination of the responses indicates that ACCESS tapes were not acceptable as the method lacked group reinforcement of usable information. Schools with four or more chemistry teachers responded with most use of the information. It is possible that where a sharing of the information occured, the usage was motivated by group reinforcement processes. Generally the tape was an individual experience which lacked the interaction with peers. Verbal feedback was

lost; lost because of the inconvenience of recording teacher reaction to the tape or lost because feedback was not important to the teachers. No distinction can be made. The communication among teachers at National Science Foundation summer institutes is an example of successful continuous training. At such institutes, communication among the group is a large factor in acceptability of the information. Lack of a feedback is interpreted as reflecting no personal identification with the abstractor. Havelock consistently attempts to make the point that linkage is a series of two-way interaction process which connects the user with various resources.[1] ACCESS tapes did not achieve a successful linkage as messages were not exchanged (only four of thirty-five in the experimental group returned recorded comments). Promotion of verbal feedback may have increased had the checklist not been used. It is possible that teachers felt responsible to use the checklist and were not up to both a verbal and written response. Had

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[1]Havelock, Scientific Knowledge, p. iv.

> the teachers used the media of the abstract they might have been more receptive to its use. Talking, even if delayed, builds trust and provides clues for attitudes and perceptions. It is this trust that opens channels of effective and efficient information transfer.

This researcher predicts that cassettes will continue their growth as information disseminators. Technology will speed this acceptance. Miniaturization, longer lasting batteries, more convenient earphones, a better indexing and locating system will enable dissemination via the cassette. Acceptability also needs to be acquired. Future research should not focus on the technical aspects such as word rate, voice quality, etc. These kinds of comparative studies will yield no better results than past studies of traditional versus new methods comparisons. The continuously improving technology and control of other variables will yield inconclusive results.

If chemistry teachers are to accept an audio abstracting service, they first must accept the concept that both chemical and educational research information is useful to their teaching. It is therefore recommended that:

1. The total education of teachers have a stronger

component of current research utilization. Studies directed at attaining this goal might include:

1.1 User attitudes of research involving audio-visual aids during courses.

1.2 Determining the optimum number of research studies that are appropriate for inclusion in a particular course.

1.3 Determining the perceptions of the teacher toward job requirements and research studies.

2. Systems of feedback be studied that are aimed at group interactions with the linkage system. Studies directed toward this goal might include:

2.1 The effect of more than one teacher listening to the tape simultaneously.

2.2 Measuring trust toward the abstractor over time and a set of other variables as number of responses recorded on the tape.

5. Chemistry teachers profile

Chemistry teachers exhibited characteristics of a teacher more than a chemist. Chemists prize primary

journals, while teachers receive current information from journals resulting from their membership in teacher associations. The data indicate that high school chemistry teachers of the New England Association of Chemistry Teachers are somewhat dependent on three monthly journals for continuous up-dating of chemical and methodology information. The average teacher is reviewing the association's Journal of Chemical Education (as might be expected since the sample was taken from this membership list), the American Chemical Society's journal for secondary schools, Chemistry, and one other journal from a wide range of choices. This average teacher depends upon the subscribed journals rather than any systematic review in a professional library.

The data obtained from this 1972 study has similarities to a 1960 study by D'Agostino[1] and a 1963 study by Mills.[2] Similarities include profile of age, education, sex, membership, and topics of teaching interest. Reliability and validity for this study are based on these similarities to previous studies.

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[1] D'Agostino, "Differences," p. 131.

[2] Mills, Characteristics, p. 36.

6. A retrospect

Respect for the chemistry teacher was greatly increased by this study. They exhibited a sincere desire to help a stranger, this researcher, to read three pages of instructions and data sheets, to give up two hours of precious time to listen to the tapes, and to be concerned enough to cooperate in this study. The sampled group showed a sincere desire to improve their information source: they gave this method a fair trial and are seeking new avenues to keep abreast of the information explosion. My sincere thanks to this group of professionals.

CHAPTER VI

SUMMARY OF THE RESEARCH

1. Hypothesis justification

A set of five hypotheses was submitted for examination to determine the feasibility of a monthly review of chemical and educational research via audio cassette tapes.

This study is one phase of the on-going self-initiated career preparation that every teacher is engaged in. Periodicals provide the major portion of information dissemination. Data is presented to indicate that the overwhelming volume of written material a chemistry teacher must scan is beyond the capacities of most teachers. More precisely, it is the profile of user needs that is generally lacking in the dissemination process. The problem is not with the production of new knowledge but with the utilization. Research in the utilization of information has not focused on the linkage systems other than computer systems. Although audio cassettes are being used for correspondence, business training, association minutes, specific lectures, etc.; the author found no systematic research dissemination via the audio cassette media.

The hypotheses submitted were designed to predict the acceptance of a linkage system via the audio cassette.

2. Research design

The research design used is a classical statistical inference model which attempts to show a causal relationship between teachers receiving a treatment and a control group over the same time span. The major concern is control for the history effect that could occur. A diagram will illustrate.

Sampling	Treatment	Measurement
Experimental (50)	Tape #1 + letters	Questionnaire + returned tape
	Tape #2 + letters	Questionnaire + returned tape + subscription
Control (50)	---- + letters	Questionnaire
	Tape #2 + letters	Questionnaire + returned tape + subscription

The design is based upon the assumption that the potential subscriber of the service needs at least two months trial. Once the control group responds to the questionnaire their usefulness as a control becomes limited. Therefore their data become useful for reliability and validity testing of the treatment with tape #2.

3. Sampling

The membership list of the New England Chemistry Teachers Association was sampled by use of a random number table. Two groups of fifty high school teachers were then chosen as experimental by the flip of a coin. This feasibility study required prediction of potential users. Random assignment increases this predictability.

4. Treatment

Treatment is not considered a variable in this design. The treatment consists of mailing a set of audio cassette tape containing abstracts of seventeen research studies, personal questionnaire, checklist of articles used, and a letter of introduction. The procedure to choose and edit the abstracts is standardized to provide replication of the treatment and included as part of the appendix. The procedure involves two screens in the time order of: first, articles from a specific list of twenty-one journals are screened on a set of criteria based upon the course outline and methodology of the chemistry teacher; second, random ordering of these articles for inclusion on the tape.

Both control and experimental groups returned a postcard indicating receipt of the tapes, a ninety-five per cent return. Data and tapes of both the control and

experimental groups were returned over the same time span indicating control for an event that might have affected one group more than the other. The split-half data analysis and t-test for the difference between means was insignificant, indicating reliability of the measuring instrument.

5. Measurement

The measuring instruments were designed to obtain personal data to enable prediction of potential subscriber, to obtain extent and type of information used by the chemistry teacher, and to determine the potential market for an abstracting service. The soft data on the questionnaire and checklist was consistent with data from other studies. The acceptance of the ACCESS tape was measured with hard data: actual receipt of payment for the service.

6. Results of the experiment

The data indicate that the high school chemistry teacher of the NEACT is likely to be age thirty to fifty, teach in a school of over one thousand students, review two to four periodicals monthly, and express the view that these journals are "moderately" relied upon for updating information.

The data indicate that ACCESS tapes are not feasible in their present form. Only four per cent of the experimental group subscribed for a third tape, yet sixty-seven per cent returned favorable comments about the tapes.

It was predicted that chemical information would be used from the abstracted research articles more than methodology information. It was found that both were equally received and used.

It was predicted that the successful linkage system would have a feedback, teacher to abstractor, of remarks on the media of dissemination. This was not found to be true: only eleven per cent recorded some remark on the returned tape even though they were reminded of this option.

7. Limitations of this study

The limitations placed on this study are of two types: limitations based on resources available to this researcher and limitations based on design that the treatment of the ACCESS tape was not a variable. Limitations are discussed in the text under procedures of sampling, the treatment, and the measurement. Sampling was restricted to the sub-set New England Chemistry Teachers Association, thus limiting inferences to the

general population. A stratified sample among other membership lists and non-member sampling in other geographic areas may have given other results. A brief comparison with two other studies indicated personal characteristics were similar, but it is still an untested hypothesis that acceptability for audio cassette research abstracts subscription might be different with another geography or non-joiner of an association.

The treatment standardization procedures were designed for replication of the experiment. This restricted the study to a specific list of research journals from which the abstracts were taken. The random selection of articles, after a prescreening usage criteria was met, avoided the bias of the researcher but still limited the selection. The researcher might have selected a different set based on a bias that might have been more acceptable to the chemistry teachers. Standardization of the recording techniques imposed the limitations due to one voice, a sixty minute cassette, length of abstracts, supportive material while reviewing the cassette, and quality of tape. Each of these attributes could have been a variable which might have influenced the data. For instance, a thirty minute tape twice a month might have been more acceptable.

The measurement procedures placed a limitation on

on the results. Data for hypothesis testing was mainly from written responses, in contrast to the audio method of research dissemination sought to be developed. Had the instructions, the measurement of which articles were used, and personal data been solicitated by audio techniques, then acceptability might have been conditioned. Measurement was also limited due to the short time span between listening and responding to the questionnaire. The actual usage of the information might not have occurred for some months later. Acceptability might have been different had the study extended over a longer period.

A P P E N D I X I

PROCEDURE FOR CHOOSING ARTICLES TO REVIEW

The procedure for the selection of research articles should result in articles that are of interest and usefulness to the chemistry and in articles that would be likely to be chosen by another researcher with similar qualifications. The details of the procedure described below set criteria for usefulness, for validity of treatment, and for the qualifications of the researcher.

For the purposes of this study the interests and usefulness to the chemistry are classified into two areas: (1) chemistry content of course, and (2) methodology of teaching. An article for consideration must fit into one of these areas.

The following outline is considered to be inclusive of traditional textbook and new chemical curriculum of CBA and Chem Study. A time order is not implied in this topical outline.

Outline for Chemistry Curriculum:
Secondary School

I. History and philosophy of chemistry

II. Measurement systems: metric and data handling

III. Atomic and molecular structure
electrical nature of matter
bonding: ionic, covalent, metallic, polar

IV. Conservation of matter and energy
mole concept
entropy and enthalpy

V. Chemical periodicy
groups I-VII and transitional metals

VI. States of matter
properties of solids, liguids, gasses
kinetic model
solution and solubility relations

VII. Acid and base models

VIII. Dynamic equilibrium

IX. Oxidation: reduction reactions

X. Organic chemistry: nomenclature and group characteristics

XI. Descriptive systems: biochemistry, nuclear, and environmental

The chemistry teacher is also concerned with the methodology of the teaching process. For the purposes of this study the following topics will be considered.

Methodology Concerns of
the Chemistry Teacher

1. Curriculum studies
   1.1 Comparison of descriptive studies chem. courses
   1.2 Interdisciplinary courses
   1.3 Policy statements by state or national groups
   1.4 Implementation procedures
   1.5 Evaluation studies
   1.6 Teacher preparation programs for cur. change

2. Techniques of laboratory management
   2.1 New student experiments to fit course outline
   2.2 Student management techniques

2.3 Facilities and equipment studies
2.4 Conditions for good instruction
2.5 Evaluation methods

3. Techniques of classroom management
   3.1 Class size
   3.2 Student grouping--use of peer group
   3.3 Scheduling

4. Learning theory
   4.1 Cognitive styles
   4.2 Affective styles
   4.3 Theory into practice techniques

5. Techniques of communication
   5.1 Audio-visual methods
   5.2 Lecture-demonstration methods
   5.3 New techniques: games, programmed guides, modular unit

6. Teacher behavior
   6.1 Self-analysis techniques
   6.2 Evaluation techniques

The use of criteria for selecting an article to be reviewed is conceived as a screening process. The sequence is:

1. Obtaining copies of the periodicals (or microfiche) to be reviewed. A list of these is included.
2. Scanning the titles to meet the criteria:
   2.1 Usefulness to the chemistry teacher as determined by being included in the chemistry curriculum or methodology concerns as outlined above.
   2.2 Usefulness to the student in chemistry class in that knowledge or technique could be used.

2.3 If the title meets either 2.1 or 2.2 then the article must be a report on research findings as contrasted with an opinion of authority report.

2.4 The article must be at the level of understanding appropriate to the high school teacher as contrasted with being elementary or too advanced. This will be the judgment of the researcher.

2.5 The article will be included if the findings are a potential benefit to improvement of the style or content of the chemistry teacher's course.

3. The titles generated by this search and screening will be randomly listed for priority on the cassette tape. (A random list of numbers will be used.)

4. The article will be read, abstracted, and edited for inclusion in the monthly cassette sent to teachers. An article may be removed from the list if on reading it is found that the criteria are not met. The next article is taken. The number of articles chosen is determined by the forty minute tape; the number will be fifteen, plus or minus five.

The procedure described for selecting a research study to be reported to the chemistry teacher is a compromise of random procedures that would yield high reliability and validity to the study and selection procedures that make the information useful to the teacher. Randomness is used as a second screen partly because of the number of studies that could be included and partly because of the importance of the information. There are three to four studies for every one that can be included on the tape. The editors of the magazines have already set quality and other criteria screening procedures and it is not the purpose of this study to judge the quality of the report, but rather its usefulness to the chemistry teacher. This justifies the random choice after the usefulness screen.

The periodicals used in this study have been selected by this researcher to contain, regularly, articles to fit the criteria of usefulness to the high school chemistry teacher as defined in previous sections. The periodicals were of three types:

1. Chemical journals--Weekly or monthly journals that synthesize research studies in one area in a manner appropriate to chemistry outline and at level of underatanding of the chemistry teacher.
2. Educational journals--Monthly or quarterly

that have major function of reporting research studies.

3. Secondary reviews--ERIC and Dissertation Abstracts.

Chemistry Journals

1. American Scientist
2. Angerwante Cheme International
3. Chemistry and Industry
4. Chemical Engineering Research and Development
5. Chemical Society Reviews
6. Endeavor
7. Education in Chemistry
8. Journal of Air Pollution Control
9. New Scientist
10. Science
11. Science Progress

Education Journals

1. Educational Technology
2. Journal of Education Research
3. Journal of Experimental Education
4. Journal of Research in Science Teaching
5. Phi Delta Kappan
6. Review of Educational Research
7. School Science and Mathematics
8. Science Education
9. Dissertation Abstracts International--Humanities
10. Educational Research Information Center (ERIC)

All of the above journals have been examined by this researcher for the past three issues and found to contain articles that fit the criteria. Other journals have an occasional article that fits the criteria, but the researcher judged that time in searching would be better spent.

The following list of articles (only briefly noted)

passed the two screens and were randomly assigned a position for recording their abstracts. The articles are listed by number from an alphabetical listing of the journals. From a set of random numbers, the articles from chemistry journals were assigned an order and the education journals' articles were assigned a separate ordering. The tape will include one-third chemistry content and those articles will appear second, fifth, eighth, eleventh, fourteenth, and eighteenth as time limitation of the recording allows.

List of articles considered	Random Selection
I. Chemistry oriented articles	
1. Racker, "Bioenergetics," Am Sc	
2. Brown, "Liquid Crystals," Am Sc	
3. Schoner, "Active Transport," Agwt	#9
4. Dalyell, "Explosions," C & I	
5. O'Reilly, "China," C & I	
6. Carbonell, "Enzymes," AIChE	#8
7. Jaha, "Noble Gases," C S Re	#7
8. Fleming, "Themoluminescent," Ed C	
9. Zuffanti, "Repulsion," Ed C	
10. Dodge, "Herbicides," End	#10
11. ----, "Air Pollution," End	
12. Schildknecht, "Evolutionary," End	

13. Brown, "Geochemistry," End #2
14. Wilson, "SO_2 Smog," J Air P #4
15. Iliff, "Organic," New Sc
16. Loraine, "Hormones," New Sc #3
17. Kellogg, "Sulfur," Science #6
18. Spilhaus, "Ecolibrium," Science #5
19. Peterson, "Accumulations," Sc P #1
20. Hewson, "Water," Sc P

II Education oriented articles

1. Livingston, "Simulation," Ed Tech
2. Grieve, "Cognitive," J Ed Res #13
3. Furukawa, "Learning," J Exp Ed
4. Anderson, "Mutually," J Exp Ed
5. Campbell, "Interaction," J Res Sc Tch #20
6. Novak, "College," J Res Sc Tch #16
7. James, "Attitude," J Res Sc Tch
8. Davidoff, "Computor," J Res Sc Tch #14
9. Herron, "Behavioral," J Res Sc Tch #2
10. Shockley, "Dysgenics," Kappan
11. Gage, "Heritability," Kappan #7
12. Kumar, "Memory," R Ed Res
13. Osborn, "Historical," Sch Sc & M #1
14. Wood, "Process," Sch Sc & M #15
15. Klopfer, "Individualized," Sc Ed #4
16. Rogers, "Curriculum," Sc Ed #5

17.	Novak, "Ausubel," Sc Ed	#19
18.	George, "Inner City," Sc Ed	
19.	Penny, "PSCS," Dis Abs	
20.	Cooley, "Society," Dis Abs	#9
21.	Stoops, "Tracking," Dis Abs	
22.	Essenfeld, "Generalized," Dis Abs	
23.	DeOliva, "Inquiry," Dis Abs	#10
24.	ED052974, "Mysterious Box"	#11
25.	ED052607, "Simulation"	#8
26.	ED052964, "SMIP"	#12
27.	ED052932, "Topic Aids"	
28.	ED052930, "Conditions"	#3
29.	ED052988, "Standards"	
30.	ED052940, "Natural"	#18
31.	ED052972, "California"	
32.	ED052993, "Ecology"	
33.	ED052063, "Behaviors"	
34.	ED052925, "Policy"	#17
35.	ED052926, "Reviews"	#6

A P P E N D I X II

Procedure and Criteria for Editing Research

The procedures described have the purpose of obtaining a quality tape that will not be a deterrent to the study, yet providing a standard procedure to achieve reliability and validity. The standards outlined are the result of listening to other cassette tapes and of interviews with Mr. Walsch and Mr. Passer of the American Chemical Society. The A.C.S. is developing a program for continuing the education of professional chemists via the cassette lecture. The A.C.S., "Guidelines to the Lecturer," forms the core for criteria to assure quality tapes.

Procedure for recording:

1. Obtain room sufficiently sound-proof to remove excess noise from traffic, air, or auto. College sound studio will be used for this study.
2. The master tape should be of high quality to ensure a high signal-to-noise ratio. The quality will be at least equivalent to BASF-hifi (Del Padre recommended).
3. The recorder will be Sony automatic level con-

trol, cassette recorder, Model 100 (Sony's best). A hand control microphone will be used.

4. The researcher will bring to recording room--titles, abstracts in outline form, zerox copies as needed, and notes from which the review will be taken.
5. Introduction to the study will relate the study's importance from the point of view of usefulness to the teacher. Reference to curriculum or methodology as outlined in Appendix I will be made. "This study from the Journal of Clinical Endocrinology may be helpful to illustrate the usefulness of the isomers of sugar," (item X of chemistry outline).
6. A two to five minute description of the study with sufficient details so that the teacher could generate a similar study. The sampling procedure to identify the population, the statement of hypotheses, the description of treatment variables with control for validity and reliability, and the measuring instruments will be described.
7. Recommendations of the study will emphasize the usefulness of the study to the teacher or students in his class.

8. The tone and pace of the abstract should reflect the enthusiasm for the study, using normal lecturing speed and speaking distinctly. The rule is that a few grammatical errors will not hurt if an unstilted presentation results.
9. Reference will be made to the list of bibliography and any formula and diagram included on the mailing list.
10. Master tape will be duplicated on quality tapes (equal to BASF-EDU) by Del Padre of Springfield.

A P P E N D I X III

PROCEDURE FOR SELECTING SAMPLE POPULATIONS

The procedure for selecting one hundred high school chemistry teachers from the New England Association of Chemistry Teachers is based on random sample techniques.

The membership list of the NEACT is located on file cards in the office of the secretary. Miss Rose Pelegrine, chemistry teacher at Newington High School, explained the notation on the cards: cate dues paid, occupation, address change, etc. A copy of two pages from a random book of numbers was used to select the one hundred teachers. Name cards were ordered by the alphabet and names were drawn in order of the random number sequence. Thus 009 and 414 resulted in the ninth and four hundred fourteenth cards being examined. Only NEACT members with dues paid (thus somewhat active) and with a high school position were selected for this study. Thus a card with either college professor or dues lapsed member was excluded and the next random number was used.

The two lists of fifty teachers were drawn and a flip of the coin determined which group was to be the experimental group. The list of names are attached.

The designated number refers to actual data of that person as used in other tabulations in this study.

1. Margarita B. Apicella
   162 Mystic Street
   Arlington, MA 02174

2. Edward F. Barry
   Main Street
   Marstons Mills, MA 02648

3. Gustava E. Bonadio
   48-17 42nd Street
   Long Island, N.Y. 11104

4. Rudolph Brada
   4585 Zuni Street
   Denver, CO 80211

5. David H. Byron
   88 Rawsom Street
   Leicester, MA 01524

6. Elliott R. Carlson
   80 Sylvan Street
   Melrose, MA

7. Leonard Chauvin
   14 Fifth Avenue
   Webster, MA 01570

8. Rev. J. Michael Conley
   10 Eliot Road
   Belmont, MA 02178

9. Mrs. Edward Dodge
   59 Lenox Avenue
   Albany, N.Y. 12203

10. William M. Haney
    381 Cory's Lane
    Portsmouth, R.I. 02871

11. Mr. Enos E. Held
    16 Fourth Street
    Bayville, N.Y. 11709

12. Francis C. Henrick
    296 Fan Hill Road
    Monroe, Conn. 06468

13. Barbara Hilli
    103 Pinewood Trail
    Trumbull, Conn. 06611

14. Nancy M. Houk
    27 East Street
    Lee, MA 01238

15. Wayne L. Hunter
    3642 N. Piedmont St.
    Arlington, Va. 22207

16. Dalia Ivaska
    61 Alban Street
    Dorchester, MA 02124

17. Robert E. Jackman
    Apt. 5-587 Bridge St.
    N. Weymouth, MA 02191

18. Stephen L. Jacobs
    P. O. Box 68
    Dexter, Maine 04930

19. Graham Jones
    24 Isabella Street
    Melrose, MA 02176

20. Allan E. Katz
    28 Considine Road
    Newton Center, MA 02159

21. George M. Kennedy
    192 Vadnais Street
    Chicopee, MA 01020

22. Mrs. Patricia A. Kocsis
    229 Harrison Street
    Manchester, N.H. 03104

23. William A. Kozera
63 West Street
Hadley, MA 01035

24. Donald S. Latham
70 Belvedere Drive
Cranston, R.I. 02920

25. Carl G. Lauro
9 Pinehurst Avenue
Providence, R.I. 02908

26. Joseph W. MacQuade
12 Gerry Street
Marblehead, MA 01945

27. Leonard E. Marget
64 Prescott Avenue
Chelsea, MA 02150

28. William J. Marks
790 Boylston Street
Apt. 25-1
Boston, MA 02199

29. Carl F. Martin
134 Fayette Street
Buckhannon, W.Va. 26201

30. Russell F. McCann
10 Bassett Street
Foxboro, MA 02035

31. H. Clark Metcalfe
118 Audbert Drive
Pittsburgh, PA 15236

32. Marjorie Nims
79 Maple Avenue
Keene, N.H. 03431

33. Adele O. Oberlander
2633 Davis Avenue
Pennsauken, N.J. 08109

34. David P. Olson
69 Hilltop Drive
Keene, N.H. 03431

35. Charles Oxman
562 Easton Avenue
Somerset, N.J. 08873

36. R. Barbara Peabody
29 Hanover Street
Newbury, MA 01950

37. John S. Petix
194 Rose Avenue
Hackensack, N.Y. 07601

38. Anthony D. Picerelli
37 Euclid Avenue
Riverside, R.I. 02915

39. Harry Pinney
67 Wright Road
Wethersfield, Conn.

40. Samuel R. Powell
Suffield Academy
Suffield, Conn. 06078

41. Stephen G. Romaine
102 Tredeau Street
Hartford, Conn. 06114

42. Miss Elizabeth Sawyer
11 Scotland Road
Norwichtown, Conn. 06360

43. Peter Sereico
185 Belleville Avenue
Bloomfield, N.J. 07006

44. Sister Thomas Mary
St. Mary's Convent
182 First Street
Passaic, N.J. 07055

45. Sister M. F. Mollura
St. Clare High School
190 Cumins Highways
Roslindale, MA 02131

46. Sr. Elizabeth O'Connell
50 Oakland Street
Wellesley Hills, MA 02181

47. Sr. Helen V. Walsh
Cathedral High School
Springfield, MA 01109

48. H. Neil Soule
62 Shaker Land
Littleton, MA 01460

49. Joseph F. Tarello
190 Mountain Avenue
Apt. 502
Malden, MA

50. Angela M. Trovato
8 Narragansett Ave.
Westerly, R.I. 02891

51. Charles H. Arnold
31 Woodland St.--11N
Hartford, Conn. 06105

52. Wendell F. Bennett
39 Lakeview Avenue
Natick, MA 01762

53. Paul C. Billett
228 Grandview Road
Media, PA 19063

54. Philippe Bouthillier
P. O. Box 302
Hartford, VT 05047

55. Mr. John Brennan
76 Derly Street
Somerville, MA 02145

56. William Burton
57 Reservoir Road
Springfield, VT 05156

57. Thomas Carlomegno
29 Hanover Place
Glen Rock, N.J. 07452

58. Dr. Sara Anne Cassaday
143 Overbrook Drive
Stamford, Conn. 06906

59. Kathleen C. Golas
33 Nancy Drive
Enfield, Conn. 06082

60. Leonard S. Hamilton
117 Ivy Road
S. Weymouth, MA 02190

61. Francis S. Hart, Jr.
56 Hollis Avenue
N. Quincy, MA 02171

62. Edmund J. Heilmeier
120 Leonard Place
Dover, N.J. 07801

63. Clarence R. Heufelder
P. O. Box 423
29 Mattapan Street
Teaticket, MA 02536

64. Marguerite Houlihan
35 St. Clement Road
W. Somerville, MA 02144

65. Richard T. Huelsmann
East Shore Drive
Stafford RFD 2
Rockville, Conn. 06066

66. Albert Iannuccilli
156 George Street
Warwich, R.I. 02888

67. William M. Jackson
289 Fairview Avenue
Fairfield, Conn. 06430

68. Robert R. Johnson
1116 Grant Street
Waterloo, Iowa 50702

69. James F. Keaney
English High School
Ave. Louis Pasteur
Boston, MA 02215

70. Catherine F. Kelliher
84 Surret Street
Medford, MA 02155

71. Roy J. Ketchum
10 Summer Lane
Rochester, N.Y. 14626

72. Austin S. Kibbee, Jr.
6 Hollmark Road
Portland, Me. 04110

73. Robert E. Knights
20 Pond Street
Georgetown, MA 01833

74. Kenneth C. Kruse (Mrs.)
85 Britannia Street
Meriden, Conn. 06450

75. Harold F. Kyte
Box 493
Bradford, VT 05033

76. Alfred R. Lambert
10 Greenwood Lane
Portland, Me. 04103

77. Everett F. Learnard
18 Florence Avenue
Norwood, MA 02062

78. Mary M. Leary
48 Westland Avenue
Winchester, MA

79. Samuel R. Mackintosh
320 Brookmead Drive
Cherry Hill, N.J. 08034

80. Raymond Martin
9 Douglas Avenue
Beverly, MA 01915

81. James Moore
271 York Street
Canton, MA 02021

82. James H. Murphy
Wakefield High School
Wakefield, MA 01880

83. Joseph P. Numes
R.D. #1
Richmondville
New York 12149

84. Mr. Michael Olmsted
Wilbraham & Monson Acad.
Wilbraham, MA 01095

85. Walter J. Palasits
176 Mountain Way
Rutherford, N.J. 07070

86. Drew Panko
115 Woodland Hills
Greenburgh
White Plains, N.Y. 10603

87. Ronald I. Perkins
39 Crawford Avenue
Exeter, N.H. 03833

88. Joseph M. Pignone
25 Flint Street
Manchester, N.H. 03103

89. Mary Ellen Plumb
Concord Academy
Concord, MA 01742

90. Gerald Robbins
154 Roger White Drive
New Haven, Conn. 06511

91. Edward W. Savery
Brinton Bridge Road
R.D. #5
West Chester, PA 19380

92. Marco H. Scheer
4 Lynde Street
Nashua, N.H. 03060

93. Aram H. Sevagian
104 Hilltop Street
Milton, MA 02186

94. Sr. Mary Alonzo
295 Adams Street
Newton, MA 02158

95. Sr. Regina Cordis
Notre Dame Convent
126 Glenwood Avenue
East Orange, N.J. 07017

96. Sr. Gertrude Mary Kerin
115 S. Sussex Street
Gloucester, N.J. 08030

97. Patricia Sobota
18 Condon Road
Bristol, Conn. 06010

98. David A. Sweeney
20 Shawn Drive
Bristol, Conn. 06010

99. Samuel H. Topper
115 Bannon Avenue
Buchanan, N.J. 10511

100. T. J. Tuori
24 Baker Hill Road
Great Neck, N.Y. 11023

A P P E N D I X IV

The following letters and questionnaire were mailed with tapes to the experimental and control groups. The letters have been examined by peer research students for clarity and bias and were re-written twice. The justification for the questionnaire is part of Appendix V.

1. March 24, 1972: Introduction to the study--Experimental group.
2. Personal data sheet: Experimental group
3. Check list: Data from experimental group
4. Bibliography of ACCESS tape: Control and Experimental group.
5. March 29, 1972: Introduction to study--Control group.
6. Check list: Control group data form.
7. April 27, 1972: Second cycle letter to experimental group.
8. Check list #2: Control and experimental data sheet.
9. April 26, 1972: Control group introduction to tape #2.
10. June 3, 1972: Reminder to return data.
11. Requisition form for ACCESS tape: Test hypothesis I.

The criteria to check must distinguish between users and non-users of the information. The following were examples considered, taken from Oppenheim[1] and experience:

1. Very important, important, indifferent, undesirable.
2. Of great importance, of some importance, of no importance.
3. Knowing this will: change my teaching, not change my teaching.
4. Used information: in class, with a colleague, did not use.
5. Did not know of this study, used information but from different source, just interesting information.
6. Likely to: get quick usage, get no usage, be considered.
7. Did not understand, did understand but too sophisticated.

The following set was decided upon due to the hypotheses stressing the criteria of usefullness rather than importance:

1. Used information with your class.
2. Used the method with your class.
3. Used information but from another source.
4. Discussed article with a colleague.

---

[1]A.N. Oppenheim, Questionnaire Design and Attitude Measurement (New York: Basic Books Inc., 1966), p. 135.

5. Expect to use at later time.

6. Just interesting information.

7. Information of no value.

The teacher participant is instructed to check one or more of seven criteria for each article abstracted on the tape. It is expected that those articles of no value will be forgotten and checked appropriately. Participant checking #1, #2, and #4 will be considered using the information: all other responses will be considered rejection of the information. This will dilute the expected halo effect by those participants liking the free service and being part of the experiment.

The control group, being sent just the questionnaire, will have the same list of articles and asked to check the criteria on the basis that they had heard or read about the information from another source. Criterion #3 will read:

3. Did not know the contents of this study.

The tendency of the control group will be to cover up their ignorance of current information.

The second part of the questionnaire attempts to obtain a user and non-user profile. In choosing a reasonable number of variables, the following were considered:

1. Personal data--Age, marital status, dependents, sex, nationality, physical handicaps, etc.

2. Education--Degrees, major, minor, highest degree, grades, colleges, size of school, rank in class, number of chemistry credits, number of N.S.F. fellowships, if presently enrolled in college, etc.

3. Type of school--Number of other chemistry teachers, size of school, urban or suburban school, public or private, specialized or comprehensive school, etc.

4. Type of class--Size, boy/girl ratio, homogenous, number of minutes of chemistry per week, minutes of laboratory, age of furniture, arrangement of furniture, college preparatory or general, ability, interest in chemistry, likelihood of doing science projects, etc.

5. Teaching load--Number of preparations, number of other chemistry classes, other school demands, outside of school job, supervisory position, number of free hours.

6. Teaching philosophy--Attitude toward science, amount of time lecturing, number of audio-visual aids used, amount of time focusing on student questions, attitude toward textbooks, etc.

7. Personal habits--amount of time reading per week, number of library stops per month, driving time to work, periodicals read regularly.

8. Other data--Availability of cassette tape recorder, author of textbook.

It is a study in itself to obtain a profile of the chemistry teachers within the sample population: the direction of this research is to test feasibility of a subscription service, not to complete a user profile. The author is attempting to predict what teacher would

subscribe to a cassette service. Although many of the above profile descriptions may yield a better predictor, it would be nearly impossible to obtain data to determine beforehand if a teacher would subscribe. For example, a high correlation between attitude toward science and use of audio cassette abstracts is likely; yet it would not be practical to obtain this information--it would be more reliable to send the free sample tape for trial. Therefore, for this study the following information is requested on the premise that a potential list of subscribers could be obtained.

First Questionnaire: to test Hypotheses #2-#5

1. Age: 20-25__, 26-35__, 36-45__, 46-55__, over 55__.
2. College degree: B.S. or B.A. in Chemistry__, Chemical Education__, Other Science__, Education__.

   Highest degree:_____ in _____.
3. Size of school: less than 500__, 500-1000__, over 1000__.
4. Number of other chemistry teachers in school____.
5. Do you own a cassette tape recorder: yes__, no__.
6. How much do you rely on the monthly journals to update yourself on general information: heavily___, moderately___, slightly___.
7. Please list the journals that you review monthly.

This study encourages the feedback of information to improve the study. This will be done by statement,

inviting the teacher to use the tape media to record reactions and criticisms of the abstracting service. The following open questions will be on the questionnaire for either aural or written reply:

8. What topics, methods, or kind of research information would you want included next month?

9. List a few adjectives that express your reaction to this tape service.

10. If you do not wish to continue receiving the free tape as part of this experiment, please list three reasons why not, in order of your priority.

The procedure described pools the recommended criteria for questionnaires and has been criticized until approved by a group of fellow research interns.

INITIAL CONTACT LETTER
TO EXPERIMENTAL GROUP

SPRINGFIELD COLLEGE SPRINGFIELD, MASSACHUSETTS 01109

March 24,1972

Your name has been randomly selected to receive two cassette tapes over the next two months as part of a research project to test the feasibility of disseminating chemical information via a new media. It is hoped that the value of the tape will be sufficient reward and motivation for you to continue in this research study. The second tape will be mailed next month after return of this questionnaire and the tape.

If you are not now presently teaching high school chemistry, please return the tape and questionnaire, so indicating.

The purpose of the tape is to bring to you a review of current research in both chemistry and methodology of teaching. I need to get some information from you to improve the system and to determine if this media is worth developing.

It is expected that listening will be done in 2 to 4 sessions, possibly on route to school. Share the information if you wish, record your criticism on the tape, record how used; feedback information that will make the service fit your needs.

A bibliography is attached for your use if a follow-up is necessary. Please return the questionnaire and tape by April 12,1972. Please, return the questionnaire to validate the study; return the tape to feedback information and to reduce the cost of the service.

Sincerely,

Ted Johnson

Edgar N Johnson
Assistant Professor of Chemistry and Science Education

DATA : EXPERIMENTAL GROUP I

ACCESS tape code #_____? 144

QUESTIONNAIRE for Abstracts on Cassetts of Chemical and Education

Please complete the questions and the checklist after listening to the tape. The questions have the purpose of identifying the potential user of the information and to improve the service.

1. Name _____
2. Address _____ _____
3. Age: 20-25 __, 26-35 __, 36-45 __, 46-55 __, over 55 ___.
4. College degree: B.S. or B.A. in Chemistry ___, Education ____
   Chemical Education ___, Other Science ____, Other_____.
   Highest degree; _____ in _____.
5. Do you own a cassette tape recorder: yes ____, No _____?
6. Size of school; less than 500 __, 500-1,000 __, over 1,000 ___.
7. Number of other chemistry teachers in the school _____.
8. How much do you rely on the monthly journals to up-date yourself on general information? heavily___, moderately ___, slightly ___.
9. Please list the journals that you review monthly.

The following questions may be answered on the tape which may be easier or answer in usual written manner.

10. What topics, methods, or kind of research information would you want included next month?

11. List a few adjectives that express your reaction to this service.

12. If you do not wish to continue receiving the free tape as part of this experiment, please list three reasons why not, in order of your priority.

DATA on ACCESS Tape USE: EXPERIMENTAL I

CHECKLIST OF ARTICLES ABSTRACTED ON THE CASSETTE TAPE

Directions: After you have listened to the tape and after you have had a chance to use or to react to the information, please check the column with criteria best describing the article. More than one check per article is allowed if appropriate.

ACCESS Tape Code # ____

CRITERIA	BIBLIOGRAPHY	1. Historical Ideas	2. Accumulating Element	3. Behavorial Objective	4. Conditions-Teaching	5. Geochemistry	6. Individualized Sc.	7. Hormones	8. Curriculum- Kansas	9. I.Q. Heritability	10. SO2 Smog	11. Simulation Programs	12. Sulfur Cycle	13. Inquiry Films	14. Nuclear Sc & Art	15. Ecolibrium	16. SMIP Chemistry	17. Cognitive Style
1. Used information with your class.																		
2. Used the method with your class.																		
3. Used information from another source																		
4. Wrote for or obtained original.																		
5. Discussed article with a colleague.																		
6. Expect to use at a later date.																		
7. Just interesting information.																		
8. Information was of no use.																		

TO EXP. + CONTROL GROUP

146

Bibilography of ACCESS Tape

1. Osborn,Gerald "Historical Ideas of Matter Including the Development of the Electron Concept",School Science and Mathematics, Jan 1972.

2. Peterson, P.T. " Unusual accumulations of Elements by Plants and Animals", Science Progress, Winter 1971.

3. Herron,J.Dudley "The Effect of Behavioral Objectives on Student Achievement in College Chemistry",J of Research in Science Teaching, v8,n4,1971.

4. "Conditions for Good Science Teaching in Secondary Schools", National Science Teachers Ass, 1201 16th St.Washington,20036,$1.50

5. Brown, G.M. "Geochemistry of the Moon", Endeavour, Sept.1971.

6. Klopfer,Leopold "Individualized Science:Relevance for the 1970's" Science Education, v55,n4,1971.

7. Loraine, John "Hormones and Homosexuality",New Scientist, Feb. 3,1972.

8. Rogers,Parley "Highlights from a Survey of the Chemistry Curriculum in Kansas High Schools,1969-70", Science Education, v55,n4, 1971.

9. Gage,N.L., "I.Q. Heritability, Race Differences, and Educational Research" Phi Delta Kappan, Jan. 1972.

10. Wilson,William,et al, "Study of Sulfur Dioxide in Photochemical Smog", J of the Air Pollution Control Ass, Jan 1972.
a) $NO + O_2 - NO_3$, b) $NO_3 + SO_2 - NO_2 + SO_3$, c) $SO_3 + H_2O - H_2SO_4$
d) $SO_2 + NO_2 - (SO_3)(NO_x)_x$ solid

11 Basic Simulation Programs; volumns I & II, Biology, Earth Science, and Chemistry, Digital Equipment Corp, Maynard,Main St. Maynard, Mass, 01754, $4.00, (Jan 31,1971) (ED052 607 on E.R.I.C.)

12 Kellog,W.W., et al "The Sulfur Cycle" Science, Feb. 11,1972

13. DeOliva,Carmen "A Study on the Effectiveness of the Biological Sciences Curriculum Study Single Topic Inquiry Films in Improving Selected Abilities in Tenth Grade Biology Students" Dissertation Abstracts International,#3113-A, Jan. 1972.

14 Keisch Bernard "The Mysterious Box: Nuclear Science and Art" Atomic Energy Commission, Oak Ridge, Tenn,037830, free (P.O.Box 62)

15. Spilhaus,Athelstan, " Ecolibrium" Science, Feb 18,1972

16. SMIP Chemistry Curriculum Guides, Luzerne County Schools, Wilkes-Barre, Pa, request from Box 111, Wilkes College, Wilkes-Barre, Pa, 18703, (ED052964 from ERIC file)

17 Grieve,Tarrance and J.Kent Davis, "The Relationship of Cognitive Style and the Method of Performance in Ninth Grade Geography" J of Educational Research, Nov. 1971.

INITIAL CONTACT TO CONTROL GROUP + PERSONAL LETTER - I

147

SPRINGFIELD COLLEGE SPRINGFIELD, MASSACHUSETTS 01109

March 29,1972

Your cooperation in a research study is solicited. Your name has been randomly selected from a sample of chemistry teachers.

The purpose of the study is to determine if dissemination of recent research information in both chemistry and teaching via a monthly cassette tape will be useful to the practicing high school chemistry teacher. As part of this study you will receive a free 60 minute tape reviewing the recent information from 30 periodicals.

Please take a few minutes to check the questionnaire; returning in the enclosed envelop. Your tape will be sent after receipt of this questionnaire.

Sincerely,

Ed Johnson

Edgar N Johnson
Assistant Professor of Chemistry
and Science Education

PERSONAL DATA

1. Age: 20-25 __, 26-35 __, 36-45 __, 46-55 __, over 55 ___.
2. College degree: B.S. or B.A. in Chemistry___,Education __,
   Chemical Education ___,Other Science ___, Other _____ .
   Highest degree: _____ in _____
3. Do you own a cassette tape recorder? Yes ___ No ____, Borrow?____
4. Size of school: less than 500___,500-1,000 __,over 1,000 ____.
5. Number of chemistry teachers in the school _____.
6. How much do you rely on the monthly journals to up-date yourself?
   heavily ____, moderately_____, slightly _____.
7. Please list the journals that you review monthly.

8. If you do not wish to continue receiving the free tape as as part of this experiment, please list three reasons why not, in order of your priority.

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CHECKLIST OF ARTICLES ABSTRACTED ON THE CASSETTE TAPE

Directions: Using the attached bibliography for exact description of the articles, please check the column with the criteria that best describes the article. More than one check per article is allowed if appropiate.

CRITERIA	BIBLIOGRAPHY	1. Historical Ideas	2. Accumulating Element	3. Behavorial Objective	4. Conditions-Teaching	5. Geochemistry	6. Individualized Sci.	7. Hormones	8. Curriculum-Kansas	9. IQ Heritability	10. SO2 Smog	11. Simulation Programs	12. Sulfur Cycle	13. Inquiry Films	14. Nuclear Sc & Art	15. Ecolibrium	16. SMIP Chemistry	17. Cognitive Style
1. Use information with your class.																		
2. Used the method with your class.																		
3. Do not know content of this article.																		
4. Wrote for or obtained original.																		
5. Discussed article with a colleague.																		
6. Expect to use at a later date.																		
7. Just interesting information.																		
8. Information was of no use.																		

DATA: CONTROL GROUP I

EXPERIMENTAL GROUP II
SENT WITH ACCESS TAPE II

149

SPRINGFIELD COLLEGE

SPRINGFIELD, MASSACHUSETTS 01109

April 27,1972

Welcome to ACCESS Tapes - again!

Thank you for returning the CHECKLIST and the QUESTIONNAIRE. Of the 60% responding to date, 16% wished not to continue the service but 8% of these cited retirement or new positions as the reason. Most encouraging was the fact that 90% of responders reacted favorable towards the service.

Tapes were reported shared by staff and students; listened to while driving and monitoring quizes. Your reaction to my voice,delivery, and editorial comments were divided between "try to get more voices to avoid monotony" to "liked your voice and delivery as I got used to it". In an attempt to develop the service I'm torn between hiring a professional as a radio announcer and your allowing me to add spontaneity of the moment. I presently feel that imperfection of a fellow chemistry teacher as an announcer is better than the more perfect voice control reading a prepared abstract. Your reactions on this are most welcome.

Please:
1. Listen to the tape and share the information.
2. Return the CHECKLIST AND REACTION SHEET. Try for a May 15 return date.
3. Return the tape; recycling is just a good idea, allows for quality tapes, and cuts cost to you.
4. Consider purchasing this service. A separate order form and envelop is enclosed for that purpose.

I will send you a summary of this study on receipt of your checklist and reaction sheet, if so indicated.

Sincerely,

Ed

Edgar N Johnson

DATA SHEET: EXPERIMENTAL + CONTROL GROUPS 2nd CYCLE - ACCESS II 150

CHECKLIST Directions: After you have listened to the tape and after you have had a chance to use or to react to the information, please check the column with the criteria that best describes the article. More than one check per article is allowed if appropiate.

ACCESS CODE #_____
(announced on tape)

CRITERIA

CRITERIA	BIBLIOGRAPHY	1. Discovery/Lab/Expos-	2. Thermoluminescent	3. Piaget/Solubility	4. Pollutants	5. Lab vs Discussion	6. Advanced Organizers	7. Carcinogens	8. Self-Evaluation	9. Pneumatic Chem-	10. Ascorbic Acid	11. Environment Book	12. Trends/Facilities	13. Cell Membranes	14. Computer-Aided	15. Teachers' Centres	16. Vegetarianism	17. College Boards
1. Used information with your class.																		
2. Used the method with your class.																		
3. Used information from another source.																		
4. Wrote for or Obtained original.																		
5. Discussed article with a colleague.																		
6. Expect to use at a later date.																		
7. Just interesting information.																		
8. Information was of no use.																		

A-25

To CONTROL GROUP II
WITH ACCESS TAPE II

151

SPRINGFIELD COLLEGE SPRINGFIELD, MASSACHUSETTS 01109

April 26,1972

Your ACCESS tape to chemical education literature has been mailed - Third Class. The planned delay is so scheduled so that you will return this CHECKLIST before listening to the tape.

It is my fault for not making the instructions clear so that you would have returned the CHECKLIST in the first mailing.

Please take a few minutes to determine if you have read or heard of the information from this article.

Thank you and hope you will enjoy the tape.

Sincerely,

Ted

Edgar N Johnson
Assistant Professor of Chemistry
and Science Education

TO BOTH TARDY
CONTROL AND EXPERIMENTAL GROUPS

SPRINGFIELD COLLEGE SPRINGFIELD, MASSACHUSETTS 01109

June 3 ,1972

A reminder - even in this season of evaluation and closure. I sent you an ACCESS tape on chemical education and questionnaires; hoping the tape would be worth your time. Please keep the tape but return the questionnaire to validate my study.

Those teachers using the tape and returing the materials indicated a very high proportion of favorable comments and uses. I will send you a summary of the study in the fall. But I need your reply - even if to tell me that you never got around to listening. You represent a sampling of chemistry teachers - your use or non use - what ever your opinion ; I need the information to complete my study on the feasibility of a cassette subscription service.

New forms and envelop are enclosed for your use.

Best to you for this summer

Thanks,

Tad

Edgar N Johnson
Assistant Professor of Chemistry and Science Education

ENCLOSED AS PART OF TAPE II TO BOTH CONTROL + EXP. GROUPS

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ACCESS TAPES

Edgar N Johnson
80 Magnolia Terrace
Springfield,Mass,01108
(telephone 413-734-1400)

Thank you for your consideration in developing this cassette service in chemical education. To continue this service, the following plans are available. A payment or purchase order is required with your option to continue.

1. I wish to continue the service at:
   a. One month (one tape)introductory offer @ $2.00 _____.
      starting (date ?) _____
   b. Three months (3-60minute tapes) for $12.00 _____.
      delivered (dates) _____
   c. Ten months (10-60 minute tapes for $35.00 _____.
      delivered monthly during school year.)

The cost of the three options is based on recycling the tapes. Add $1 per tape if you wish to keep the tape and check here_____.

What do you get for this cost? An inservice education program, a review of thirty chemical and educational journals, a cost saving in time, an opportunity to feedback your interests so that the service better fits common interests; all on quality C-60 cassette tapes.

RESUME OF EDGAR N JOHNSON

Presently chemistry and science education teacher at Springfield College. Former (12 years) chemistry teacher at West Springfield High School and science coordinator of West Springfield Public Schools. Member of NSTA,NEACT, and western Massachusetts Science Supervisors group.

A P P E N D I X V

GENERATION OF A QUESTIONNAIRE

The purpose of the questionnaire is to obtain data to test the hypotheses of this research. Two types of information are requested: (1) concerned with the verbalization of the use to which the abstract information was utilized, and (2) concerned with obtaining a profile of the chemistry teacher. The first type is an indirect measurement on how the chemistry teacher will use the information on the cassette. A direct observation of the teacher's behavior by some sort of secret television feedback to a trained observer might be a more valid measurement of the use to which the tape was put, but that is beyond the capabilities of this research. A checklist that verbalized the teacher's behavior is chosen over personal interviews (which are expensive and subject to the influence of the researcher); a questionnaire with open-ended responses (little statistical control); and a questionnaire with rating scales (require extensive tutoring of the rater). Oppenheim claims that the checklist is least likely to contain errors of bias in design and bias of the responder. He claims the checklist is at its best when used and con-

structed to test a specific hypothesis rather than as an exploratory tool.[1]

The checklist design to test what kind and how extensively each article was used will take on the format following:

Directions to Teacher Respondent

Time order list of bibliography on cassette	Criteria to check
1. Author, title, journal, date	
2. Author, title, etc.	

[1]Oppenheim, Questionnaire Design, p. 138.

A P P E N D I X VI

PRELIMINARY REPORT

The following data was sent in May, 1972, to the dissertation committee and chemistry teachers who had expressed such an interest. The sampled chemistry teachers received their copy after returning questionnaire #2 so that their response would not be influenced.

During the spring of 1972, I attended meetings of the New England Association of Chemistry Teachers and talked with chemistry teachers about the project. Sample tapes and this report went to about five interested teachers. The officers of NEACT were kept informed so that there would be no possible embarrassment caused by this survey to their membership.

ACCESS tape #1 and this preliminary report was also sent to Dr. Moses Passer, American Chemical Society, in response to our interview in January, 1972. At that time I inquired about A.C.S. sponsorship through their "small grant" project.

PRELIMINARY REPORT on Abstracts on Cassetts; Chemical Education Subscription Service -- Edgar N Johnson May 1,1972

I. Sent out 50 tapes, letters, questionnaires - 3/24/72 to random sample from membership list of NEACT.

Returned from Experimental Group

	Card	?'s	Check	Tape	Retired	Stop	Used Tape	#6	
1st Week	26	5	5	6	3	4	-	2	by 3/31
2nd Week	12	6	7	14	2	2	1	4	by 4/7
3rd Week	3	3	4	3	1	2	-	3	by 4/14
4th Week	1	12	12	11	1	3	1	2	by 4/21
5th Week	-	4	4	4	1	1	-	-	by 4/28
Total	42	30	32	38	8	12	2	11	
%	84	60	64	76	16	24	4	45	

Control Group - sent questionnaire and letter 3/29/72 - 50 NEACT

returned - by 4/7- 23 questionnaires _ 60% not returning checklist, had to send letters just before tape #2 mailed (4/26/72

by 4/14 - 2
by 4/21 - 2
by 4/28 ---
toatal -27 or 54% return (reminders sent with duplicate questionnaire & checklist 4/27/72

HYPOTHESIS CONSIDERATION

1. Although receiving positive response verbally from 22 of 50 in experimental group, they have not submitted any money or purchase order. Option was sent with #2 tape 4/29/72. Still expect minimum of 20% to subscribe.
2. Hypothesis on visual inspection is accepted- as 109 used responses for 24 chechlists of experimental compared to 29 used responses from 9 control group's checklists.
3. Hypothesis claiming more usage of chemical information than education research is rejected on basis of used responses; exp.group - 37 responses/6 articles same as 72 responses/11 artic
4. The claim that teachers using the tape would record their reaction is not supported as only 2 of 38 returned tapes were used as a feedback mechanism. Dissappointing as linkage system (model system) should have feedback mechanism.
5. Corelations to age, degree, # of teachers - not done but gut feeling is that no correlation will be evident except retired group .

ACCESS tape code #____? 158

QUESTIONNAIRE for Abstracts on Cassetts of Chemical and Education

Please complete the questions and the checklist after listening to the tape. The questions have the purpose of identifying the potential user of the information and to improve the service.

1. Name ~~Experimental Group Summary of May 1,1972~~
2. Address _____
3. Age: 20-25 0, 26-35 8, 36-45 7, 46-55 8, over 55 9.
4. College degree: B.S. or B.A. in Chemistry ___, Education ___
   Chemical Education ___, Other Science ____, Other_____.
   Highest degree; M.S. in some science _____.
5. Do you own a cassette tape recorder: yes 14, No 15? (school 2?)
6. Size of school; less than 500 3, 500-1,000 6, over 1,000 19.
7. Number of other chemistry teachers in the school 0/3;1/7. 2/6;3/5;4-7/1
8. How much do you rely on the monthly journals to up-date yourself on general information? heavily 7, moderately 13, slightly 6.
9. Please list the journals that you review monthly.
   JlChem Ed.-26 ; Chemistry-20, Sc Tch- 12, Sc Am- 3, Science-3; Chem & Eng N-7; NEA , Sat Rev , Sc Dig-2, local educ news, Ecology Today - very little duplication

The following questions may be answered on the tape which may be easier or answer in usual written manner. only 2 used tape

10. What topics, methods, or kind of research information would you want included next month? as is -5
    new idea- 3 , environment 4, sex differences, chem tests, philolosoph history(2 for -1 no), curriculum studies, individualized, specialtopi
11. List a few adjectives that express your reaction to this service.
    useful-3, helpful-3, keeps one up to date, thought provoking, good idea-8, motivating informative-3, saves time-3 , efficient-3, interesting- 6, enjoyed-3, unique- 2, gimmicky, enjoyed editoral-3
12. If you do not wish to continue receiving the free tape as part but 3 did not of this experiment, please list three reasons why not, in order of your priority. TOTAL of 4 chose not to receive #2 tape

    too much time to listen
    not comprehensive enough on any one article
    scatter gun approach not good
    retiring or moved to new position - 8
    articles not carefully researched by narrator to bring across clear and concisely the meat of article.
    many mispronounced words
    narrator interjected too much of his personal opinions

CHECKLIST OF ARTICLE'S ABSTRACTED ON THE EXAMPLE PAGE

Directions: After you have listened to the tape and after you have had a chance to use or to react to the information, please check the column with criteria best describing the article. More than one check per article is allowed if appropiate.

"DISCUSSED MANY WITH COLLEAGUE – 3

REPORTED ACCESS Tape Code #6 – 11/20/24

EXPERIMENTAL AS OF 5/1/72

CRITERIA	BIBLIOGRAPHY	(1) Historical Ideas	(2) Accumulating Element	3. Behavorial Objective	4. Conditions-Teaching	(5) Geochemistry	6. Individualized Sc.	(7) Hormones	8. Curriculum- Kansas	9. I.Q. Heritability	10. SO2 Smog	11. Simulation Programs	(12) Sulfur Cycle	13. Inquiry Films	(14) Nuclear Sc & Art	(15) Ecolibrium	16. SMIP Chemistry	17. Cognitive Str.	
1. Used information with your class.	6	5			4	1	1		1	3		3		1	3			29	*
2. Used the method with your class.			1			1												2	*
3. Used information from another source	5	2					2		1	1	3	1						15	(25)
4. Wrote for or obtained original.				5	1	1		2			3			7	2	5		26	*
5. Discussed article with a colleague.		2	7	2	2	6	4	8	3	1	2	1	4		4	3	3	32	*
6. Expect to use at a later date.	3	9	1	7	7	4	2	2	2	8	6	7	1	5	6	1	1	67	
7. Just interesting information.	9	9	14	9	13	9	11	9	11	6	6	6	7	9	7	8	10	153	
8. Information was of no use.	2	2	3	1	0	1	5	2	4	0	3	0	4	2	0	1	2	32	(184)
TOTAL	25	29	26	24	27	23	25	23	22	19	15	19	16	24	22	18	16		

* CONVERSES "USES" [illegible]

SPRINGFIELD COLLEGE SPRINGFIELD, MASSACHUSETTS 01109

March 29,1972

Your cooperation in a research study is solicited. Your name has been randomly selected from a sample of chemistry teachers.

The purpose of the study is to determine if dissemination of recent research information in both chemistry and teaching via a monthly cassette tape will be useful to the practicing high school chemistry teacher. As part of this study you will receive a free 60 minute tape reviewing the recent information from 30 periodicals.

Please take a few minutes to check the questionnaire; returning in the enclosed envelop. Your tape will be sent after receipt of this questionnaire.

Sincerely,

Ted Johnson

Edgar N Johnson
Assistant Professor of Chemistry
and Science Education

PERSONAL DATA,

1. Age: 20-25 __, 26-35 7, 36-45 1[illegible], 46-55 2, over 55 10.
2. College degree: B.S. or B.A. in Chemistry___, Education __, Chemical Education ___, Other Science ___, Other _________ .
   Highest degree: _____ in ____________________
3. Do you own a cassette tape recorder? Yes 17 No 8 , Borrow? 12
4. Size of school: less than 500 5 ,500-1,000 6 ,over 1,000 [illegible] .
5. Number of chemistry teachers in the school ______.
6. How much do you rely on the monthly journals to up-date yourself?
   heavily ____, moderately_____, slightly ______.
7. Please list the journals that you review monthly.
   S.A. [illegible] Sci. [illegible] J. of Chem. Ed. [illegible] Chem. [illegible] NEA 1 J. of American Chem. Soc. NSTJ [illegible] Nature 1 Physics Today Physics Teacher Chem. & Eng. News Science Club [illegible]
8. If you do not wish to continue receiving the free tape as as part of this experiment, please list three reasons why not, in order of your priority.

CHECKLIST OF ARTICLES ABSTRACTED ON THE CASSETTE TAPE

Directions: Using the attached bibliography for exact description of the articles, please check the column with the criteria that best describes the article. More than one check per article is allowed if appropiate.

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CONTROL as of 5/1/72

CRITERIA	BIBLIOGRAPHY	1. Historical Ideas	2. Accumulating Elements	3. Behavorial Objectives	4. Conditions-Teaching	5. Geochemistry	6. Individualized Sci.	7. Hormones	8. Curriculum-Xenses	9. IQ Heritability	10. SO2 Smog	11. Simulation Programs	12. Sulfur Cycle	13. Inquiry Films	14. Nuclear Sc & Art	15. Ecoliorium	16. WHIP Chemistry	17. Cognitive Style		
1. Used information with your class.	9	1		1	1		1	1	1	1		2						11	*	
2. Used the method with your class.			1			1						1	1	1				5	*	
3. Do not know content of this article.	6	6	6	4	5	5	6	6	7	7	8	6	6	7	8	8	7	108		(n-38)
4. Wrote for or obtained original.																		0	*	
5. Discussed article with a colleague.	1	1	1	1	1	1	1	2	1	1		1					1	13	*	
6. Expect to use at a later date.	1	1	1	2	2	2	2	1	2	1		1		1		1		18		
7. Just interesting information.	2	3	2	2	1	2	2	2	1	2		2			1		1	23		
8. Information was of no use.	1	1	1	1	1	1							2				1	9		
	13	(14)	12	11	(11)	12	(12)	12	12	(12)		(13)	9	(9)	(9)	9	10			

SPRINGFIELD COLLEGE SPRINGFIELD, MASSACHUSETTS 01109

April 27,1972

Welcome to ACCESS Tapes - again!

Thank you for returning the CHECKLIST and the QUESTIONNAIRE. Of the 60% responding to date, 16% wished not to continue the service but 8% of these cited retirement or new positions as the reason. Most encouraging was the fact that 90% of responders reacted favorable towards the service.

Tapes were reported shared by staff and students; listened to while driving and monitoring quizes. Your reaction to my voice,delivery, and editorial comments were divided between "try to get more voices to avoid monotony" to "liked your voice and delivery as I got used to it". In an attempt to develop the service I'm torn between hiring a professional as a radio announcer and your allowing me to add spontaneity of the moment. I presently feel that imperfection of a fellow chemistry teacher as an announcer is better than the more perfect voice control reading a prepared abstract. Your reactions on this are most.welcome.

Please:
1. Listen to the tape and share the information.
2. Return the CHECKLIST AND REACTION SHEET. Try for a May 15 return date.
3. Return the tape; recycling is just a good idea, allows for quality tapes, and cuts cost to you.
4. Consider purchasing this service. A separate order form and envelop is enclosed for that purpose.

I will send you a summary of this study on receipt of your checklist and reaction sheet, if so indicated.

Sincerely,
Ted

Edgar N Johnson

ACCESS TAPE REACTION SHEET

Name._____

Mailing Address
(if different) _____

WRITE OR RECORD YOUR RESPONSES ON RETURNED TAPE.

1. Do you have any additional comments on how you used or reacted to Tape#1 since returning the questionnaire?

2. Describe your reaction to tape #2.

3/ Preferance for tapes:

_____ Tape #1 was better due to :

_____ Tape #2 was better due to :

_____ No major difference in the two tapes

4. Again, what topics, methods or research studies would best serve your interests and needs?

5. Additional comments to improve service most welcome.

RETURN WITH CHECKLIST AND TAPE

ACCESS TAPES

Edgar N Johnson
80 Magnolia Terrace
Springfield,Mass,01108
(telephone 413-734-1400)

Thank you for your consideration in developing this cassette service in chemical education. To continue this service, the following plans are available. A payment or purchase order is required with your option to continue.

1. I wish to continue the service at:
   a. One month (one tape)introductory offer @ $2.00 _____.
      starting (date ?) _____.
   b. Three months (3-60minute tapes) for $12.00 _____.
      delivered (dates) _____
   c. Ten months (10-60 minute tapes for $35.00 _____.
      delivered monthly during school year.)

The cost of the three options is based on recycling the tapes. Add $1 per tape if you wish to keep the tape and check here_____.

What do you get for this cost? An inservice education program, a review of thirty chemical and educational journals, a cost saving in time, an opportunity to feedback your interests so that the service better fits common interests; all on quality C-60 cassette tapes.

RESUME OF EDGAR N JOHNSON
Presently chemistry and science education teacher at Springfield College. Former (12 years) chemistry teacher at West Springfield High School and science coordinator of West Springfield Public Schools. Member of NSTA,NEACT, and western Massachusetts Science Supervisors group.

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