

The Characteristics of Educational Research: mapping the domain

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It is a tribute to the President of the British Educational Research Association that his address to last year's conference compelled me to explore further some of the vital issues which he brought to our notice. The improvements in educational research both in conception and methods which BERA was established to foster and promulgate will be the sooner achieved if we can successfully respond to the challenge then offered. The challenge was that to recognise 'the specificity of education as an object of investigation' we must face up to the conceptual, technical and methodological problems which must be solved in order to establish conceptual and technical norms based on the recognition of educational criteria. Brian Simon saw this new focus on the processes of education as the result of historically recent events following the abolition of selection to secondary schools, the evolution of the comprehensive system and the development of new curricula. These events were in his view primarily due to the exercise of initiatives by some LEA's and of professional autonomy by some teachers. They were not built on foundations laid by imaginative research programmes. Indeed according to Brian Simon the educational research of preceding decades had been distorted by the heterogonic growth of psychometrics which "provided not only the means but also the rationale for maintaining intact a system to which the processes of classification of streaming and selection were central to the detriment of education" [1]

So long as the educational system was maintained in this 'steady state', characterised by homogeneously stratified groups of pupils and invariant curricula, the circumstances for developing a research of education were unpropitious. When the geneticist is confronted by plants with flowers of the same colour he is unable to begin researches which might lead to an explanation of the mechanism of inheritance. Similarly, the educational researcher can only elucidate mechanisms of educational change when alternative procedures are available naturally, or made available experimentally.

The view being expressed here suggests that when alternative educational procedures are available the educational researcher can get to work in order to unravel some of the mysteries of these processes. This casts the researcher in what Philip Taylor [2] describes as the role of "contemporary historian whose lot is to trail some way-not too far-behind, looking at the consequences of human decisions and relating them to the context of choices in which they were made". The effect of the educational researchers' work on educational decisions and practices is to sharpen some of our thinking about education but cumulatively, according to Taylor, it may have effects in bigger ways.

This seems to be a fairly accurate description of what many educational researchers have in recent years done, some of the time, but seems not to be the total picture of research as it is, and certainly not as it needs to be, to be effective in building up a systematic understanding of educational processes. To do this researchers must have the means and opportunities to intervene in a deliberate and planned way in the educational process. There is an important distinction to be drawn between experimental and non-experimental approaches to the study of educational phenomena. We will return to this issue later and try to establish the complementary relationship between these two types of approach.

But I wish to return to this major challenge of trying to identify and map the features of the domain of education (and therefore educational research) which are in Simon's terms 'specific' to education. Presumably, Simon would disagree with Cronbach's [3] emphasis when he says "most educational research, though not all, is psychological". He would on the other hand agree with Langeveld's [4] assertion that "educational studies are a 'practical science' in the sense that we don't only want to know facts and understand relations for the sake of knowledge, we want to know and understand in order to be able to act 'better' than we did before!"

Both Simon and Taylor share similar views on the essential differences between educational research on the one hand and research in such disciplines as psychology and sociology which impinge on education on the other. The psychologist's interest in the mechanism of mind, the sociologist's concern to elucidate social structures and dynamics might well attract them to the educational system in order to collect data to elaborate or validate part of the conceptual framework of their own disciplines, but neither is principally concerned to make the system 'better' or more efficient. If they do so, they do so incidentally to their main purpose. According to Taylor [5] "it is the centrality of *practical* judgments which distinguish educational research from other kinds of research which use similar methods".

This seems to me to be precisely analogous to engineering or agricultural research where any proposed research will be judged according to two sets of criteria; the first being concerned with the way the question was posed and the probability that the methods proposed will add to existing knowledge in the field, the second with utility; is this fact likely to be useful to practitioners?

The disciplines of physics and chemistry relate to both these practical fields in the same way as to psychology and sociology to education. This is what Thouless [6] meant when he described education as "an applied science directed towards achieving certain results in the intellectual growth and development of children".

However, by simply adding to the test of educational knowledge 'is it useful?' to the test 'is it true?' we have not advanced our cause of mapping the domain of education to a very significant degree, other than to frame the map.

Central to Simon's thesis were three propositions:

- (1) That there is a distinctive field of knowledge informed by conceptual structures called education which impinges on disciplines none of which can adequately describe it.
- (2) That once this field is identified criteria will be available to determine potentially effective research questions and research procedures.
- (3) That the goal of educational researches is to improve educational practice.

Central to any map of education is knowledge about the learner, his characteristics and predispositions about the conditions likely to advance his knowledge, skills and understanding. Another triangulation point on the map is knowledge of teachers' professional minds and especially their behaviour when engaged in the process of teaching. Transactions between learner and teacher and the conditions which increase the likelihood that something valuable is learnt constitute a third point. A fourth point is a knowledge of the environments in which learning takes place and the availability of resources conducive to learning.

A problem for the educational cartographer is the possibility of confusion between *schooling and education* which carries with it the possible assumption that the only education worth considering occurs within the present institutional framework for formal 'education'. Even Brian Simon [7] quoted an American philosopher's attempt as he put it to "define educational phenomena more specifically" with evident approval:

what occurs in the classroom, in the process of teaching, is neither a chance happening, nor determined by anything comparable to a law of nature. Here is a planned, deliberate, explicit intervention designed to promote learning which may differ from place to place and from time to time, but which is observable and subject to analysis. .

Shulman [8] in his article on the Reconstruction of Educational Research also focuses on *schooling*. Most conceivable schooling situations will possess certain common characteristics:

- (1) They involve the attempt to modify or manipulate a setting (with or without a teacher) to bring about *desired* changes in a learner.
- (2) They take place over relatively extended periods of time.
- (3) They involve the simultaneous input of multiple influences and the likely output of multiple consequences-some predicted, others not.
- (4) They are characterised by variability of reaction to ostensibly common stimuli; that is, not all learners learn equally or react similarly to specific acts of teaching.

As such descriptions go this is more complete than most. To Shulman's credit he refused to duck such issues as time-scale, unpredicted outcomes and differential learner responses.

From such statements it is possible at least to map *schooling*, although not, I believe, education, if only because the learner's progress towards goals deemed to be desirable may take place by chance rather than design outside as well as inside schools.

It was implicit in Simon's thesis that "focusing directly on education" would require the development of concepts (and an appropriate terminology) of educational phenomena and a variety of research methods to establish their validity. Descriptions of schooling such as those quoted above, and there are many similar, could be generalised as follows, to illustrate how (admittedly in a fairly primitive way) Simon's expectations might be realised.

The processes of schooling may be analysed in terms of Intentions, Processes, including Strategies and Tactics and Outcomes.

Intentions may be described in terms of subject matter to be learnt, concepts formed in the mind of the learner to give facts meaning, skills to be developed, attitudes fostered towards a subject or process of learning that subject or more general values engendered. Intentions indicate the changes which the teachers hope will take place in the learner.

Such intentions may be examined and defended rationally once a language is available for their description. They may also be examined empirically, at least at the descriptive level, in an exploration of differences of intentions between teachers teaching similar or different pupils. Also the grounds upon which some intentions are selected and others rejected may be examined and tested against appropriate criteria. Contributions to educational thought such as those of Hirst and Phenix provide a rational basis for the defence of some intentions. In a less elegant but not less useful way some psychologists have attempted to describe subsets of intentions called objectives in behavioural and hence observable terms. The development of vocabularies and syntaxes of intentions is under way and associated concepts are thus open to public inspection and debate.

The middle term of *intentions, process, outcomes*, represents difficult territory for the map maker. One problem is that terms used to describe teaching processes lack precise behavioural definition. When such terms are used no clear picture comes to mind of concomitant teacher or pupil behaviours either overt or covert. Terms like discussion, lecture, demonstration, experiment, discovery are among those used to describe processes in this category. It was interesting to note some reactions to the Humanities project when, in order to secure the acceptable intention that pupils when faced with a contentious social issue (and given conflicting evidence and opinion) arrive at a point of view, which they would defend against their peers, in front of a teacher acting as a neutral chairman. Process is a sensitive area. The vocabulary currently in use may be protectively vague. No map of schooling can be complete without a taxonomy and ecology of classroom transactions. Yet we are still ignorant of the strategies teachers use such as the selection of facts to be taught, the experiences given to pupils to advance concept development or to train them in specified skills. We do not know how teachers sequence experiences, design and use diagnostic procedures and instruments to monitor pupils' progress, or the strategies they use to maintain motivation or other conditions for

learning or even to make the classroom a congenial place to be. Only in the fields of programmed learning and computer-based instructions has the detailed analysis of alternative strategies been systematically undertaken. Both rational and empirical studies of strategic process decisions by teachers may be undertaken. The former to examine the rationale behind the selected processes and empirical studies to examine the congruence between intentions and processes, and their effects in terms of pupils' response.

The *tactics* of processes refers to the script of the lesson written by the players as the lesson unfolds, the blow by blow account of transactions between teachers and pupils, between pupils and between pupils and resources. Some limited successes have been achieved by those attempting to explore links between the language, thought and action of transactions. The development by linguists of metalanguages with functional syntaxes has been helpful in this direction. Researchers with an anthropological turn of mind may yet provide some useful insights into the tactics of processes. As yet the study of process-tactics is in a similar position to the study of plants and animals before Linnaeus. Much patient observation, reflection and analysis has yet to be done in order to arrive at taxonomic principles which give meaning and significance to such events. Only then will we get beneath the surface contours of inadequate conventional descriptions of process to a deeper significance. The study of process-tactics is essentially empirical not only to establish congruence with intentions but to develop an ecology of these transactions. What are the conditions which favour a particular species of transaction? How are different species of transactions related? Do they compete with or sustain each other? Is there in educational transactions an analogue to ecological succession where some species of transaction can exist only when conditions have been established in the habitat by species earlier in the succession? The metaphor is useful if only to point to the inadequacy of available metalanguages for educational transactions.

In the realm of outcomes, their observation and measurement, our map seems to be richly endowed with ordered concepts established and supported by available research and technology. On close inspection this may be seen to be an illusion. As Shulman indicated, intended objectives are a subset of realised outcomes. Where objectives can be realised to a measurable degree during the time when the process is operating, when norm referenced tests which yield one-dimensional constructs of attainment give a valid representation of the objectives, where pencil and paper tests make demands congruent with intended outcomes *then* the demonstration of outcomes is a relatively straightforward matter. However, it is at least possible that many outcomes of educational processes do not satisfy these stringent requirements. The answer to such reasonable questions as: 'have pupils learnt what I tried to teach them?' 'have they learnt anything else incidental to my purpose', either things, of which I would approve or which are educationally counter-productive will only be achieved when we get off from the Procrustean bed of conventional testing and devise other means of acquiring data on outcomes which will stand up to analysis and critical scrutiny. The fairly recent renaissance of criterion-referenced and master testing, and attempts to analyse the dimensions of attainment tests to facilitate profile reporting are steps in this direction. But bolder moves are required both to provide a more flexible calculus of test

construction and analysis and to probe covert changes in the perceptions of pupils of subject matter, the learning process and the context in which educational processes occur.

Thus, in admittedly an all too brief and sketchy way, I have tried to respond to the challenge offered in last year's presidential address-"to focus directly on education, to make this the starting point"-and examine some of the implications for research.

You will note that following a host of precedents I confined my map building to *schooling*. Both philosophers and educational researchers who have reflected on the nature of the educational research enterprise have frequently emphasised the centrality of practical concerns. Short term professional pay-off is for many a necessary condition in judging educational research. To assert as Thouless [9] did, that education is an applied science, may suggest that all educational research must be done in response to questions arising from problems within the educational system and that success can only be achieved when the results are applicable to current educational practices. Any such restriction must result in an inadequate map of education. It would also lay educational research open to the charge that its sole function was to increase the efficiency of the existing system in terms of accepted criteria and deny it the opportunity to explore potentially more effective alternatives.

An American author, Patric Suppes [10] expressed the view that:

we must recognise that belief structures of education, the basis on which decisions are taken about policy and practice represent an accretion of many years of experience and fantasy.... A central problem of research is to attack that belief structure when it is unsupported by data or systematic theory.

Taking the process of learning to read as an illustration, he explains the goal of research as follows:

to construct a theory that can not only predict errors or difficulties of students, but a theory that postulates structures rich enough to process information in the same sequence of steps a student does!

Such theories must, in my view, be included in our map of education. It follows that a concentration on existing schooling practices is unlikely to achieve the goal of constructing and validating theories of this kind. The expectation that all educational research must have immediate practical pay-off is not conducive to this enterprise. Nevertheless it would be hard to deny that research of this kind was educational.

Another example of educational research which leads to the conclusion that a larger canvas than schooling is required to map the educational domain, is furnished by another American author, W. D. Rohwer [11]. This author attempted to set out the conditions for what he calls 'decisive research' and uses for his example two research objectives.

- (a) Determining the optimum time for beginning formal instruction about some skill or topic, and
- (b) determining how this schedule should be varied in order to adapt to individual differences.

To accomplish these objectives in terms that bear directly on school subjects he suggests we take a task from one of them, define it and construct a suitable instrument for observing the performance of pupils of different ages in a variety of controlled conditions. He set out what he regarded as 'critical features' of 'decisive research' in education. It should be *cumulative*. The programme should be planned so that the same task may be used repeatedly. If a variety of tasks are to be used there should be minimal variation between them and there must be clear reason to believe that the same process is being tapped. It should be *developmental*, the task being applied systematically across age ranges. It should be *experimental*. We need to know the identity of conditions which 'activate the processes responsible for "performance".' It should be *comparative*. We want to make inferences about individual differences, i.e. the range of variation of performance across different kinds of children that is associated with effects of different experimental conditions. It must be *realistic*. A key assumption is that the optimal timing of formal instruction will be indicated by evidence that the underlying processes necessary for successful completion are available in a substantial proportion of the population.

When Rohwer goes on to describe his own research it is significant that he was forced due to 'practical obstacles' to devise a 'task' for this purpose which was *not* drawn from a discipline or field of the schools' curriculum, but another task from which he hoped to gain "some verifiable convictions about the development of mental processes". In fact it was the ability of pupils to remember associated word pairs.

This may seem rather a damp squib after this heady talk of decisive research. However, from our present point of view the example serves as a case where educational research must inevitably operate outside the normal conditions of schooling in order to establish descriptions and defensible theories about educational processes.

My third example is of a different kind and one which represents the greatest challenge to our concepts both of education and educational research. I have recently served on a consultative committee to the Leverhulme sponsored Health Education Project. This project brings to bear on the problems of health education a variety of interests, not only LEAS, and school teachers but medical practitioners, paediatricians, health visitors and social workers and others. I suppose, but this has not to my knowledge been made explicit by the development team, that an important goal in health education is the autonomy of each person to make informed decisions on matters affecting his physiological and psychological wellbeing as far as possible free from ignorance, fear, myth and from dependency on authority. This autonomy will only be achieved when an individual knows the sources from which information and help are available and can communicate with them. Perhaps because the Project Director was aware that professional territorial claims have been established in much of this area, which tend to

be defended rather aggressively by their inhabitants, his initial enquiries took place not in schools but in the community. The team examined the relationships between some medical, paramedical and other professionals and their clients in particular communities. As the data accumulated (and some professionals took to the hills) a picture began to emerge of health education. It was blurred and incomplete. Some features which became apparent included the educational significance of being pregnant. Antenatal clinics are populated with women in a high state of readiness to be involved in an educative process. The facts and procedures learnt are impressive but the 'students' may also learn to face up to complex genetic problems and the probabilities of the immunisation process. They also wrestle with the problem of facing the pains of normal childbirth and the conflict between post-natal depression and the cow-like disposition said to be ideal for breast feeding.

In a similar way underprivileged families may *learn* from social workers, health visitors and doctors about nutrition and sanitation or simply how to cope. The problem of conceptualising educational processes of the kinds included in the wide brief of this project is formidable. Obviously the restricted confines of definitions of schooling with its "planned, deliberate, explicit intervention designed to promote learning", will not do. In this case the learner in the community occupies a position in a network of communication. At times in his or her life cycle access may be gained to knowledge, to the means of acquiring skills, affective support or material assistance, providing the right linkages exist and providing the channels of information are open to two-way communication in comprehensible languages. On this broader canvas the school and its curriculum has apparently a significant but relatively small part to play in health education. It would be in my view a salutary experience for educational researchers to look more often at instances of education in this wider context. I am convinced that lessons learned here will enrich our conceptualisation of the educational process inside as well as outside schooling.

I am not of course suggesting that we should deny Taylor's thesis that educational research is distinctive because of the centrality of practical judgments. I am suggesting that we should allow educational researchers the resources necessary to engage in research where the pay-off in practical terms is some time ahead but where theoretical pay-off is potentially high. Also I wish to encourage educational researchers in the course of their practice-focused work not to confine their attentions to any transient system of schooling but to explore a wider range of educational phenomena wherever they are found to occur.

Methodology

Simon recognised that when education is "firmly placed at the centre of the picture" there are many difficulties at both the conceptual and technical level concerning the methodology of research. Having attempted a primitive conceptual map-making exercise in response to his challenge, it is appropriate to examine briefly some methodological problems in educational research. The authors to whom I turned for some enlightenment on these matters did not in most cases live up to my hopes but did to my expectations.

Impressions left on the mind suggest that there is a widespread belief that physical and biological sciences employ research methods involving *only* critical tests of hypotheses against observations in the 'observable world'. There are some researchers who are convinced that these powerful techniques can and should be used in educational research and others who advance cogent reasons why research in the social sciences (including education) cannot be conducted by these methods. Authors who have attempted to unravel the essential operations of scientific thinking-a rather prestigious list -have found themselves engaged in a species of epistemological alchemy. But in the process some elements of the method have been defined and because they were so articulate there is a position to defend. The opponents imply that alternative methodologies will discover truths inaccessible to this quasi-scientific educational research, but they are not always as precise as I would expect either about the nature of their data or the way they operate their criteria to establish the truth of any educational proposition which they advance.

Constant vigilance is required wherever any method is used to collect and examine data to test propositions for truth. In his closing chapter to the UNESCO report, *The Role of Research in Educational Change*, Yates [12] calls for a critical appraisal of research methods. He holds the opinion that many researchers in the social sciences and education in particular use the "experimental designs of classical physics in order to gain the recognition and respect of their academic colleagues". He interprets this physical model as a search for 'algebraic relationships' that obtain among variables, i.e. it seeks to define empirical laws. The pursuit of invariant laws like Ohm's Law which, once established, enables designers of electrical appliances to operate with a high degree of confidence, he implies, cannot be matched in educational research.

Gowin [13] in his contribution to a *Philosophical Redirection of Educational Research* is critical of Travers because he assumes that "Educational Research is to be like research in natural sciences-to search for generalisations which are expected to hold in a variety of situations." According to Gowin the search for such generalisations is destined to prove abortive because human behaviour (especially that manifest during learning) is context dependent.

The same point is made by Thouless [14]

We must also recognise that the concept of the 'crucial test' or the 'decisive experiment' has, in the educational field, a degree of impermanence not matched in the physical sciences. Results are crucial or decisive only in the existing situation, with this kind of educational organisation, with teachers with pupils having this kind of antecedent experience, having this kind of training, these kinds of attitudes.

Lovell & Lawson [15] in their excellent primer on *Understanding Educational Research* make a rather different point when they contrast the natural scientists' exploration of the 'matter-energy system' with the investigations of human behaviour which may not be wholly contained within this system but is partly determined by physical forces such as 'mind' or 'will or even by transcendental influences.

Should these arguments then persuade us to reject the methods of investigation of the natural sciences in educational research? I think not. Demonstrating that the *findings* of physicists include invariant empirical laws in the matter-energy system, and pointing out that there are *a priori* grounds for the belief that such laws will not operate in, the educational process, does not demonstrate the futility of applying the methods of enquiry used in natural sciences in educational research. Moreover I am not convinced that human behaviour is as idiosyncratic as is assumed in these statements. Advertising companies, actuaries, tax gatherers and the discipline of economics depend for their existence on aspects of human behaviour which seem to be quite remarkably predictable. The *a priori* assumptions may owe more to man's wish to elevate himself from the matter-energy system to a position a little below the angels, than be founded on the facts of human behaviour. My main concern however is that we accept or reject the methods of physical sciences on the grounds of utility not on the expectation of dissimilar findings. The physicist produces mathematical models of natural events. The syntax of mathematics facilitates a rigour of discourse unparalleled in other languages. Such hypothetical statements are examined for goodness of fit in the observable world. If, in pursuit of regularities in teacher-pupil behaviour, we find such models to apply only under certain specified conditions, then the use of these methods will be justified. I hope we do not deny educational researchers access to these methods on doctrinaire grounds as insubstantial as those quoted.

The methods of enquiry used in the life sciences have proved attractive to educational researchers. Animals and plants, like people, exhibit individual differences while retaining their species characteristics. Also they are usually available for experimental purposes in only relatively small numbers compared with the astronomic numbers of particles available to the physicist. The aspect of empirical enquiry which has received most attention recently, and a certain notoriety, is the field testing of alternative methods of husbandry, e.g. fertilizer application, curriculum package application. The methods of experimental design and data analysis we owe largely to R. A. Fisher and were developed to take account of the conditions which obtain when living organisms are subjected to different treatments, within group variation, sample size, interactions and so on.

Yates [16] describes the position thus:

It is because of this need for special emphasis on the field testing phase in educational research and development that current methodological practices are being questioned. In the natural sciences widely generalised and applicable findings may reasonably be expected from fundamental research. In the social sciences, and in educational research particularly, such expectations are likely to be frustrated because of the extent and significance of the differences among the institutions and situations involved. The 'local' variables are so potent that they call for special attention from the researcher ... in the educational field. Much firmer distinctions are of course forced upon us. Among schools of the same 'type', for example, the range of variation is so great that it is most unlikely that a prescribed method of teaching will yield the same results in each.

It is well to recognise that much useful educational research currently undertake uses methods derived from the principles implied in these descriptions. Nevertheless recent criticism of the 'agronomist paradigm' has to be answered. I am reminded of Stephens [17] review of researches undertaken over several decade each of which hoped to answer questions concerning rival educational treatments, very few of which lived up to expectations. An even more severe criticism is that the mere comparison of some effects of method A compared with method B, while it may tell us which, if either, is the more likely to produce superior gains on some measured variables, does not of itself elucidate the learning mechanisms involved. As Yates says: "The question at issue is the extent to which these studies can be satisfactorily undertaken with the research methods that have been developed for somewhat different purposes."

The fact that these methods have failed to live up to expectations, i.e. yield statistically significant results in favour of one treatment and failed to facilitate the elucidation of mechanisms, may however not be due to inherent defects in the method. There are many possible practical reasons for 'failure' but I would draw attention to three. First, the failure to specify and observe treatment variables with anything approaching the degree of precision required, e.g. streamed-versus-unstreamed; discovery learning-versus-rule giving; secondly, the lack of reliable and valid methods for observing and measuring a broad spectrum of outcomes; thirdly, the assumption that the 'plots' to which treatments are assigned have any simple relationship to the administrative divisions in which the schools and school systems are organised.

Again I conclude that it would be premature to deny access of educational researchers to the potentially powerful means of testing hypotheses. I accept, however, that the method needs some elaboration in order to improve its pay-off. It would also be to our advantage to put the ideal of true experimental designs, in Campbell & Stanley's [18] terms in the broader perspective of what is loosely termed 'scientific method'.

Dewey's [19] formulation of the hypothetico-deductive method seems to allow more ways of testing hypotheses than the definitive experiment. It may be paraphrased thus:

- (a) Some problem is encountered which cannot be solved or explained.
- (b) Such observations are made and such facts gathered as appear to be relevant, so that the problem can be localised and defined more accurately.
- (c) The investigator makes intelligent guesses to explain relationships between facts.
- (d) He then works out the consequences if the hypothesis were true.
- (e) He then looks for evidence of consequences which would follow if the hypothesis were true.

The advances made in the study of geology and astronomy, and, to a substantial degree, in classical biology are the results of enquiries conducted according to this prescription but with only observational and correlational studies to support them. The theory which accounts for the evolution of species by natural selection, and the tectonic plate theory of continental drift, both theories of considerable explanatory power, were established by observation, speculation and association-not by experiment.

Histories of science, especially autobiographies of scientists, give a very different picture of the process of science from that presented by the distillation of philosophers of science. Foundations of modern experimental science were laid on centuries of alchemy and the patient acquisition of observed facts, by systematic classification and speculative theorising. In educational research I believe we are encouraged, perhaps by academic pressures, to run before we have learned to crawl. Yates called for alternative research methods, particularly that we should re-examine the case for non-experimental methods. Such methods as he describes would serve not only to increase the data base of educational research but also advance informed speculation and provide hypotheses which could be tested in due course.

There is a case also to be made for the use of non-scientific methods of enquiry where appropriate. While I cannot agree with Gowin [20] when he states that "any set of complex events can be validly described under an almost infinite number of conceptual systems", I accept that appropriate disciplines, each using its own criteria for truth, will make available interpretations of the educational process, and one cannot judge *a priori* that one is better than another. The criterion of utility, of course, could and should be applied.

If we refer to the map of schooling sketched earlier, or to the larger canvas of education, it should be possible, if Simon's assertion is true, to relate research methods to the components of the map.

The study of intentions is essentially multi-disciplinary. The logical relationships between intentions and the aims and purposes of education, from which they come, may be examined according to criteria derived from philosophy. The perceptions of teachers' intentions may be examined idiographically, the distribution of intentions empirically. The perceptions by pupils of teachers' intentions may be similarly investigated. Factors which determine the particular selection of intentions may also be explored, presumably by methods of enquiry which take fully into account the particular environment in which the teacher works.

The study of processes may take the form of the examination of the rational grounds on which particular strategies are used. However, facts about processes will be best obtained by observation. The congruency between processes and intentions on the one hand and the examination of possible causal links with outcomes on the other, require the use of essential scientific procedures; observation, classification, speculation, theorising correlational studies and where feasible experimental studies. However, in order to probe the meaning of observed processes and their relationships to each other, to the people involved and the content in which they operate, conceptualisations may come from anthropology, ecology, linguistics or social and cognitive psychology.

Outcomes perhaps inevitably will continue to be territory for the empiricist. As I suggested earlier, the procedures and the way we conceive outcomes will have to undergo

transformation. We certainly need some more productive theories of cognitive structure and growth.

It would seem that research in education will benefit from a multi-disciplinary attack on many major problems. Internecine warfare between rival methodologies is unhelpful. The only grounds for rejecting the application of any discipline to educational problems are that it fails to contribute to educational theory or that it fails to provide useful data and concepts.

In conclusion I wish to add a point or two about teachers and research. Constantly teachers are regarded in reviews of research methodologies as the objects of communication and consumers of research findings. While I would agree that it is our responsibility to write accounts of our researches and their implications in comprehensible prose which give teachers access to our minds, and share the hope that our work does yield usable findings, I am even more concerned that we think of teachers as professionals *with* whom rather than *on* whom we do research. Effective teaching is more likely to be achieved when the teacher himself is operating in reflective and empirical modes. Teachers operating in this way cease to be tiresome intervening variables and become self-conscious instruments of educational processes. Then the problem of communication is solved. Some teachers will be in on the act when the play is being written, not merely witnesses of the performance.

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