

THE AUDIO TUTORIAL SYSTEM

Postlethwait devised the Audio Tutorial system in the early 1960s. Fundamental to the system is the guideline that learning is an activity done by an individual and not something done to an individual. Postlethwait realize that the structuring of an educational system should be done on the basis that the programme must involve the learner, with the role of the teacher being to provide a situation conducive to learning by providing the direction, facilities and motivation to the learner. But what are the necessary ingredients for such an approach? Postlethwait suggests that the major ones are:

1. repetition
2. concentration
3. association, in the form of a coherently structured system
4. the use of units which adapt to the individual student needs
5. provision of appropriate experiences, which are relevant to the course objectives
6. multiplicity of approaches to accommodate the different degrees of receptivity of students
7. the use of an integration-experience approach, with each activity supplementing previous experiences, resulting in greater total achievement.

The system started in 1961 when supplementary lectures on audio-tape were introduced to provide an opportunity for biology students with poor backgrounds to keep up with their classes. The first tapes were supplemental lectures. Their nature changed, during the first year, toward an audio programming of a variety of learning experiences. Initially diagrams and photographs were available with the tape, but Postlethwait soon realize that other materials could be included and this led naturally to the inclusion of whole experiments which were conducted under the guidance of the audio-taped programme. Eventually a weekly learning kit was prepared and students could do the full range of study for a week without attending any of the formal sessions for the course. Student reactions were so favourable that an experimental section was set up in which students received all their instruction programmed by tape. The students met their instructor only once each week for discussion sessions. When the experimental group took the same exams that were given to the conventionally taught group, their performance was substantially the same, clearly demonstrating that an audio-programmed course was just as effective as the conventional lecture course. Following this experiment the system was formalized and introduced on a much larger scale. There were three basic study sessions plus other specially assigned activities in the scheme. These sessions were termed:

1. Independent study session or ISS
2. General assembly session or GAS
3. Small assembly session or SAS, which included integrated quiz sessions or IQS

INDEPENDENT STUDY SESSIONS

These take place in the learning centre and the course units may be studied at any time by the students. The centre is equipped with booths for individual study and 32 booths serve up to 600 students. The basic equipment consists of a tape recorder and 8mm movie projec-

tor, together with other materials appropriate for the week's work. A central table is also provided for bulky materials and expensive items of equipment. On entering the learning centre the student assigns himself to a specific booth using a record card. A time card is also filled in, which indicates the precise time of arrival and departure, and a duplicated set of behavioural objectives for the week's work are collected. Students begin their session of independent study by checking the objectives and listening to the introductory remarks of the senior instructor on the tape. Following the introduction the student will be asked to look at a given section of the study guide. Having read the relevant section the tape is started up again and may refer the student to a chapter in the text book which is relevant to the current week's unit. This is an example of what the student hears as he listens to the tape:

"The first experiment is exercise 1, and since we are more interested in the data than the manipulation of the experiment, the materials have been set up for you and are available on the central table. Will you turn off the tape player and do exercise 1 and then return to the tape for further discussions."

The student proceeds to the central table and collects the necessary data before returning to the booth. The student may be required to undertake a number of activities such as reading journal articles or viewing a movie either at a central location or in the individual study booth. However, much of the work concentrates on the use of the study guide, which includes numerous tables of data and photographs of experiments. Frequently the session is concluded by asking the students to work through a number of problems from a standard text. An instructor is on duty during the opening hours of the learning centre to give individual assistance when necessary. Special areas are also available for students who are reviewing the previous week's assignments, or who are waiting for a booth. There is also a small library of books, journals and articles available for supplementary study on the week's subject. And, of course, coffee and tea are provided to help students to relax and discuss work with other students.

GENERAL ASSEMBLY SESSION

This is scheduled near the end of a week's work and is designed to include guest lecturers, films and examinations. All students are invited but attendance is not compulsory.

SMALL ASSEMBLY SESSIONS

These take place on a regular basis with 7 or 8 students meeting a course instructor initially for an integrated quiz session in which students are required to give short lectures on items taken from the previous week's independent study session. The most important feature of this short lecture exercise is that any student must be ready to give an account of any part of the work. This is based on the idea that one really learns a subject when one prepares to teach it. Following the oral quiz a written test is given to the group, usually consisting of twenty question and lasting 15 minutes or so. Of the three main features of the Audio Tutorial approach students rate the independent study sessions and small assembly sessions and integrated quiz as being very important components. The general assembly sessions are seen as being less important, and many students feel that they can be dispensed with altogether.

REVIEWS OF RESEARCH

Fisher, K.M. and MacWhinney, B. (1976) 'AV Autotutorial Instruction: a review of evaluative research', *Audio Visual Communication Review*, 24(3), 229-261.

Kulik, J.A., Kulik, C.C. and Cohen, P.A. (1979) 'Research on Audio-Tutorial Instruction: a meta-analysis of comparative studies', *Research in Higher Education*, 11(4), 321-341.

Student achievement: Fisher and MacWhinney (1976)

Great claims have been made for the AT approach and these claims require careful scrutiny to determine their validity. The first major review was by Fisher and MacWhinney (1976), and a total of 89 studies were reviewed, covering the years 1962-1975. The studies were mainly concerned with college students, with a few applications in elementary and secondary schools. In 44 of the studies comparisons of student performance in Audio Tutorial and conventional classes were made, and in 27 studies student attitudes were reported. The following is a summary of the results for the 44 comparisons:

	Number of Studies	Favours AT	Favours Lecture	Favours Neither
Elementary	1 Word pattern 1 Spelling 2	2 (100%)	0	0
Junior High Mathematics	1	0	0	1 (100%)
High School Science	4	2 (50%)	0	2 (50%)
College Science	25	17 (68%)	1 (4%)	7 (28%)
College Non-science	12	9 (75%)	0	3 (25%)
All Schools	7	4 (57%)	0	3 (43%)
All Colleges	37	26 (70%)	1 (3%)	10 (27%)

These figures have led to the conclusion that:

Student achievement on written examinations with audio-tutorial (A-T) instruction nearly always equals, and usually exceeds, that obtained with the conventional method. (Fisher & MacWhinney, 1976).

Kozma et al. conclude that more than two-thirds of the studies attributed superiority to the audio-tutorial approach, and that only PSI has shown similarly positive results across stud-

ies. But caution is needed in accepting such a statement. The data can be analysed in a number of different ways to obtain different results. For example: if we indicate that ‘favours AT’ means that there is a statistically significant difference ($p < 0.05$) in favour of the AT group the picture is slightly different:

	Number of studies	Favours AT ($p < 0.05$)	Favours Lecture ($p < 0.05$)	No Difference
All Schools	7	4 (57%)	0	3 (47%)
All Colleges	37	15 (40%)	1 (3%)	21 (57%)

This gives a different impression. Although the results favour AT in the schools (only 7 studies), this is not the case for the college results (37 studies), where 57% indicate no difference. If we consider only the more reliable results (marked with ‘*’ next to the study in Fisher and MacWhinney’s Table 1) and again only use statistically significant results under the ‘favours AT’ heading, the results do tend to a more favourable support of the AT approach.

	Number of studies	Favours AT ($p < 0.05$)	Favours Lecture ($p < 0.05$)	No Difference
All Schools	6	4 (66%)	0	2 (33%)
All Colleges	20	12 (60%)	0	8 (40%)
Combined Schools and Colleges	26	16 (62%)	0	10 (38%)

Examples of studies reviewed by Fisher and MacWhinney:

Elementary School

Audio tapes and print materials (reading) 2nd grade; audio tapes only for spelling Both good experiments, with statistically significant results in favour of AT.

High School

Mathematics and biological sciences. 4 good experiments, 50% favouring AT. No details of exact nature of the AT approach. College Science

Melca (1968) found that his AT group scored higher than the traditionally taught group on a post-test, when there was no difference on pre-test scores for 3 measures: Scholastic aptitude test; College entrance exam; and an achievement test in genetics. Fisher and her colleagues (1975) made pre- and post-test comparisons in introductory genetics courses, using a video-based system of AT, and found the ‘video-autotutorial’ approach to be statistically superior.

Flocker (1972) measured the motivational aspects of the AT approach when he gave 210 AT students an unannounced mid-term exam, which had been taken by 755 conventionally taught students on an announced basis. There was no difference in performance despite the difference in preparedness, demonstrating the highly motivating effects of AT.

Gould (1972) found that only 15% of grades were below 'C' for the AT students compared with 30% below 'C' in the conventionally taught group.

Erhart (1969) found that mean scores were very similar but the proportion of the AT group receiving 'A' grades was higher than the conventional group, and the proportion receiving 'D' grades was higher in the conventional group.

College Non-science

A broad range of courses. The operation of av equipment, learning shorthand, and a course on foundry work and welding all showed AT students to be superior.

AT was not widely used in the humanities, but when it was used (Western civilization and American history) it proved to be more effective than conventional approaches.

Student achievement: Kulik, Kulik and Cohen (1979)

Kulik et al. (1979) used a complex statistical analysis which permits a more accurate appraisal of the effectiveness of new instructional methods. It is possible to identify the magnitude of differences between groups studying under a new method and those studying under traditional methods. In this case the results indicate not only statistical significance but also the educational significance. The reviewers point to the increasing interest that has been directed to methods of individualizing instruction, contrasting the 4 or 5 articles per year during the 1940s with the jump to 35 per year in the 1960s and 100 and more in the 1970s. They suggest that one reason for adopting the AT approach was to help meet the needs of the low and average students, and to help the brighter students to move more rapidly through the course. An early attempt to quantify the differences between AT and conventional groups was made by Kulik and Jaksa in 1977, and the improvement was identified as 3%, this being quite a small educational improvement. For the meta-analysis a total of 48 acceptable studies were identified. To be included in the sample the course had to take place in a college, the duration of the study had to be more than a couple of hours per week in a one term course. The studies had to be methodologically sound and groups which clearly differed in aptitude or had criterion tests that were 'taught to' were excluded from the study. These represent the same criteria adopted by Fisher and MacWhinney to identify their group of methodologically sound groups. As an index of achievement the average AT examination score minus the average conventional score was used for the 42 studies which reported measures of student achievement. The results favoured AT groups in 29 (69%) of the studies and the remaining 13 (31%) favoured the conventional approach. But, if a statistically significant difference was used to differentiate the groups, only 15 studies showed a difference, the remaining 27 studies showing no statistical difference. Of the 15 statistically significant differences 11 were in favour of AT and 4 in favour of conventional. As percentages of the total this gives:

	Number of studies	Favours AT (p<0.05)	Favours Lecture (p<0.05)	No Difference
Colleges	42	11 (26%)	4 (10%)	27 (64%)

This is not such a favourable result as that obtained by Fisher and MacWhinney who found 60% of college results statistically favoured the AT approach. This result was, however, for a smaller sample of methodologically sound studies. Kulik et al. calculated the average difference between AT and conventional groups and found the conventional group scoring 67% and the AT group scoring 68.5%, a difference of 1.5%. This is a small educational effect and the calculated Effect Size (ES) of 0.2 confirms this. The ES is calculated by subtracting the average conventional score from the average AT score and dividing the result by the Standard Deviation of the conventional group. An ES of 0.8 is large enough to be considered educationally significant and means that the new method shifts the position of the average pupil to a level of performance previously associated with the top 25% of students. A medium ES is 0.5 and above.

Student Drop-out

If AT provides greater motivation and makes learning easier one would expect a lower drop-out rate in AT courses when compared with conventional courses. But, with the increased demands made on the students in terms of independent study and the weekly assessments it could be argued that students would be more likely to drop-out of the AT system. Fisher and MacWhinney (1976) reported six comparisons of drop-out rates, with only 2 showing a higher rate for the AT courses. Kulik et al. (1979) identified 22 such studies. The results showed no overall effect of instructional method, with only a slightly higher drop-out rate of 19% for AT, compared with 17% for traditional courses.

Student Attitudes

Fisher and MacWhinney report 16 studies with an average of 85% of students expressing a preference for the AT approach. Kulik et al. disagree with such figures and identified only 6 studies in which student ratings were made. In no case was there a statistical difference between the rating for AT when compared with the rating for conventional instruction. Fisher and MacWhinney report several studies in which it was possible to increase coverage in the AT course and Erhard is quoted as having students who rate AT more favourably than conventional instruction, but would not wish to take more than one AT course per year because of work load.

Cost Studies

There does seem to be an economic advantage in favour of AT, but the set-up costs are high and several years may be required for realization of the full cost advantage. Postlethwait reported a saving of \$12,000 in 1963, mainly from increased efficiencies of scheduling and use of equipment. Cunningham (1973) reports a saving of \$1.00 per student hour for AT (Costs per student hour: AT=35; Conventional=36). Nance (1971) determined that over 5 years AT would save 35% of the costs of conventional teaching, but his system used slides rather than 8mm film for instructional purposes.

Components of Audio Tutorial

Self pacing and the Independent Study sessions were highly rated by students, as were the oral quizzes. The General Assembly sessions have met with less enthusiasm and one study found that only 4% of students thought the lecture GAS component was of value. GAS received the lowest overall rating of the components. Becker and Shumway (1972) found that transcripts of tapes were rated as more useful than the tapes themselves.

Predictors of Achievement

Although the system was devised to help the less able student there is no evidence that the system compensates for lower abilities, according to Kulik et al. Aptitude and achievement were as highly correlated in AT classes as they were in other courses. Thus, individualized instruction in which students are free to vary the time and manner of learning does not seem to narrow the gap between gifted and disadvantaged learners.

Kozma, R.B., Belle, L.W. and Williams, G.W. (1978) *Instructional Techniques in Higher Education*. Educational Technology Publications, New Jersey.