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ABSTRACT

Although programmed instruction per se has not been used at the Open University (OU), the principles of programmed instruction have heavily influenced the development of systematic instruction and this paper describes the OU instructional development process in the context of seven principles of programmed instruction developed by Lysaught and Williams (1963): (1) student characteristics must be borne in mind; (2) objectives should be defined in operational terms; (3) subject matter should be arranged in a logical sequence of small steps; (4) there must be frequent active responses from students; (5) after each response, students must be able to check the accuracy of their responses; (6) students must be able to work at their own rates; and (7) the performance of students and the effectiveness of the programmed instruction should be evaluated. This discussion shows that, while these principles have influenced course development, they have not gained universal acceptance. Rather, the OU course teams have followed the principles where common sense dictated, and have abandoned them where the positive-rational philosophy underlying the principles appeared to cut across the interests of students. (JB)

THE DEVELOPMENT OF SYSTEMATIC INSTRUCTION IN THE OPEN UNIVERSITY.

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A working paper for the Congress of the Deutschen Gesellschaft für Erziehungwissenschaft at the University of Tübingen, March 8-10, 1978.

THE DEVELOPMENT OF SYSTEMATIC INSTRUCTION IN THE OPEN UNIVERSITY

Introduction

When Professor Dr Horst Dichanz of the Fernuniversitat first asked me to contribute to this Congress he invited me to write about programmed instruction in Great Britain. I could not write such a paper for two reasons. First, I am not familiar with developments throughout Great Britain, since my work since returning from America has been chiefly at the Open University. Second, programmed instruction is no longer as widely used as it was, if we are to believe the literature (e.g. Howe and Romiszowski, 1976), so perhaps there is little to say.

Professor Dichanz then asked me to write about programmed instruction in the Open University, but you will not find a single programmed text anywhere in the Open University's vast stock of learning materials. Instead, I have written about the development of systematic instruction in the Open University, because this development was heavily influenced by programmed instruction.

Principles of programmed instruction

Lysaught and Williams' (1963) A Guide to Programmed Instruction laid down seven principles:

1) Student characteristics must be borne in mind.

2) Objectives should be defined in operational terms.

3) Subject matter should be arranged in a logical sequence of

small steps.

4) There must be frequent active responses from students.

5) After each response, students must be able to check whether the response was correct.

6) Students must be able to work at their own rate.

7) The performance of students and the effectiveness of the programmed instruction should be evaluated.

Programmed instruction is based on these principles. The principles in turn are based on Skinner's theories, which belong to behavioural psychology.

When programmed instruction crossed the Atlantic, the British neglected its psychological foundation, but produced programmed texts that looked like the American ones (Hawkridge, 1967).* The French, on the other hand, wanted to understand the theory before acting!

In 1968-69, when the Open University was being planned, there were those who thought that programmed instruction might be one of its principal modes of instruction, since the University would be using

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*I was in Africa at that time, 1960-66, experimenting with programmed instruction for African students (Hawkridge, 1965, 1967, 1970). I could not accept Skinner's psychology, but tried to apply the seven principles. I moved to America in 1967 and worked in a large computer-based instruction project founded upon the same principles (Hawkridge, 1967), modified to some extent.

text as its main teaching system. The report of the Open University Planning Committee (1969) specifically mentioned programmed instruction. Yet there was uncertainty about how the technique might be applied in so massive an undertaking. Educators were already aware that it was expensive, both to develop and to publish. Thus in 1969 it seemed likely that programmed instruction would not be used in the new University,** but that principles of programmed instruction would employed to develop the University's teaching on a systematic basis. In the rest of this paper I shall try to show how these principles have influenced the University.

Student characteristics

From the start, Open University course teams were faced with the question: Who are we trying to teach? Unlike most universities, the Open University was expecting to enrol adult students from many occupations. A study of students taking the correspondence and television courses of the National Extension College in 1969-70 (McIntosh and Bates, 1972; McIntosh 1972; McIntosh, 1974) provided the first set of data about ages, social and occupational backgrounds, study and leisure habits, and other characteristics of students who would be likely to take the Open University's courses. As thousands of applications poured into the University during 1970, data from the forms were analysed to provide profiles of the students wanting to

**The first Foundation Course in Humanities, now being replaced, contained two programmed texts on logic (Wilson, 1971). These texts proved to be exceptionally difficult for students to master and were withdrawn. The text that replaced them was not in programmed format.

take each of the first four courses, due to be offered in 1971 (McIntosh and Calder, 1976).

These data were only able to confirm the guesses already made by course teams - and to refute those made by some of the University's critics. For example, it became clear that most students would be men, that their median age would be below 30, that teachers would be the largest single group by far, that people with really weak secondary education would be a minority, and that the student body would be scattered into the most remote parts of Great Britain.

Similar sets of data have been collected every year and are available to course teams making new courses. Indeed, for courses at present being taught, the University prepares statistics showing the characteristics of students still studying each course at different times of the year. In other words, we know a great deal about student characteristics, probably more than in most universities.

In our experience, however, it is not easy to follow the principle of 'bearing in mind student characteristics' when developing courses. Possibly we have the wrong data: our statistics do not tell us much about students' reading capabilities, for example. Possibly our data are rendered less useful by University policy: if a course is to be open to all students, it does not help to know that 15% of the students are housewives. The course must still be written will all entrants in mind. The 'entry behaviour' (to use a Skinnerian term)

for the course must be set at a low level for the Foundation courses. Higher level courses may be entered by students on the basis of what they have studied in the Foundation courses.

Objectives

A large number of Open University texts contain lists of objectives. Course teams have often accepted the need to state objectives clearly for students, and have recognised that course development is made easier in many cases when authors clarify their objectives at an early stage.

Objectives have been criticised heavily in course teams, however, and in particular the idea of 'behavioural objectives' has been rejected with some vehemence. In a short paper there is not enough space to rehearse all the arguments that have surrounded course objectives; in summary. these objectives do not identify covert learning, they trivialise complex learning, and they require a goal-oriented, operationalised approach that is anathema to many academics in the humanities and social sciences. MacDonald-Ross (1973) offers a valuable critique reflecting a range of views.

Logical sequence of small steps

Fifteen years ago, few researchers were raising questions about what was meant by 'logical sequence' and there were dogmatic opinions about the size of step or 'frame' being not greater than 20 words. At the

Open University, we now achnowledge that we know very little about what is a logical sequence. Our recent studies (Hawkridge & Lewis, 1976; Pask, 1976) indicate that the structure of knowledge is far more complex than most authors realise, and that students find many apparently logical sequences to follow. It is possible to enter a body of knowledge at many different points and to pursue many different routes through it. Hence there is little guidance for authors - students will learn in their own way in spite of the sequence chosen by the author, we might say.

As for small steps, we have considered this 'chunking' of learning material from several angles. For instance, a step may consist of a single concept, an example, and a test item. The length of the step is not vital: what is important is that the concept is explained well, that the example is a good one, and that the test item is valid. In practice, a step may consist of enough text to accomplish these purposes, or of a short piece of film, or of audio-tape.

This model looks good, but in practice we have found it difficult to apply. Authors are not certain what makes up a single concept. They do not know when to offer examples, or how many to offer. Devising test items at the right places is a tricky and time-consuming activity. Indeed, our concern about bad test items in the wrong places is such that we have set up a special study group on this matter (see Rickards, in press, for recent American work in this field). We still believe that 'chunking' is helpful to students, as

Skinner stated, but we are less certain that we know how to do it during course development.

Frequent active responses

Frequent responding is a corollary of breaking down instruction into small steps, but perhaps the emphasis should be placed upon active responding. For Skinner, active responses were always overt responses. Covert responses cannot be observed, therefore they cannot be measured or recorded. In his work in programmed instruction, Skinner insisted on student responses being written (see, for example, Skinner, 1968).

In the Open University there are academics who believe that students will learn best if they respond actively, and some courses are built around student activities of many kinds, ranging from written responses in the margins of the texts to research projects that take several months to carry out. Other academics reject this approach, in the belief that the thinking and reading students do is more important than other more overt activities.

Unlike Skinner, we teach students who choose exactly what to do, in the privacy of their homes, with our learning materials. We know that there is a wide range of opinion about the usefulness of the student activities that have been built into Open University courses. Some students answer every question in writing; others just read the questions and answer them in their heads. A few use the questions for

group discussion. On courses that include project work, some students devote great effort to the project element, others neglect it in favour of studying the books more carefully (Macmillan, 1975; Henry, 1977). In eight years, we have moved from a dogmatic view that expected almost all students to seize eagerly the opportunity to respond actively. Now we provide a facility that students are simply encouraged to use.

Checking correctness of responses

Skinner considered that unless subjects, whether rats or students, were able to check the correctness of their responses immediately, reinforcement of the responses would not occur. In the case of rats he was able to adduce experimental evidence in support of his view. In the case of students, such evidence never became available, but programmed texts were constructed on the principle that correct answers had to be available immediately to students.

We debated this principle at some length in the Open University. Some of us did not think there were 'right' answers to every question, but within our texts, from the very first year, we included what we called self-assessment questions, to which answers were provided, sometimes on the same page, sometimes elsewhere in the texts. These questions therefore closely paralleled what Skinner had provided. In many of the texts, however, there were also other questions (sometimes called 'in-text questions') for which no answers were

given. These were intended as stimuli, to set students thinking, and perhaps to provide a basis for discussion, whether in a pub or a tutorial group.

In addition, the University requires students taking courses for credit to complete certain tests during the year. Some of these tests are graded (and commented upon) by tutors, others are graded by computer. The former type are usually essay tests, the latter are multiple-choice. The students soon realised that the University could not supply model answers for all essay tests, although a few course teams did prepare some. In other words, students generally accepted that feedback on correctness of responses in essays should come from their tutors - after a delay of a week or two at least. To provide model answers for the multiple-choice, computer-graded tests did not seem to many students to be too great a task for the University, and pressure for such a provision increased. The University took the view that it wanted to retain the questions for later use, but agreed that course teams could release answers in certain cases. Thus students may be able to find out whether they went wrong on these tests.

It is worth adding that the Open University, like all distance-teaching organisations, is under a greater obligation to provide feedback to students about their progress in learning than are face-to-face teaching institutions, in which students are able to question their tutors and teachers (and vice versa) on a personal basis and frequently.

Students work at own rate

Although programmed instruction in general failed to make proper provision for individualising learning, its proponents did recognise one of the principal variables: learning time. Indeed, experience in many fields with programmed texts has revealed that even in supposedly homogeneous groups the slowest learner is likely to take at least twice the time of the fastest.

The Open University was faced with a dilemma: it wanted students to be able to work at their own rate, but it could not offer a completely flexible study schedule. Broadcasting imposed a strict regime; in addition, the administrative complexities of handling very large numbers of students on a flexible schedule seemed overwhelming. After long debate, we reached a compromise. Students could choose the load they wanted for a given year. Courses were either whole or halves, and a student could take as little as a single half-course, or as much as two whole-courses. Half-courses were spread over the calendar year, just like whole-courses.

We found some other ways of increasing flexibility within this framework. For example, students do not have to complete all the tests for a course. This is particularly important when our students, all of whom have jobs (including the housewives!) of some kind, find that there is a particularly busy period at work or that the family wants to take its annual holiday. There is also some provision for students to specialise on parts of the courses that interest them most. Thus a

student may put in far more work on nineteenth century philosophers than on nineteenth century artists, even though both are fully represented in her multi-disciplinary course.

The workload on students is generally heavy, as our data show (e.g., Womphrey, Young and Blacklock, 1977). There is great variation, however, which probably indicates not only that some students can spare more time to study than others but also that some students need more time than others. Within limits, the Open University system expects students to work at their own rate.

Evaluation

In programmed instruction, the performance of students is continuously evaluated, not only through end-of-lesson tests. Every frame contains a test item. As I have indicated, the Open University provides many opportunities for students to evaluate their own performance or be evaluated by tests, but rejects the idea of frame-by-frame testing.

What is accepted quite widely in the University is the need for evaluation of the effectiveness of instruction, and quite large sums of money are spent on securing data for this purpose. We interpret instructional effectiveness much more widely than did Skinner or the proponents of programmed instruction, who generally claimed that the only criterion of effectiveness should be student performance on tests, and that the tests should be based solely upon the programmed

instruction. We feel that at the university level in particular a wider interpretation is necessary, encompassing students' attitudes towards and opinions on the course material, tutor opinions, and study habit data as well as test figures. We employ survey research techniques (mainly questionnaires and interviews) to collect a wide range of data against which performance can be correlated (see, for example, McIntosh and Woodley, 1975; Burt, 1975).

I do not want to give the impression, however, that we have found solutions to all the problems of course evaluation. One of our biggest difficulties is that our data frequently tell us that something is wrong, but not what is wrong (Hawkridge, 1978). Even when we can find out exactly what is wrong, we may not be sure how to change it to improve instruction. We are like doctors in being able to see that the patient is ill, and we may be able to diagnose the illness. Our science is in such a primitive state, however, that we cannot be sure that our medicines will cure, or even alleviate, the illness. In these respects, I believe we are no better off than those engaged in developing programmed instruction. Error counts per frame, for example, tell such developers that something is wrong. The instruction in the frame can be changed, or the test item can be changed. If the error count drops, nobody can be certain why it has dropped, except in trivial cases. If it rises, one can only try some other remedy. It is a quite intuitive process.

Conclusion

It will be clear to you by now that the principles of programmed instruction have influenced Open University course development, but that they have not gained universal acceptance. The most obvious case of rejection is the format - whether linear or branching. Less obviously, the University has rejected a doctrinaire stance based on behavioural psychology. In true British empirical tradition, the University's course teams have followed the principles where common-sense dicated, and have abandoned them where the positive-rational philosophy underlying the principles appeared to cut across the interests of students. The Open University is acclaimed as a centre of excellence in teaching. It owes something to the programmed instruction movement (as I do personally). I believe it has learned from that movement and adopted an eclectic view of instruction that is more appropriate to its educational mission in Great Britain.

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