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Implications of Programmed Instruction for South African Education

By

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I have undertaken to talk about some of the implications programmed instruction may have on our schools and my subject by its very nature ties up somewhat with other aspects of programmed instruction. It is inevitable that previous speakers have dealt with aspects of it. My words, therefore, may act as a kind of summary of some of what has already been said. I don't claim to say anything new. I merely intend to draw your attention to perhaps a few important matters.

As I see it there are at least two immediate and related problems regarding the entry of programmed instruction into our schools. The first is the demonstration of its effectiveness under South African conditions, and the second is how it should be introduced. The thoughts regarding effectiveness are modest and hesitant, and experimental procedures are not yet effective, but it appears that programmed instruction is not at best much more effective in at least some cases than conventional teaching and such findings seem to be regarded in those cases as satisfactory. My own feeling is, however, that those who administer education may want more than that for their money. Present educational standards are not unanimously regarded as constituting a high criterion against which to measure anything. The usual reservations must be made there, of course, the glorious exceptions to all this. We hear repeatedly, for example, of the flood of first year university failures, the children who even before the age of 10 have acquired a hatred of number work, the older pupils who mutilate their language, the typists whose spelling has the doubtful virtue of originality. If programmed instruction is to accomplish only a little more than that, the country may refuse to have it.

But assuming programmed instruction can do better, let us consider how it may be introduced. In the past new movements in education have been made by enthusiasts, or to be fair by original thinkers and their followers. Unfortunately, the followers have included many whose enthusiasm was stronger than their wisdom. If we take this warning (when I say we, I mean those of us attached to programmed instruction), if we take this warning seriously, it means that those who have any respect for programmed instruction should hold themselves responsible for it. Suggestions as to what can actually be done may be found in current advances in the American scene, especially those relating to curriculum revision. For many years university teachers have stood aloof from this planning of school curricula, and as a result of the lack of liaison between those with advanced knowledge and those who taught children, the school curriculum became unrelated to modern knowledge, particularly in mathematics and science. This is now being put right. Many new improvements are being made by groups which now include university subject teachers.

That is what I have in mind when I recommend that programmed instruction might be handled and introduced in a similar way. The universities ought to help the schools. While writing these notes, and that wasn't last night, I was called to the telephone to be told that the Natal Education Department, represented here by the gentlemen our Chairman has mentioned, has decided to work with the university Department of Education for the introduction of programmed instruction into Natal schools. This is one of the ways programmed instruction can be encouraged, yet at the same time kept under control. That there is a need for such caution, that is keeping it under control, may be emphasised by reference to statements made by two influential men. Mr. Christopher Chataway, the athlete, now parliamentary secretary to the British Minister of Education, said this year: "I should be right to express an interest in this subject, to welcome the development that is going on, but to emphasise that it is possible at this stage of the development both of programmed learning and of teaching machines, for people to buy textbooks and machines that are not properly validated and so a certain amount of caution is required". Professor Skinner issued a similar warning during an address at London University last October. He

said that commercial interests in America had seized teaching machines. Hasty programmes were being published. Programmes and teaching machines could be bought in supermarkets and from door to door salesmen. The need for caution is clear enough here.

Perhaps we may now turn our attention to some of the effects which in my guesswork, programmed instruction may have. Let us deal again for the third time (for someone dealt with it earlier this week), with the curriculum. In a speech broadcast over the Voice of America in March of 1962, A. A. Lumsdaine asserted that many teachers, as a result of making programmes, have for the first time realised what their subject matter consists of. They find they have "defined much more precisely then ever before exactly what it is they are trying to teach". If this is generally true, then we may expect that the rise of programmed instruction will lead to the long overdue criticism of what we teach in each subject and eventually to an overhaul of curricula in general. Consider for example much of what is taught in primary schools under the heading of hygiene. Mothers could tell you how much effect it has on children. Eventually someone will, for there is no limit to human folly, try to put this material on a programme. Then when he finds himself face to face with the assumption that you make a child behave hygienically by encouraging him to make statements about hygiene practices, he will, if he is sane, laugh at his own stupidity, give up his intentions and do something to alter the curriculum. The same could be said of arithmetic. In fact it has been said repeatedly, that when teachers start to programme it, that is the time when they may get an even clearer picture of what has to be thrown out. I think then that we may confidently expect that programmed instruction will lead eventually to much curriculum revision, and when that is done I hope that the American way of doing that kind of revision will not be overlooked.

Let us now consider the danger that programmed instruction may be pushed too far. I think there is a fair chance that if too much is claimed for programmed instruction it may be discredited. I say that because this error has happened already in our craft of teaching. Progressive education made claims of increased efficiency of learning, improved personality and character building, conservation of a democratic ideal. The project method claimed to foster both individual development and social awareness while teaching subject matter. More recently the Cuisenaire rods have been advocated for use in university mathematics. This claim, though it may well be true, does not gain the respect of teachers. H. G. Good, writing on the history of education in America (and H. G. Good is an American) describes the Dalton plan, the Lancaster monitorial system, manual training and other ideas as "fads" and he defines a fad as "a scheme or device for which magical powers are claimed". Again there is a warning clear enough here. The British Association of Programmed Learning produces a list of work being done in programming, a glance at which suggests that many teachers want to try their hands at it. This is at once encouraging and dangerous, but provided no unauthorised person can try his programme on school children, no harm can be done, and I should be perturbed to see the wrong subjects being programmed and in particular I refer to those activities which involve aesthetic enjoyment. Poetry can be dealt with in such a way that children experience enjoyment, but it can also be handled so that factual content and passages memorised gain precedence. At the moment I would suspect a programme that claims to increase aesthetic enjoyment. To give another example, a programme claiming to teach history might also be questioned. In short I would recommend that the decision regarding what to programme should be made only after consideration of the appropriateness of the material. Blunders, especially at this early stage, might jeopardise this movement.

We might find it interesting to speculate on how programmed instruction might affect pupils. Let us consider, as has been done already, the bright pupil. With the exception of the English system of specialist studies at advanced level, and one or two similar movements, it is probably true to say that the bright pupils do not receive the very special attention advocated for them by writers from Plato down to Lord James of Rusholme. Certainly this is true of South African education. Perhaps this is because the bright pupil has not been raised to the status of a problem, that very magic word. The bright one need not be very obvious in class. He can hold back and he often does. He usually goes no further in the syllabus than do the average and the dull. At the most, for example, he may be only very slightly noticeably quicker at translating from one language to another and he may do a few extra examples in mathematics. He is kept to the pace of the class and rarely is he made to take on the extra subject or subjects he could easily include. Thus it is rare for bright boys to study foreign languages. All these short-comings in our treatment of the bright are partly due to the apparent absence of a problem, but programmed instruction may change that. The bright boy will now tend to become more obvious. He will finish his programme or session with the machine much more quickly than the others. Experimental evidence of that

was quoted yesterday by Dr. Krige and the teachers will have to do something about it. It would appear that the bright boy will take a third or half the time required by the average. This calls for drastic action, for he cannot be left sitting there doing nothing. And I hope it calls also for a drastic remedy. Some teachers have agreed with me that the top class in a large school could easily reach senior certificate examination in mathematics, the one I am familiar with, by the end of Standard 9. I think that programmed instruction may show the need for special treatment for the bright. Programmed instruction, going one stage further, may be the very technique by which the bright will be advanced still further. At the other end of the scale is the pupil who is on the pass/fail border line. We all know how he seems to give adequate answers in class and is not questioned too often lest the teacher confirms his own suspicions that the boy does not understand what is going on. And none of us is not guilty at this point. He, too, by being inconspicuous, is no problem. He is noticed when he and others like him fail in examinations, but then it is too late. But now comes programmed instruction which shows this boy up. He gets stuck frequently by frames easy to others. He takes a long time over a unit of work. In short, he quickly becomes obvious. What is to be done? Frankly I do not know, but I hope that when the difficulty is highlighted, educationists will begin to admit that attending lessons and passing examinations are the hallmarks of what is called an academic course. Then they may admit that to provide easy courses and easy examinations for for pupils who are regarded as non-academic is indeed a strange contradiction.

Programmed instruction will, I hope, focus attention on all such individual differences and result in more thinking about tailoring the education to the child. As well as the dull boy, there is the backward boy. Programmed instruction will, for reasons I have previously mentioned, make him also conspicuous. Can it also help him? There are already signs that because programmed instruction allows a pupil to proceed at his own speed and frees teachers to give individual help, we may see remedial teaching being offered via programmes. It seems reasonable to expect that every school may soon have its remedial room where special programmes and machines and a very small teaching staff cater for such pupils, such backward pupils. The boy who has been off school for a month is more likely, paradoxically, to get personal help from a machine than from a teacher. Some remedial work has already begun in England and the result may be that South African courses in remedial education may soon include a study of programmed instruction and its applicability to remedial work. This fascinating topic will undoubtedly attract many teachers and we may see remedial teaching even in our secondary schools where it is always suspected that it is not really wanted.

Let us now consider what has been called by someone else "the personal touch". This topic was brought to my notice by a teacher who expressed strong dislike of a machine which removed from learning the relation of pupil and teacher and I do not feel ready to dismiss his concern by the standard argument in programmed instruction books that programmed instruction will not be any more harmful than was the arrival of the text book. There may be more in it than that. This misgiving, the teacher's misgiving, implies that there is a personal relationship and that it is an asset, but we may clear the air by saying that the personal contact is rather limited when the class exceeds 40, especially when a class has a different teacher every 45 minutes. A little mental arithmetic indicates how little personal contact there is, but we must not overlook the fact that just as, perhaps, to my disadvantage, you have done a bit of assessing of personal contact in the last ten minutes, so there is personal contact even when a teacher is addressing a mass of pupils. Such teaching of large classes is bound to be somewhat impersonal, expecially if the teacher uses authoritarian methods and has to rush through a syllabus. But even so there may be grounds for believing that the machine may lose by depersonalising (if I may be forgiven the word) teaching. An extremist might be tempted to hold the view that learning has happened when a correct quick response has been made, and I do not refer solely to proponents of programmed instruction, there being many teachers today and in the past who held that view regarding arithmetic, geography and even poetry. Some of these would probably believe that to know is important, but how one came to know is less so. This is a point I would like to draw attention to. All school subjects are not to be regarded as pieces of fact or truth existing out there waiting to be brought into the mind of the learner. For the majority of learners, what is learned is a product of the minds of men, and one is tempted to ask what has been lost by depersonalising some learning.

Surely whatever good we derive from our schools and universities is much more than a kind of algebraic sum of the facts of the syllabuses. There is, for example, a kind of beauty in mathematics which can be made evident by the attitude of a teacher, and it can be infectious. There is a kind of honesty which a science master can pass on via his subject and it resides in his tone of voice, his facial expression, his general attitude. A machine may not be able to do this. There is also the impact, the influence of the entire personality,

a thing about which perhaps not enough is known. The trouble is that a programme must be largely impersonal and in that sense it suffers a loss. Whether improvement in technique will make good that deficiency remains to be seen, but it is hoped that the matter will receive attention from research.

I sympathise with the teacher I referred to. Although Professor Skinner has programmed part of his university psychology course in his book written in conjunction with Dr. Holland, *The Analysis of Behaviour*, I would like to know not only whether the students learn from it as well as from Professor Skinner's teaching, but which method is the more effective in making students want to go on learning more psychology.

Now, by pure chance, we turn to what might be a consideration of some of the effects of programmed instruction on psychology, and I am fully capable of dealing with this because I am not a psychologist. I want to speculate on what effect this subject of ours may have on educational psychology and on methods of teaching. To begin with let us make an assertion. Let us assert that although teaching methods should be based considerably on the finding of psychology and other sciences, it rarely is. Sometimes the two subjects are taught in various institutions as if they were not connected, and it is not just by chance that they are sometimes taught by different people. Programmed instruction may do a service here. Presumably teacher training institutions will include it in their syllabuses from now on. No college dare not. The plain fact is that here is a teaching method which just cannot in all honesty be taught without reference to psychology. I admit that a programme proceeds in a manner reminiscent of the Socratic method and I grant the claim that Comenius three hundred years ago had the small step concept for teaching, and I would be even more ready to give credit to the machines of Pressey nearly forty years ago, but no one appears to be able to get past that paper presented at Pittsburgh in 1954 by Professor Skinner entitled "The Science of Learning and the Art of Teaching". No one can talk of Skinner type programmes without referring somehow to the experimental work on learning, immediate reinforcement and the like. Is it too much to hope for that the arrival of programmed instruction will bring an interest in psychology? At least we have some right to hope that the psychology applied in programmed instruction may be employed generally in teaching.

Consider firstly the principle that learning takes place best when the learner is active. I was looking at a book the other night where the author points out that when a teacher is saying a thing many times to imprint it in the minds of the pupils, the teacher is the only one present getting reinforcement. Acceptance of this principle will remind teachers at all levels that the lecture at best is an economy device. It has been stated that the lecture came into being because it was cheaper during the Middle Ages for a student to walk across Europe to hear a scholar talk than to buy this scholar's book. Yet we have hung on to the lecture given by one to many as the accepted setting for teaching as if printing had never been invented. Kaarhof, in his little book *The Farce Called Education*—a good title—has pointed out there are some people who learn better from lectures than from any other means—illiterates. I sincerely hope that the psychology of programmed instruction will undermine our entrenched, blind faith in the sanctity of the arrangement called "a lesson".

Then there is the principle that repetition is effective only under certain conditions. Acknowledgement of this may lead to removal of things called number tables, which, despite numerous reports and the pleas of many educationists, are still being taught as assiduously as if they were holy writ. Relevant use and intelligent drill which is the criterion of programmed instruction may become the accepted methods of fixing facts in all subjects.

A third central fact in programmed instruction is, as has been mentioned already, the immediacy of reinforcement. The discovery, or rather emphasis, of this on learning remind us all that the vast amount of unpleasant, even sordid toil involved in marking pupil's work may not be rewarded by increased learning of a significant amount; in fact it looks again as if here is an example of the wrong person seeing the material being repeated. I hope the arrival of programmed instruction will turn the attention of questioning minds on to the setting of homework. But—and I hesitate to say it—I fear we may yet live to see the day when a child may be ordered to take his programmed book home to finish a piece of learning. Habits, especially bad ones, die hard.

Perhaps the greatest effect of programmed instruction will be its power to demonstrate as has never been done before the enormous differences amongst pupils. The traditional classroom has tended to stress uniformity and conformity in handwriting, dress, method of expression, techniques in mathematics, behaviour in general. Now we are going to be reminded of how wrong that is and that conformity and uniformity are characteristics less of the school than of the factory.

These are some of the effects which some of the principles behind programmed instruction may

have on the role of psychology. I have no doubt that others will suggest themselves to you. I think programmed instruction is going to be a challenge to psychology, or at least to some schools of it. Not all psychologists and few laymen can accept the following statement by Dr. J. G. Holland of Harvard. "The old, defunct explanatory concepts of knowledge, meaning, mind or symbolic processes have never afforded the possibility of manipulation or control, but behaviour, verbal or otherwise, can be controlled with ease and precision". I should be very interested indeed to know what other schools will say when they turn to discuss programmed instruction, for they must—they cannot stay out in the cold and not heed this big movement. So far the only reference I have seen in my limited reading is a very small reference from someone who favours Guthrie's concepts. One of Guthrie's concepts is that the fact that a response does follow a stimulus is itself a reinforcement, but they used that fact as proof that Skinner was right when he said you should encourage learning without making errors.

The subject of readiness has sometimes cropped up in education. I think programmed instruction is going to throw some light on this concept of readiness for learning. At one extreme of it, there is a belief that no child could master a piece of learning until he was psychologically ready to do so. This led to various aspects of the syllabus being assigned to those standards where children would be ready for them and this concept was rarely disputed because it would be complicated to try out in a low standard material normally taught higher up in the school. Others held the belief that any subject can be taught at any school age provided the method is appropriate. As an example, I understand that a new approach to physics starts by introducing the beginners at once to the concept of atomic structure in a way that he can understand. Professor Davies, Head of the Madison Project at Syracuse University, claims from his experience, his recent personal experience, of teaching mathematics to children aged ten upwards, that readiness is made by the method of teaching. This view was expressed by Professor Marcel of Columbia ten years earlier and Professor Jerome S. Bruner puts it very neatly: "Any subject can be taught effectively in some intelligently honest form to any child at any stage of development. With the proviso so long as the child views his world from a child's viewpoint. Programmed instruction is relevant to readiness for learning. Since programmes are built by pupils, it follows that a wholesale investigation of the learning powers of children is virtually forced upon us. And since the pupils who have finished one task can under programmed instruction easily be put on to the next, I suspect we are going to have our eyes opened widely about what pupils can accomplish when the method is right. I suggest that the concept of readiness for learning is wide open".

A few other considerations on the effects of programmed instruction on children. It has been claimed by some that programmed instruction may have unexepcted side effects on children. It has been suggested by B. N. Lewis in the February, 1963 copy of the *Programmed Learning Bulletin* that "there are reasons for doubting the long-term wisdom of teaching in this, the small step, Skinner way. In the first place, it equips the student rather poorly for the outside world. Secondly it is probably inadequate for the teaching of any form of skill." Now the plain fact of the matter is that any educational system which has its final results, J.C. or matriculation as its immediate or ultimate aim, is living in the past. Any teacher who teaches only for such goals is inadequate. In the world today and especially in the unique social structure of South Africa, we must accept that a good school turns out pupils who want to go on studying afterwards. What will be the reactions of programmed children (may I call them that?) when they find higher education uses conventional textbooks? Frankly, I do not know, nor can I guess, but the man in the street would deny that a life of ease is an appropriate training for facing difficulties. This assertion that programmed instruction will act as a brake on other types of study must be taken seriously for it will be a very long time indeed before further and higher education uses automated methods widely.

Now the teacher. Some of the implications for the teacher may be considered and firstly I want to ponder on the statement often made in the literature of programmed instruction that it will raise the status of the teacher. The argument is that marking books, stating facts which any child can read for himself and assessing skills are jobs to be done in another way, carry no dignity since they can be done by other means.

Programmed instruction, by removing such routine work, leaves the teacher to give personal help, that is his real function, by concentrating on it, he gains status. Unfortunately, these arguments have come from another culture pattern, one where the status of teachers, so Americans, or some American writers tell us, is at times low. Will the status be raised in the case of teachers whose status is fairly respectable? Is it not possible that a respected, successful teacher may fear that machines or other devices which infringe on his method of teaching will detract from his status? My own view is no more than this—that statements based on one culture pattern may not be true in another. And I would advise

some caution in this matter until we, too, are sure of our facts from our own evidence.

There is yet another aspect concerning teachers. Admittedly anyone can construct a programme, but only teachers can study how it works with children, in fact only teachers can help with revising and perfecting a draft until it emerges as a real programme. Alongside this, consider the fact that South Africa must, to cut costs, make its own programmes and translate them into two languages. I submit, therefore, that it may eventually become necessary to plan programme construction. It is not good enough to expect teachers to make programmes in their spare time. Good teachers have no spare time, and I think it will be necessary to relieve a few experienced teachers of some of their duties so that they can have the time and the opportunity to make and perfect programmes.

The problem of language has another implication. Most programmes will have to be available in two languages, and I suspect that just as an intelligence test loses validity sometimes on mere translation, a translated programme may run into similar semantic difficulties. Probably translation will have to be followed by at least a trial run in the new language. I doubt if translation can be regarded as enough.

There is a feeling in the air nowadays that programmed instruction is the only new feature in education. This is untrue. My own feeling is that the wholesale assault on curriculum improvements is a movement of vast importance. As has been mentioned, physics has been revolutionised. That has been done by a group called the Physical Science Study Committee, Mathematics by the Schools Mathematics Study Group and, for those who want it, the whole list of these projects for science, mathematics, English, foreign languages, social studies appears in a report called "Current Curriculum Studies in Academic Subjects". In England there is the Schools Mathematics Project organised by Southampton University. Bodies such as these are deciding what is to be taught in schools. Since programmed instruction is no more than a method of teaching it must take cognisance of these new developments. It must become familiar with the new material in the new books. It is a mistake to waste this bright new method on teaching material which may soon become obsolete. I suggest that all those concerned with programme construction should keep a sharp lookout for changes in subject matter so that it can be incorporated into programmes. In other words, I am reminding us all that programmed instruction is merely one member of the education family. It must not be an independent individualist. It must co-operate in the general plan. In the same way, we may hope that those who specialise in programmed instruction, presumably many, will not run away with the idea that they, of all people, possess the best teaching method. On the contrary, it is only another aid. For example, I think that programmed geography teaching is a barren procedure if it does not use films, globes and text books, and Mr. Patrick Thornhill, the author of *Earth in Orbit*, the first British programmed text book, informed me in a letter that he envisaged the use of globes "posted up round the classroom". The implication there, of course, is that programmed instruction is not a device which enables the teacher to catch up with his reading in the wrong time.

I come now to something personal. The first major implication of programmed instruction, in time at any rate, is the effect of this conference. Another like it may not happen again for some time, so I should make the most use of this opportunity by offering a suggestion. Programmed instruction is new and all who are working in it and studying it ought to have access to some clearing house of information. The American Association, to which anyone may become a member, costs one dollar, and the British one costs 10/– and each publishes a bulletin from which it is comparatively easy to learn what is going on there. But perhaps we need a South African body. I wonder what the producers of *Symposium* would say if we suggested that *Symposium* acquired a sub-title to indicate its function to report on programmed instruction in this country. Then we should know what is going on in South Africa, or for that matter in Southern Africa.

In concluding I should like just to stress a few points. Firstly, this new teaching aid lends itself to commercial exploitation. Any competent engineer or craftsman could make a thing called a teaching machine, and his contraption, because of its novelty effect, would probably do an apparently reasonable job of teaching. Add to that our teacher shortage. What we have obviously, therefore, to guard against is that the market should be flooded with inferior equipment.

Secondly, this whole movement is merely concerned with one of many teaching techniques. It should be remembered that there are others. Programmed instruction is not to replace any of them, but merely to aid them all. Those in programmed instruction would do well to be modest in their claims and humble in their intentions. And I think it is only fair to admit that that has been the general tenor of speakers already at this conference.

Thirdly, programmed instruction should not blind us to the fact that other advances in education are necessary—curriculum improvement is long overdue, differentiation needs more consideration. Our examination system should be revised; perhaps wide educational reforms are now needed, into which programmed instruction can be incorporated.

Fourthly, there is a need for much research on this subject so that schools and university, and commerce and industry can anticipate respectable evaluation of programmes and machines. Universities should help in this. I cannot share the view earlier expressed at this conference that experimentation on a provincial or local level will not suffice. Lack of centralised control will lead to the healthy diversity education always needs and has benefited from in the past.

Finally I should like to record my optimism. The convenors of this conference have got us off to a good start. If the spirit of this conference permeates future work in programmed instruction all will be well.

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