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ABSTRACT

The role of research and development in education is considered under nine main topics: 1) the need to reach agreement on a working definition and an acceptable classification of types of research; 2) the need for a balanced program requiring specific provisions for speculative and practical research, with school research units to ensure the conversion of theory into practice; 3) the development of speculative or basic research to ensure long term benefits and practical research concerned with products, program, efficiency, and assessment; 4) the development of better communication among researchers and developers throughout Canada and in other countries; 5) the improvement of facilities for training researchers; 6) the development of one or more grant structures to allocate ample funds for research and development; 7) the increase of the proportion of educational funds spent on research and development; 8) increased emphasis on problems in the academic, vocational, professional, and other segments of the education complex, whether in school or not; and 9) increased attention to the role of technology in education to ensure that the right choices be made and that the new methods will be effective. (MBM)

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ON HARNESSING R & D TO ADVANCE EDUCATION

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CHAPTER 1

ON HARNESSING R & D TO ADVANCE EDUCATION

Concern of this paper is with theory of research and development in education, an area which we can continue to neglect only at our peril. Today there is a call for innovative practices and development efforts that will provide education more in accord with recognized needs. At a time when demands are often backed by action, even violence, they cannot be ignored. Yet complying with them is not the answer. Wayward innovation, bandwagon programs and panic decisions must be eschewed. Progress is being made, and changes are being introduced at a greater rate than ever before but not rapidly enough. Our concern is with adopting the most effective and most economical way of testing and assessing proposed changes at a time when there is a greater spread of exciting innovations inviting administrators to partake than ever before.

The purpose of the paper is therefore to consider how we can bring some order out of the highly complex montage most people visualize when they think of all of the things that are going on under the rubric research as related to education.

It will attempt to provide some appreciation of the sorts of activities that could contribute to orderly advance of the education process.

It will also suggest why the sort of activity we have grouped under R & D should be ordered somewhat to ensure a balanced program and the husbanding of our limited resources.

Furthermore it will be concerned with ways in which the image of research in education can be burnished.

It is suggested herein that there is need for reaching agreement on and implementing an R & D policy if education is to benefit as have agriculture, health, fisheries, manufacture, space exploration and such. Just as the Science Council of Canada has pointed out a great need to spell out a science policy for Canada related to research, so in education we assume that if the recommendations of the Science Council and the Economic Council are to be achieved concerning the development of human resources, there is an even greater need for a policy for R & D in Education.

Over the years a wide variety of various sized research studies have been completed and reported. Of these a few have been implemented directly or indirectly into one or more schools, while many more have made no apparent direct impact on the program. Some of these were theses relegated to shelves in the archives to collect dust. Some were historic questionnaire survey efforts, or case studies, interesting, but only academically. Among the reports were many which were inconclusive, recommending further work, or reporting no significant differences in their findings. Of those reporting valid results many were correlational and did not establish causal relationships. A small and important percentage however have had direct bearing on educational practice, though others cumulatively have affected attitudes to individual differences, to special education, to reading methods and to other instruction, etc. A number have influenced decisions and practice.

If educational research activity has been spotty and peripheral to the education process, our problem would seem to be one of integrating the bulk of such activity into the very structure of education at all levels and in all segments. This is not to suggest that all research and development projects be aimed at solving practical problems, recognized in the field, or that provision for assessment of impact be built into all submissions for funding. It does imply however that this procedure be considered for development projects. For basic research projects, whether aimed at discovering new relationships or at validating theory, such would be undesirable. At most those applying for grants could be expected to indicate that the results of their work could add to our stock of knowledge, might or might not have application to education, that their hypothesis was strong (a hypothesis is strong when its affirmation can affect theory or practice), and that their design and proposed treatment of data were adequate. If approval is desired it should come from other basic researchers competent in the area.

No facets of contemporary life offer greater challenges to education than those resulting from the rapid contemporary social and cultural changes in which we are participating actively, or to which we must continuously adjust. Today's education must be dynamic. The sort of education which would have received accolades or praise but a few decades ago comes nowhere near meeting today's expectations. Not that what is expected of education today is carefully spelled out, nor that one can identify most current gropings, innovations or trends with any degree of precision. For we are now in the middle of a revolution in educational aims and procedures. We spent much of the first half of this century in devising a smooth operating system in which teachers were expected to perform as skilled technicians, using approved texts for all courses and following a course of study which detailed what was expected. The schools acted as a selective agency with annual platoons moving up the education ladder and with the final select contingent entering university where the selective process continued for another four or more years. Education was a creature of society but operated on its fringe. Now society has become concerned with eliminating dropouts, rehabilitating those who need it, helping the disadvantaged, providing more adequately for individual differences and generally operating child-centered schools for the good of the individual and of society. Education is now brought back right into the center of societal activity. Many even look to educators to solve our social and economic problems, and to research to solve our education difficulties. Some assume that during the next quarter of a century increasingly sophisticated research on the learner and learning process will be conducted on an increased scale by psychologists, sociologists, chemists and members of related disciplines, with similar efforts on instructional processes and on curriculum design, all of which will produce potentially revolutionary teaching techniques. The new procedures together with appropriate organizational and administrative arrangements and practices will make full use of the newer media and automated devices, and will provide an entirely different school setting.

The additions of new knowledge, which can be related to schooling and new applications of information that already exists, will undoubtedly be responsible for new frontiers, as challenges to educationists during the next decades. Yet the implementation of a reasonable R & D program is not a matter of life or death to education, which will survive in any case, with administrators making the best guesses possible using the information at hand. Only if the

public becomes aware of the potentialities of research and development used in an orderly approach is there any likelihood that R & D can aspire to a rightful role in this, rather than continue to dwell on the periphery of education, contributing little to the ongoing process. Otherwise education will continue to reflect little planning, assessment and evaluation, and few innovations will be tested before implementation on a large scale.

Yet it is almost certain that perceptive and rational leaders in some nations will realize that models which exist in other fields of social endeavour prove that social processes can be advanced through research endeavour. To the extent that a nation makes full use of potential brainpower and directs it towards achieving solutions, it will forge ahead.

Education has need of goals and of models designed so that those goals can be reached. These goals will provide a basis for listing problem areas where research should be undertaken. Some of these may point to gaps in theory while others will relate to the need for changes in practice. It is not enough for educators to list problems in the hopes that members of other disciplines will provide solutions -- if not today, then tomorrow. Educators should not only accept responsibility for developmental research but for undertaking considerable basic research as well. Yet educators would be remiss in their approach if they did not make full use of relevant research findings from other disciplines, or enlist members of other disciplines whether working on their own or as members of a team in attacking important problems in education.

But even though it is accepted that education researchers, among others, should attack problems basic to education, it must be remembered that the results of theoretic research seldom have an immediate impact on educational practice. Most research studies are directed towards predicting how phenomenon will interact under specified conditions. Such findings must be translated into action in a variety of unique situations where this knowledge, as it changes the ongoing process to some degree, will inevitably conflict with value systems and vested interests. Yet until the results of research are converted into action they are only of potential value, and until we succeed in conducting research and translating it into kinetic action we have failed to take advantage of its potential.

R & D in Education and the Social and Physical Environments

Today it is incalculably difficult to assess the power of the forces at work aimed at effecting change in education, or to calibrate the pressures of each, whether they are cooperating or in opposition to specific changes. Here we shall settle for listing but a few that are readily identifiable and forego any attempts to rank them.

First, our current social climate favours change and has placed few restrictions on the areas open for modification. Much of what we considered as "our way of life", almost sacred and worth fighting two wars for, is no longer defended and is open to debate. Our institutions, values and beliefs may be subjected to scrutiny and student voices for change sound louder than conservative protests of defence. Power struggles are inevitable and some activists, even anarchists, would be willing to tear down and start from scratch,

at least to rip everything apart. Youthful idealists are torn between two camps, neither of which seem in tune with their thinking or feeling. Some of the violence is directed towards the larger social struggle and even now there are those who are fearful and wonder how much we can salvage.

Second, during the late forties and the fifties first priority in education was directed towards providing pupil places for rapidly increasing enrolments as the post-war surge from a high birth rate first entered the elementary, then the secondary and for the next decade will be swelling enrolments in higher education institutions. At the same time increasingly more were remaining in school longer and demanding greater diversity in the educational offerings. More recently at the elementary level there has been a falling off in the number of entrants, but greater demands for improvements in quality, and greater provision for individual instruction. In education, in contrast to industry, quality production as with art work, demands greater diversity in the output, not a uniform high quality product.

At the post-secondary level, provision must be made for youth who wish to continue whole or part-time at school, while providing also for those who have left school but wish to return to raise their level of education, add to their competence or pursue studies further afield as a hobby. Community and junior colleges, technical institutes and related institutions are springing up to meet these needs. For the rest there must be new universities and colleges, expansion among those already established as well as other new institutions, new programs and methods.

Third, is the knowledge explosion, as it has been aptly termed. Among other things it reflects rapid expansion in the conducting of research, the proliferation of reports, additions to theory, much of this adding to our store of knowledge. Because of this, specialists, for example in biology, now are expected to master not only what was previously required (allowing for updating), but in addition acquire considerable information on genetics, chemistry and other related disciplines. They can do advanced thinking related to the biosphere, world overpopulation, the producing of a better race and so forth. Once they have reached the growing edge of biology, the opportunities for going beyond into the unknown are more prolific and appealing than ever before. The situation is somewhat similar in many other areas. The focus of efforts have recently shifted somewhat from the physical sciences to focus on the biological sciences. Because of the growing need to understand behavior one can hazard a guess that the focus of inquiry may next be directed towards challenges in the social science fields, including education.

Fourth is the possibility of introducing one or more of a wide range of innovations into the schools ranging from new curricula, to media and gadgetry which is both teasing and inviting. Nor was the climate ever better. With many disciples proclaiming the newer media and with reports seeming to substantiate phenomenal claims, one may well ask how any practitioner can be persuaded to wait for firmer validation. There is not much doubt that the newer gadgetry will be introduced, just as it has been introduced into the home, the farm, and the factory. There will be mistakes, disillusionment and disruption, more probably the teachers than the pupils being disturbed, in part by the mechanics of operating machines, in part from seeing them as a threat, and in part by frustration. There is an urgent need for more product research, related developmental research and in-service training.

Among professionals and laymen there is general agreement that education can and should be improved, that it has fallen behind our emerging society and therefore is not preparing youth for a place in society, let alone helping to prepare them for the unsolved problems of today's social organization. But if most people want change in education the demands here are still far below those for help in solving our social problems other than education. In the education context we hear demands for secondary school completion for all, greater post-school opportunities, free access to universities for all who can qualify, special education for the disadvantaged and other minorities, a systematic approach to streamlining education, as well as innumerable suggestions for changes in content and methodology. At the same time the amount and variety of education and training being supplied in industry have grown greatly. If this be added to evening courses in schools and colleges, the totals increasing rapidly should soon equal or surpass the numbers in formal education. The cradle to grave slogan of some years ago is rapidly becoming more of a reality. Yet the full implication of cradle to grave education has not yet been felt. It has relevance for curriculum construction, methodology, school administration, etc.

In this, a free society, the effectiveness of our schools in part determines the wellbeing of all citizens. However, any impact of the school on society is not something that will happen overnight. The product of the schools can be expected to contribute towards helping determine society's direction for up to half a century. Since no one believes that we can solve tomorrow's problems with today's answers, the most the school should attempt is to develop youth intellectually while building in a background of useful knowledge and values so that through adulthood satisfactory new adjustments can be made and better solutions reached to the emerging problems than would have been made otherwise.

Today the entrants at all stages of schooling on the average are more knowledgeable and ready for school than their counterparts of any previous generation. The average teacher today also knows more and the product of our schools is generally more advanced. The amount learned per student hour has probably risen. Yet few are satisfied that we are doing a good enough job. The desire for change and the number of innovations introduced reflects the current dynamic situation. It is now generally accepted that change is the normal state although the incidence of change can be speeded up or slowed down. Many protest against change for the sake of change and wish to maintain some degree of equilibrium among those forces seeking to stabilize and those aimed at upsetting the status quo. They want controlled, disciplined advance brought about in planned ways and in line with established modern goals.

The erosion of religious beliefs and convictions, widespread disillusionment with political and economic practices and economic values, and the displacement of the traditional extended family as the core of life must have a marked influence on education. Our culture, mores, and everything that went to make up our cherished way of life is now being questioned as is the sort of education institutions for which our forefathers fought. It is not our purpose here to dwell on the changes in the social structure which reflect our changing social values, our changing way of life, new relationships in a shrunken world where greater involvement is inevitable, and mutual responsibilities to find the good life for all peoples. This is a part of the context in which education must function as is the movement of peoples, the risks from

over-population, pollution, violence, and even the question of whether or not our civilization will survive. At the local level are problems concerning suburbia, the inner city, marginal rural areas, communication difficulties, increased mechanization and automation. Knowledge of man's relationship to the biosphere, a new interest being fostered by Unesco, should become a part of everyone's education so that we will become interested in relevant advance in science and technology. We should also consider the organization of societies by man within the framework imposed by our physical environment, and be concerned with making our peace with nature, while still adapting our physical environment to our needs.

Questions as to how the schools must relate to all this as well as to a consideration of the restructuring of formal education is a concern of everyone today. Outwardly its ramifications are found in student, teacher and racial unrest, activism, commission reports, philosophic treatises, educational literary efforts, and the introduction of new programs, to mention but a few. An atmosphere in which a wide variety of questions are being asked is one in which research of all sorts should flourish. There is room for the inventive and the innovative mind, the critical analyst, the critical synthesizer, the careful experimentalist, the surveyor, and the comparative educationist.

The formal education system is an instrument of society and reasonably responsible to its expressed wishes. Such wishes, however, are seldom unanimous. Our political system assumes that people take sides on what to them are important issues. In education we sometimes divide educators into traditionalists and progressives, or distinguish between those emphasizing subject matter, its structure and content and those favouring a "child-centered" school. But these distinctions at best only scratch the surface. Such divisions may represent certain of the differences of opinion concerning what we expect of our schools, but only some, for there are citizens who do not believe in sending their children to school, some who think religion must be a core subject, and others who feel that schools are outmoded institutions. By and large, it is traditional for Canadians to believe in education, yet although many groups have debated various aims at great length with both heat and light benefiting from the experience, we do not have one statement of aims and goals for education that has been generally accepted.

For some years educationists have noted with regret that the public is generally unaware of the extent to which dedicated educational scholars, and others, devote time to research activities. Research is much better known in health, agriculture, mining, the physical sciences and industry. In education, R.W.B. Jackson provided an overall picture of the situation in his 1961 Quance lectures, and F.G. Robinson did a mail survey on researchers for CCRE in 1964. The situation, however, has changed greatly since the early sixties, and CCRE now favours a more complete survey as soon as manhours and finances are available. Quebec is already doing this for the province.

Among the persistent reasons why such a study should be undertaken are the following: there is a current shortage of researchers and developers in education; a lack of money readily available for research projects; an increasing demand for estimates of R & D personnel for the future; increased demands for graduate and post-doctorate programs; a need for more planning and development programs; the need to assess the newer media and to discover

suitable ways of introducing them into the program; concern about the disadvantaged and other special students; need for the dissemination of research information and for a system to ensure that this is done; and the whole problem of training researchers and developers and attracting professionals from other disciplines to work in the field of education.

Such a survey should assess the current situation providing: data on the numbers involved and their competencies; present provision for research; freedom in the selection of projects; availability of equipment and supplies, technical and secretarial help; and concentration on selected areas, etc. It should be concerned with potential, assistance and incentives. It should make recommendations concerning the expansion of present establishments where necessary and the setting up of new ones, the sort of projects to be given high priorities, inter-disciplinary cooperation and money needed to meet recommendations. The sorts of establishments to be found in other advanced countries should be surveyed for the purpose of establishing guidelines as well as to avoid needless repetition. The information compiled in such a survey could be a base for annual updating so that a continuous assessment of the situation would be maintained.

The survey must recognize that Canada has two official languages and that research reported in one needs to be translated into the other. Its recommendations should provide for communication from producer to consumer with feedback and suggestions going up as well as down. It could identify certain areas needing research and suggest the body that might appropriately accept responsibility for each of these.

The Present Situation

The bulk of research and development concerning education is now being conducted in faculties of education and institutes. Institutes may consider R & D as one of their chief activities or may limit their research involvement to funding approved projects. Faculties generally consider their main function as the preparation of professional education personnel, and place research and service in the second rank. Much of the research undertaken by faculty members falls under descriptive research in which questionnaires and other forms are used in surveys, or is historical. Among the experimental studies many should be properly classified as pilot projects since the numbers involved are small and the sample an unselected captive group from one or several of their classes. Other studies include those undertaken by graduate students as part fulfilment to master's or doctoral requirements. Among these there is an occasional major breakthrough, a few action research projects, and a number which provide service. Some of the studies are undertaken in laboratories, some in schools and some elsewhere. They may be experimental or descriptive, with occasionally a big study using a large sample, multivariate analysis and being fairly definitive.

Research conducted by the Departments of Education is usually related to testing, evaluation or curricula. This is in addition to the collection and limited analysis of data on pupils, teachers, schools, etc. Royal and other Commissions set up by governments normally make use of surveys and analysis. Universities and schools conduct institutional research aimed at assessing and improving the program but only a limited number of units have made much use of this to date. Research in the professional associations has been a combination of action and operations research or service studies, information collection,

and synthesizing with a few large scale studies of which some resembled commission reports, and others more closely resemble longitudinal surveys or studies in depth.

With increasing interest in finding applications for the newer media already on the market and developing other media, there is need for considerably more research both with the instruments known as hardware, and with the programs to be used with these, known as software. Private industry is now investing considerable sums into the development of each of these, with the products ranging from simple teaching machines to computer related equipment, as well as films, slides, tapes, programmed texts, and such. Much of the field work, assessment and evaluation on education can be made by private firms, the approach varying according to whether it relates to a packaged program or new gadgets.

Design of This Report

Discussion in the chapters to follow will focus somewhat on a number of points. First is the need to reach agreement on a working definition for research and development and an acceptable, appropriate classification of types of research. This is not just a matter of ensuring effective communication, but is expedient for grant purposes, for ensuring a balanced program, and for devising models basic to good administration.

Second, we should aim for a balanced program which requires specific provisions for both speculative and practical, that is, developmental or problem-oriented research. The first necessitates some risk capital for discovery projects, with grants for concentration on theory and related tasks by others. It also will provide for developmental research, whether to adapt basic research to practical normal situations, to solve field stimulated problems, or to produce products for the school. Communication must be provided between producer and consumer and it is suggested that school research units if suitably developed could ensure theory being converted to practice.

Third is a discussion of speculative or basic research which is necessary to ensure long term benefits and of practical or developmental research concerned with products, program, efficiency and assessment. The latter should receive much more attention.

Fourth is communication among those researchers and developers concerned with theory and practice across Canada, and researchers in other countries which has not kept pace with modern methods for collection, storage, retrieval and distribution. Better dissemination strategies using both the old and the new should be devised or invented and implemented.

Fifth, our facilities for training researchers are inadequate to meet demands. Forecasts suggest that we could well use from 4,500 to 5,000 researchers and developers with graduate degrees, to provide for an adequate balanced program of R & D in education.

Sixth, there is need for one or more grant structures to allocate ample funds for R & D in education. It would neither be frugal or wise to scatter money at random to all who were curious about something related to the schools. Shortages of human and other resources and a plethora of identified needs, from tiny to large, suggest that projects supported be limited to those with proposals that could affect education for years, are important for theory, and are not likely to be answered in the near future by other countries.

Seventh, our best estimate at present is that just under 0.2 per cent of the total spent on education goes for R & D. This is just one-tenth of what could well be invested.

Eighth, R & D in education should be directed to problems in the academic, vocational, professional and other segments of the education complex, whether in school or not.

Ninth, the role of technology in education deserves special attention. Because of new advances in other disciplines such as biology, chemistry, etc., greater use of the computer and related machines, and today's social acceptance of change, it is likely that the schools of the next decade will be much different from today. Exponents of R & D strongly recommend that R & D be harnessed and integrated into the ongoing process to ensure that the right changes will be made and the new will be more effective. With the proviso that this does not support the neglect of basic research which ensures long term dividends, and that research results be not suppressed, the suggestion merits strong support.

CHAPTER II

RESEARCH IN THE FIELD OF EDUCATION

Within the boundaries of the human sciences, somewhere between the world of pure thought dedicated to theories for which knowledge is of paramount importance and the practical world of informed action in which utility and other practical matters take precedence, there is a broad area in which consideration of theory and utility mingle in varying proportions. With education, as with health and the human sciences, the desire to add to our stock of known facts is linked or in conflict with a desire for action, and recourse is had to the discoveries of a variety of disciplines to help cover the many segments which need study. Some of this is problem focussed, multidisciplinary research in which certain projects are attacked by interdisciplinary teams. Yet most decisions taken by educationists are made with too little supporting data or research findings to support them. Among educational researchers one can reasonably expect to identify those involved in basic research aimed at expanding our knowledge, others concerned with applications of basic research to school situations and still others involved in field-induced or problem-solving projects. The background of these researchers is most likely in one or more of several disciplines. For, though psychology has squatters' or settlers' rights, it is now recognized that there is an important place for sociologists, economists, engineers, communication experts, etc. What they must have in common, whether working alone or as members of a team, is an abiding interest in solving education problems of which the results are possibly of use in formulating theory, in taking practical decisions, or in providing ideas as plans for action. In those instances where research fails after having proved something which is then scrapped, the fault may lie with the researcher who fails to set out specific meaningful conclusions; with the user who has neglected to recognize possibilities; or because there is no system to ensure that the gap between theory and practice will be bridged and the innovation implemented.

In discussing research, we are concerned herein with disciplined inquiry in the field of education whether undertaken by educational researchers or members of other disciplines. In a report of the National Academy of Education, Research for Tomorrow's Schools,* a distinction is made between conclusion-oriented studies (knowledge seeking research in this report) and decision-oriented inquiry (developmental research), with each broken down finer in the chapters to follow. The Committee attempted to set forth the nature of disciplined inquiry and to judge how well current research was effecting this.

Although we often consider R & D as a complex package of activities, and treat the two as complementary in many instances, like the two parts of a nutcracker, we usually find it desirable to consider each separately in attempts to understand them. We may then go further and subdivide both research and development into smaller parcels since the two together represent activities and methodology which are becoming more highly complex year by year.

Considering research and development as complementary, the interesting partnership exhibited by R & D somewhat resembles a husband-wife relationship. For some purposes they can best be considered as separate entities, for others they are as one. Their functions are normally separate but there can be an overlapping whether as in cooking, housecleaning, repairing, etc., and one or other of them may perform all or none of these functions. Here it is accepted that research and development are generally two separate activities, their aims are different and the characteristics of researchers are and should be different

* Research for Tomorrow's Schools, Disciplined Inquiry for Education, James S. Colman, Laurence A. Cremin et al, The Macmillan Company, 1969, 231 pp.

from those of developers. However, it would be an oversimplification to assume that they were entirely separate and dissimilar, for neither is easily defined nor delimited, with research varying according to the segment of education considered and as to whether it is laboratory, field, institutional or product oriented. The position of an educational researcher in a private firm is probably quite different from one in a university.

In general, research can be distinguished from other activities in that it is rigorous, systematic study. In scientific research a problem is identified and all assumptions which seem to have a bearing on the problem are postulated. All relevant data are collected and reduced to quantitative terms. After processing the data, conclusions may be drawn and these so stated as to apply within the perimeter established in identifying the problem at the outset. In other words the problem is set out in a clear, concise statement. After preliminary analysis the hypothesis, or educated guess, is formulated. All relevant data are then collected and processed and the resulting findings assessed. Unfortunately this statement is not definitive and goes little way to settling any argument as to where research begins or leaves off. As noted, some would limit research to carefully controlled laboratory experiments.

Apart from striving to satisfy his basic needs, man is concerned with arriving at a better understanding of his environment and adapting it to his acquired needs so as to increase his enjoyment and satisfaction. He has institutionalized much preparation for living in education institutions and this has become his biggest business. In research in education emphasis is on assessing what is being done and deciding what more to do to increase efficiency. Research is expected to find answers to these questions cheaper, faster, better and more reliably than could be done using experience, logic and imagination not harnessed as research. There is thus nothing mysterious about research as endeavour. It began as measurement, with many difficulties being met in quantifying certain attributes and qualitative characteristics. It has since been discovered that simple experiments designed to hold all factors constant but the experimental variables were neither satisfactory, nor possible, in most situations. As a result the research methods and techniques gradually became more sophisticated and highly complex until today few have a comprehensive grasp of the statistical field. But though the layman cannot appreciate what the developmental researcher is up to, he is still hoping to find sound answers to problems related to the on-going process. The layman here is in a somewhat similar position to what he is in most situations. At the time of the Model T Ford most drivers were their own mechanics -- but no more. We now rely more and more on experts hoping that what is mysterious to us is straightforward to them. We can push buttons or flick switches, but when nothing happens we call for technical help.

The layman can appreciate the need for research in a situation where he has satisfied himself that any answers he gets otherwise lack the necessary validity for acceptance. Only when we are up against problems which baffle us, ones where we are not satisfied to accept the opinion of authorities, common-sense based on experiences which are too unrelated or limited, or intuition which is silent, do we feel the need for research. Or again, when two opposite plans of action appear to have equal truth claims, we want more facts. Researchers themselves, on the horizon of what we know, wish to go further and make new discoveries, or want to validate or question theories relating limited known facts. Such aims are not mysterious, though research procedures continue to become increasingly complex and even researchers are inclined to specialize

and become expert in limited areas. Others would draw a line between research and development and between research and studies or investigation, while some would use the word "research" so loosely that it would even include looking up something in an encyclopedia.

Many writers attest to the current popularity of the word "research" and find an aura of glamour and prestige leagued with it. It is associated with upward mobility in academic circles, and with prestigious mental activity as with an Edison or an Einstein. Some complain that every activity from space discovery to football have proponents who advocate more research and would wish to restrict the use of the term to experimental projects in the natural sciences. To them, scientific research must be objective and subject to exact replication. This precludes work in the social sciences or at least limits it to an objective study of behaviour. Contrariwise others contend that education is a legitimate field for inquiry, but add that the methods of science are not adequate to validate the sort of hypothesis that must be posed in education. As a result education researchers may be found working in the laboratory or classroom under carefully controlled conditions or making observations in the field under "natural" or normal educational situations.

In the social sciences variables can seldom be controlled without affecting the setting, and even the presence of the experimenter introduces an extraneous variable. Exact replication is impossible. The most we can do is to use adequate samples, ensure adequate exposure and think in terms of probability rather than truth. To some extent the computer will provide for exact duplication and eliminate some teacher variation.

Some educationists, to ensure that R & D contribute more to education, as it has in some other fields, would have researchers make decisions concerning the implementation of innovations. Yet decisions implemented through legislation are the responsibility of administration and not of researchers. Any researcher accepting such responsibility ceases to be a researcher and becomes an administrator. It is one thing to suggest that decision makers should have objective evidence before making decisions, quite another to suggest that such data and information are all that should be considered in making a decision. An administrator has his own set of values, social, political, economic, and experimental and makes his decisions in a complex context.

It is well known that in automobile manufacture, for example, decisions concerning new models are made by a director or board of managers who use evidence from agencies, designers, market analysts and as many other experts as can contribute to sensible forecasts of likely acceptance and market returns. However, it seems clear as crystal that modern automobiles do not precisely satisfy the wishes of designers, safety engineers, etc., although each of these has contributed to the end product. Nor does it follow that the factors determining education decisions are, or should be, the same as for automobiles, although the process of decision making is found to have so much in common in most situations that many decide that selected candidates can be prepared as executives irrespective of the industry or area.

R & D in education has developed on the periphery of the formal education operation. In part because of this its effect on policy has been minimal. Although the research community should not demand a lion's share in decision making at the legislative level, they may be worried because many decisions affecting the lives of thousands of youth and the expenditure of millions of dollars are being made without objective data substantiating the position taken, pilot studies, or provision for assessment after the changes have been instigated. Their concern can well be with efforts to receive support so that factual data are made available. However, they would need to be more concerned if this were the chief function that research personnel were expected to perform. Developmental research is aimed at improving the program, but if such efforts are aimed exclusively at short term benefits, this would be a shortsighted policy indeed.

One expedient aim in R & D policy in education should be of necessity directed towards establishing and maintaining a balanced thrust in all research segments after designing a policy that considers both short and long term goals. This should ensure some quick returns for money invested in developmental research and the expenditure of certain risk capital on exploratory research which hopefully might result in "break-throughs". Some developmental projects might be directed at "debugging" innovations and other product research as well as curriculum construction, school organization, instruction and other phases of program. We are only beginning to assess the efficiency of many of our units, many of which were established under entirely different living conditions, mostly rural, than we find today.

Let us next look at certain segments of educational research which have been separated out for purposes of convenience and understanding, while recognizing at the same time that lines of demarcation between disciplines are becoming less distinct as our knowledge grows. Just as research should not be confused with decision making by administrators, so neither should it be confused, for example, with such other education activities as evaluation, guidance, planning, curriculum construction, conducting examinations, or writing history, although research activity may be used in undertaking any or all of these. Its relation with most of these, as with education in general, is that of providing a variety of ways and means for controlling, isolating or looking at certain variables and relating these to changes that occur. Developmental research can also be used to discover better guidance tools and techniques and to test these in a controlled situation, possibly in a selected university or school.

Certain of the main reasons why we should look to R & D in education for help relate to our expectations for education in today's society. Some expect that education will keep our economy moving ahead so that we can compete at least on equal terms with other nations. Some are concerned with the stability of our society and with the cooperation of nations everywhere to keep the world not only habitable but inhabited -- it would ensure an opulent society benefiting all men and women -- one in which they have an opportunity for self-realization.

Speculative Research (Basic or Conclusion-Oriented)

Speculative Research is the social science equivalent of "pure" in the natural sciences. It is sometimes called fundamental and is considered to be knowledge-oriented. Its purpose is two-fold in that it may be directed to new discoveries, or again may be directed towards substantiating, augmenting, or even disproving one or other theory devised to relate a few, or many, findings from connected or unrelated research projects.

Experience has taught us that leads for basic research endeavour can come from within or outside education; from researchers, technicians, teachers or others. Anyone who has conducted a suggestion program will appreciate this. Yet it does not follow that just anyone can take over from the idea stage or that any but an expert can follow through. Nor does it follow that if one cannot predict where ideas will come from, that anyone can be subsidized to follow through. There is nothing said here which would prevent anyone on his own from attempting exploratory studies, or pilot projects to see whether or not an idea stands up when tested. If the results are positive they can then provide a hypothesis for a carefully controlled research project or the study repeated. These projects are generally time consuming and expensive and most of them are highly sophisticated as is the design and the statistical treatment of such data.

Most theory-related research will be devised and developed in universities and institutes. The likelihood of contributions to theory coming otherwise are slim, and more than likely they will be the product of researchers who have been working in the education field or a related one for some time, and have considerable expertise in the area.

We have noted that discoveries by researchers in one discipline often have relevance for others. This appears so obvious in the relationship of psychology to education that some suggest that basic research be undertaken only under social science disciplines. This position cannot be accepted for many reasons. First, contributions have come from biology, chemistry and engineering. Second, a good many researchers have moved from other disciplines into education, and wish to undertake basic research. Third, educationists should not stop at identifying problems, they should subject these to rigorous research.

Nor should it be necessarily desirable for researchers undertaking basic research to be related closely to the education "assembly line". Those concerned with adding to our knowledge should not be required to provide for implementation or for assessment of the changes. They should not be asked to spell out possible applications in the classroom. Yet this does not argue that everyone in basic research should be free to do what he wants, when he wishes, and in any way he wishes to go about it.

Research should neither be oversold, nor written off as an epiphenomenon, a fifth wheel to the education cart. It provides a wide variety of tested procedures which can be used in expanding our stock of knowledge and of determining beforehand what is likely to happen if we set in motion certain procedures. It may do this with a relatively small sample, in a relatively short time, and at a cost which is a fraction of implementing new procedures on speculation too often, to have them fail. It can prevent waste efforts, and safeguard against implementing fads and bandwagon attractions. One normally turns to research when he is not sure and when a decision matters.

Because of recognized limitation to the number of researchers and in the cost of research, projects undertaken should be important in that if they are successful they will contribute something worthwhile to what we know, or provide a satisfactory solution to a real problem. Selection and approval of projects is a matter for judgment but certain criteria can and should be set out to help and to provide guidlines for grants-in-aid.

Practical Research in Education (Applied, Developmental or Decision-Oriented)

In any suggestions that practical research can be compared with science and applied research with engineering, the analogy should not be pushed too far, for there are resemblances and differences. It is mentioned here in part because it suggests that the selection or use of terms is important and can be misleading. In some instances the function of applied research is to find applications for basic research in the field of education, in others it is problem solving. We assume that basic research will result in new principles and that these principles will be applied to situations in education to increase efficiency, improvement, or both. This linear approach is an acceptable procedure in several areas and it would seem to provide a partial answer, but only a partial answer, in education. Some recognize that as in engineering, while use is made of scientific principles, applied researchers are generally concerned with field induced problems and with permanent or semi-permanent structures. Research projects which are problem-related, or field-induced, overlap into institutional and other areas and a good argument could be made for considering all of these as practical research.

Product Research

Product research is a rapidly growing area. Despite some abortive, misguided spurts followed by abashed retreats, education is slowly moving into the technological age -- that is, slow as compared with its growth in business and industry. The universities have been responsible for many of the ideas which have caused this conversion, yet for some reason have failed to turn the focus of such intensive light on the university process itself to any appreciable extent. However, with classes of 100 to 200 or more, with the desire to use much of their time in research, and with a different emphasis on responsibility for student success, university personnel can be expected to make greater use of modern media and devise new uses for them. Perhaps one reason for education being one of the last areas to be affected by the newer technologies is that education incentives are not basically economic, although economic demands on education are increasing in impact. Also it is easier to see immediate dividends from industries other than education. Many hesitate about making changes in the schools where tradition is exceptionally strong and where many teachers are happy to continue what to them is a functional art.

Business is on the alert for lucrative outlets and has already considered education as a likely field where it can both sell some of the hardware and software already in stock and turn out new products to meet identified needs.

Computer applications in the field of education are on the increase. It all began with use of the computer for payrolls and stock accounting, as in business, but its use was soon adapted to pupil records, programming, and later computer assisted instruction and guidance. Actually the newer media, when we

have passed the substitution stage and use them to the full extent of their possible contribution, and in the way they best can contribute, are capable of transforming much of instruction, testing and guidance, and providing this service at home or at school, and on request rather than at scheduled times. This is true of formal education and training whether in a school or out and irrespective of age, time when wanted, or other limitations previously set.

Yet all has not been, nor will it be, clear sailing. Media have at times been introduced into schools prematurely with the teachers unprepared to use them. Teaching machines, with but few programs sold, introduced casually into instruction and soon relegated to store rooms. Even language laboratories were introduced with too little preparation and assessment. There is need for considerable research on all media from overhead projectors, to cassettes and to computer assisted instruction. These range widely in price for installation and their use with CAI appears to be prohibitive for anything except large scale implementation. The preparation of programs is likewise high. It seems only practicable where such programs will be used over and over and for many students. Costing studies are essential as are feasibility studies. These can best be undertaken if government, industry and education cooperate, even though this suggestion raises problems as to how far this can be practical where industrial research on new products is secretive.

Institutional Research

If we use the term institutional research to embody the sorts of research activities that are carried on by universities, colleges, and school systems, aimed at a better comprehension of what is going on in the institution and improving the program of that institution, then our concern is with an area of research which has been neglected for the most part, yet one that can probably produce short term results fastest, and act as a link between the academic researcher and teacher. The sort of research carried on here could be classed as practical, developmental or programmatic. It would seem to provide the most natural development in the educational enterprise since it is carried on within the school system, is in close contact with everyday school routines, and involves the active participation of the school's own personnel.

The purpose of education is to affect the learner's behavior whether we consider his competence for work or social situations, his aesthetic appreciation or his cultural interests. What happens in the school setting is most important. Schools and colleges are for those who attend, but as instruments of the state the activities provided are expected to foster those ideals that the population holds dear, which go to make up our civilization. The purpose of research and development in education is to ensure that the on-going process is as effective as possible in achieving the aims of education. Institutional research can provide an important part of this answer. It is concerned with what teachers and pupils do, the decisions of administrators, and with the problems of learning as they confront the policy-maker, administrator and teacher in the untidy down-to-earth, day-to-day situations. Its scope is limited somewhat according to the local situation, but it can bring to bear all of the wealth of experiences that have been ordered and reported elsewhere, ascertaining whether or not some of these have application in local attempts to find better answers to certain problems than have been found previously. Many "bugs" can be eliminated and hypotheses coming out of this activity could produce better research than solutions pulled out of thin air.

With the trend towards administering all education as larger rural or urban units and consequent decentralization of authority, and at a time when more is expected of the schools than ever before, the need for "School Research Units" seems paramount. There is no accepted model at present for such units. Considerations of how they fit into the administrative structure, how independent they are to determine program, and the best relationship with the teachers should be worked out.

Work of the unit could be concerned with removing bottlenecks from flow charts, and with research efforts related to understanding the input, the process and the output. Other efforts would be concerned with curriculum planning studies initiated in the light of good analysis; the systematic construction and testing of prototypes with the consideration of method, material and organization, and the systematization and instrumentalization of the instructional process. Activities related to this sort of endeavour could be planned, designed and field tested within the framework of the system, and analysis could follow. Because new products are making an impact on education, many of the sort of projects noted above will be related to the newer media, its proper introduction and use in the education process.

The modern metropolitan school administrative complex is a far cry from school board meetings in pioneer days when three farmers or tradesmen sat around an oil lamp deeply concerned with providing a little red schoolhouse and teacher for their offspring, and operating the school according to school law and regulations. The modern board does all that the pioneer board attempted and more. Its officers work on a year-round basis and are concerned with managing Canada's biggest business. They must provide academic and vocational schools or classes for elementary and secondary students and their parents, a number not much below the total members of the work force. They provide special schools or classes for some 15 or more types of atypical children who cannot benefit from the regular classroom instruction, classes for New Canadians of all ages; work in the performing arts, music, art, language, etc.; adult education classes, both daytime and evening, including citizenship, vocational, academic, commercial, cultural and special language. Services provided include guidance and counselling, psychological, health and special academic departments, attendance and child adjustment services. In addition they provide for computer, food, library, language study, manpower retraining, publications, teaching aids, forcasting and other services.

The trend is towards providing for greater flexibility, freedom and an environment in which children are free and encouraged in learning, to develop their curiosity and to be excited through discovery. This is possible only if the board cooperates with the administrative and teaching staff making full use of professional expertise in fulfilling such expectations. This can provide for a different sort of education enterprise than the highly structured rigid system which had been more or less perfected over many years. It is expected that the school enterprise which has been undergoing transformation with increasing speed over the past decade will continue such metamorphosis throughout the foreseeable future. Yet the speed of change hardly seems rapid enough to please most adults and such complaints as are heard, except for those concerned with rapidly rising costs, suggest that enough has not been changed. This urgency to bring about change is likely to make most researchers appear conservative, for although researchers by their very nature assume that all things can be improved and wish to move ahead, by their commitment to research they cannot favour rushing ahead blindly before proposed routes have been explored and the ground appears solid enough to hold the vehicles.

What appear as panic decisions, or innovations supported by whim and caprice, will continue for some time at least with too many of the new methods and devices neither adequately tested before introduction nor the results assessed afterwards. Yet no research unit could be expected to provide adequate information about the many possible and proposed changes which are identified and could be introduced. Eventually, if things settle down, proposed changes could be introduced on an experimental basis before general implementation. Even today some carefully controlled pilot studies are providing valuable information for decision taking. School Research Units can be invaluable in this.

There are many reasons for establishing SRU's in Canadian school systems. Perhaps it would be worthwhile to detail some of these.

First, there is need to bridge the gap between research discoveries and their implementation in the ongoing education process. In a few instances findings can be implemented directly. In some there is need to develop suitable applications for real situations. Recommending change is not enough as many of these will have to be demonstrated and development and demonstration centres on the use of middlemen may be in order. Certainly SRU's can find an important niche in all this.

Second, the units can keep both the lay members of their board and teachers up to dat with what has been substantiated through research not only in Canada but elsewhere. They can make recommendations for pilot projects.

Third, SRU's can act as middlemen with the universities and institutes in a variety of ways. Many candidates for higher degrees wish to undertake projects in the schools to obtain data for theses. The units can protect individual schools agair being snowed under with too many of these, can ensure good liaison and can help the candidates obtain good cooperation.

Instructional staff in college faculties often wish to conduct research studies using the school populations. Again the SRU's can help with this. In some instances packaged programs have been prepared which can be introduced into selected schools, experimental classes or schools can be organized under direction from a faculty. But this traffic is not only one way. Members of the SRU's can benefit from a great deal of advice and help from experts in the faculties.

Fourth, the units can cooperate with those teachers who are interested in action research, assessment and innovations. Research is one of the areas which teachers may select as special interest in addition to their primary function which is that of providing instruction and fostering growing youth. Those interested in undertaking research or helping with research or development projects would be helped where an SRU is established.

Experimental projects undertaken in schools should be supported by appropriate expertise in experimental design, statistical treatment and interpretation. Experiments should be designed or supported by a unit of which at least one person is fully aware of strengths and weakness in research procedure, one person is a subject matter specialist in the area and a third is from the social sciences. The biggest hurdle is sampling. Validity of most school based

research is low because the sample used is not random. This detracts from its possibility of generalizing its conclusions although it may be adequate for the local school situation and for decision making for that unit. If such endeavours are treated as pilot projects, then it is valuable in that replications may provide promising hypothesis.

Teachers can well be encouraged to conduct studies and investigations relating to their work. If there is a research unit in the school district the teacher can receive help and encouragement which should ensure that the project will be expedited and designed so as to ensure valid results within the limits imposed by the uniqueness of the situation. This seems like a sensible solution to the argument as to whether or not teachers should do research. The answer is that researchers should do research, that some teachers are researchers, but in any case teachers who are subject matter specialists can contribute to a developmental research project. Most experimental projects conducted in schools should be backed by expertise of someone who knows experimental design and statistical treatment; by someone who is a subject matter specialist and is fully aware of practical problems in the school situation and generally by a social scientist who can contribute from his knowledge of people. This does not apply to all studies or investigations, but it does have application for most action research, pilot projects, etc.

With the trend towards setting up larger areas in the rural units and combining all schools in the urban areas, and concomitantly allowing each unit more freedom; this decentralization makes it necessary for each larger unit to accept responsibility for the education offering at a time when much more is demanded of the schools. By providing for personnel and research units it should be possible to produce good flow charts and pay more heed to the input, process and output than has been done ordinarily.

The desirability of setting up experimental schools and classes is greater today than ever before, and the possibilities of these cannot be met by various schools setting out new programs. Where there are SRU's both of these are to be encouraged.

Service Related to R & D

The service function of research related activities is receiving increased attention as enrolments and expenditures rise sharply, the information explosion gains in momentum and there is upheaval in our value systems. The need for data banks, product evaluation, surveys and investigations, information systems and such is becoming more evident year by year. The compiling of data and other information at the action research level will likely increase in variety and methods of collection, abstraction, storing and retrieval.

Persons required to undertake service functions should be employed with such duties. Employing professionals to undertake research, then preempting their time with filling service needs may appear expedient, but it is not defensible and can only result in dissatisfaction unless the researcher selected was basically an information officer who is happy with that sort of work.

Service is required in departments, institutes, schools and associations. Operations research can contribute to good administration. Studies can contribute to our knowledge but are not designed to add to our theoretical knowledge of education nor to the accumulation of scientific findings that are relevant to educational operations. They may sharpen problems and suggest hypothesis but are not definitive.

R & D Strategy

As Canada is a Federal union with formal education the responsibility of the provinces, each province can determine its approach, priorities and schedules independently, and where the local units are reasonably autonomous as with the universities, each can determine its program of research with or without provision for development. Unless there is voluntary cooperation, Canadian efforts could be repetitive, fragmented, uncoordinated and wasteful. To the extent that those in positions to determine program are reasonably aware of efforts in other countries, provinces, school districts, universities and industry, they may determine policy which appears most appropriate under the circumstances.

Policy for R & D in education must of necessity be focussed on a wide variety of activities including the selection of those areas where the need is greatest, where solutions appear most promising, and where our limited resources of men, equipment and money can make the greatest impact. It must attempt to bring some order out of the current heterogeneous situation.

When problems are clearly identified, efforts should be directed first to discover whether or not satisfactory answers to the problems have not been found in other countries, or if they are being sought systematically at the present time. Where no satisfactory solution is readily available a decision must be taken as to what priority can be given to the problem. It is not enough to undertake worthwhile activities, a scarcity of skilled human resources suggests that efforts be focussed on promising adventures or real needs relevant to situations likely to continue for some years. Considerable effort needs to go to providing tailor-made products and suitable experiences for all students with full recognition of personal needs, strengths and weaknesses of each, whether physical, mental, emotional, psychological or socio-economic.

Polls have indicated that the majority of people today favour rapid change in education. To ensure that changes introduced will effect improvement, there is need for carefully designed and administered strategies and for selection so that students will receive satisfaction from the talks and activities. These will be selected with appreciation of the knowledge explosion, the pace of technological advance and the special needs of minorities in different geographic areas.

Greater emphasis needs to be placed on pre-school services including nursery and kindergarten. This may relate to the inner city, suburbia, marginal rural areas and outposts or to other groups of children considered as special or disadvantaged. Non-graded schools, independent study, large and small groups, and increased use of educational media, new school construction and many other

ideas need considerable investigation before implementation. The need for educational specifications for programs and new school building is rather urgent. The S.E.F. (Study of Educational Facilities) reports[1] are one good example of the sort of program that can be recommended.

The following topics illustrate some of the issues concerning policy for educational research and the wide range of such topics: (1) Determining of the real problems we should face with suggestions as to where and by whom they should be attacked. (2) Who should undertake R & D? What numbers of professionals and technicians are needed, and what equipment etc. is necessary? (3) Is it a good investment? How should this be paid for? What strings, if any, should be attached? (4) How best can the results of research be made known? Who should be made aware of this? (5) Who should determine what research should be undertaken? (6) How best can we bridge the gap between research and implementation? (7) Can we ensure a balanced program providing for all types of research, and both short and long term results? (8) What limitations, if any, can or should be imposed on research undertaken? (9) How can we make interdisciplinary research effective in education? (10) How best can we stimulate the intellectual growth of infants during their first few weeks? What, if any, are the long term effects of such stimulation? (11) How can we provide for increasingly sophisticated laboratory experiments designed to extend our knowledge of such issues as: a) maintaining creative ability in youth, b) storage and recall - memory, c) thought processes and verbal learning, and d) motivation, emotional life and its effect on cognition.

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[1] S.E.F., F2, Educational Specifications and User Requirements for Intermediate Schools, The Ryerson Press, 299 Queen St. W., Toronto, 254 pp., $10.00, 1969.

CHAPTER III

TOWARDS SOME UNDERSTANDING OF THE D IN R & D IN EDUCATION

Today we are not only more fully aware of living in a dynamic world in which all pervasive change comes with greater speed and magnitude than at any previous period, but we are more determined than ever before to control the direction and consequences of those changes. More widespread action, for which projections and scientific preparations have been made, is being coupled with a greater knowledge of probable consequences than ever before. It is contended herein that this has as much relevance for education as for any other segment of our life.

Yet at best we are but nicely started in our actual attempts to predict and control forces in our environment and much behind advanced theories of what could be done. The desire for knowledge and the desire for action may or may not be combined in research endeavour. Within the human sciences, as with the natural, it is possible to have concern mainly for theory where advancing knowledge alone matters and is of intrinsic value, or with the practical world of informed action where theory and considerations of utility mingle in varying proportions. There is no necessary incompatability between theory and informed action. Short and long term progress can be effected best through the implementation of a well balanced program which ensures that neither theory nor sensible action are neglected. Such a dichotomy, however, is an oversimplification which can be misleading. In actuality, educational theory, in part, has membership in the human sciences which are never clearly defined nor simple. Education is a concern of our economy, of our society, of our political organization, and of our religious and aesthetic life; and its relationship with these is highly complex. Any simplification can but serve as a matter of convenience. The greater the simplification the further it will be from the reality -- the converse does not necessarily hold.

Since the purpose of educational inquiry can never be exclusively that of adding to knowledge about education, but must be concerned as well with effecting improvement in the education process, research councils such as CCRE find it expedient and advantageous to interest themselves in the broad area of investigation ranging from basic research through development to dissemination and institutionalization. Their concern must extend to developmental research at all levels and in all institutions.

Contributions to our fund of knowledge about education are being made by economists, sociologists, anthropologists, engineers, historians and others in addition to researchers trained in the field of education. This is a situation which is more likely to expand than shrink. It recognizes that some problems in education can be attacked best by teams of members from two or more disciplines and that there should be provision for both multi-disciplinary and inter-disciplinary approaches, with various strategies adapted according to the problems at hand.

Contributors to education theory in the past, such as Aristotle, More, Mill, Rousseau, Molyneux and James, to mention but a few who are well-known, had generally delved into several fields such as education, sociology, morals and political science. These educators were generalists with specialization in

several areas. Today many scholars cross discipline lines as a matter of interest and necessity, but the widening scope of most fields mitigates against mastering a broad area of any one discipline, let alone of several. One alternative to having one person who is a specialist in several disciplines attack a problem, is to use a team of specialists. Not too much is known about how best to do this, but education would seem to provide one of the best areas for developing guidelines for this sort of cooperation. For not only is education of concern to members of many disciplines but it has reached a new peak in importance for productivity and survival. It absorbs a major share of government budgets at all levels, employs increasingly large numbers of professionals and technicians and is counted on to play an increasing role in our growth. More attention, some of which will be highly critical, will be directed towards better utilization to meet the needs of our technological society, not to mention growing social demands. Educators would be well advised to provide machinery for planning and a balanced research program with provision for effecting improvement in education systematically.

Anyone concerned with the future of R & D in Education -- and there are many who are -- may well ask what is likely to happen if we are satisfied to maintain the status quo in administrative structure despite an increasing incidence of change and demands for much greater efforts. The current organization in education is fashioned for maintaining the system as developed, with conservative efforts for advance and incidental planning. Or alternatively should we adopt a more aggressive policy with more assessment and planning and provision for introducing change -- not yearly models as in automobile manufacture but with provision for testing out promising alternatives. If we select the latter there must be provision for harnessing R & D and more planning. Before the complex situation in R & D can be ordered attempts need to be made to separate out the parts, and define them. In any attempt to order R & D we find it expedient to recognize certain types of R & D activity and aim at a balanced program with activities designed to increase our knowledge, shortening the gap between theory and practice and generally improving both segments of and the whole education process.

Development Versus Research

Emphasis in this section is on the D in R & D (or the two D's in R, D and D -- some separate the D into two parts and refer to R, D and D with the second D standing for dissemination or diffusion) which covers all systematic activities concerned with the development of new programs, developments aimed at providing solutions to problems, and activities undertaken to disseminate information on innovation and such.

Development may be found as ancillary to a research project or research may perform a major or minor role in a development project. It is conceivable that even today some development efforts make no use of scientific approaches or research and therefore have no place in this discussion. On the whole, development has certain distinguishing features which warrant its separation out, as with research, from the research-developmental-activity complex for certain purposes. The objectives of development differ from those of research in that they are user-oriented, program-involved and practical, whereas research aims are discovery- or theory-oriented, with the research being conducted essentially to add to knowledge. That the results of research may later result in an improved program

or a more useful and efficient product is often incidental. This is however not to suggest that no researchers are concerned with the use that will be made of the discoveries. Examples from the natural sciences have shown that such a position for researchers is not tenable, whether one considers the atom bomb, chemical warfare, desalination of water, pollution, etc. Or again one could readily give examples of scientists who are greatly concerned that society should make the necessary changes to take advantage of their discoveries.

As development projects are generally concerned with program they may appear repetitive in structuring as each step of trial and assessment may require many revisions. Thus the process may be subject to alteration at any stage, scrapped if found impractical, or implemented permanently. Development projects utilize research findings and experimental procedures. In turn they often provide a base for further research as well as encouragement to researchers to expand their undertakings.

Most often researchers work alone, although most of them use assistants and technicians. A number of them may work at separate though related projects in the same area with each contributing to a theoretical concept. A few may operate on combined projects. Developers on the other hand generally work in teams, the undertaking being a joint effort. These differences, however, should not be applied too rigorously for there are exceptions. On occasion the same person will attempt to follow through with a research and development project from beginning to end, and there are those who would favour putting someone in charge from conception to implementation. Generally, however, this is not recommended as the qualifications and interests related to each of these steps are dissimilar. This should also be recognized by youth in deciding on a career, although here even the research field must be subdivided with consideration for the type of research and where it will be carried on, e.g., an academic career of teaching and basic research, or an industrial career concerned with product research.

Again, it is possible to conceive of basic research being conducted within an institution, most likely a university faculty, without it having any effect whatsoever on the education program of the college. This could not happen with successful developmental projects. Much research on school administration in an institution likewise may have no effect on how the institution is operated; and many successful experiments on methodology will not rub off on the teaching in that institution. Such research was not undertaken as developmental projects. Instructors will continue to lecture or dictate notes extolling the project method, socialized education, programmed instruction and such, and lecture on the good points of democracy while operating a classroom autocratically. An instructor's theory cannot be judged by his modus operandi.

What Development Is

Normally some confusion may be expected from the use of such a word as development if, in using it, we give it a particular meaning. Certain persons with a leaning towards developmental psychology, emergent evolutional or developmental education will find its use misleading, whereas those in business administration or working on space projects will feel perfectly at home with it. The

Oxford Dictionary. In recognizing these two sorts of concepts, defines development as proceeding in two main streams, the one "a gradual enfolding", the other "a fuller working out" -- the first being an evolutionary unfolding from within, as in some psychological theory; the second being essentially change effected by agents from without. It is to the second meaning in the definition -- a fuller working out of details in education, or segment of education, to bring it gradually to a more mature, advanced and effective state -- that we shall direct our attention.

Used in this way it follows that development activity will often be generated from research results and in turn stimulate further research effort. The incentive for development efforts may come from a variety of sources and at a variety of levels such as: (1) questions as to the applicability of basic and applied research results to unique education situations; (2) problem-focussed, field-induced, or mission development projects aimed at reaching solutions to recognized needs; (3) product development; (4) development of a curriculum, organization and methods at all levels and for all institutions; and (5) personnel development programs. We shall make use of these somewhat in pointing to certain sorts of developmental activity that could be recommended for various educational settings.

1. One sort of developmental activity is that aimed at closing the time gap between research discovery and implementation. It is primarily concerned with: selecting research findings which appear to have some possible immediate practical application in one or more education settings; culling out research findings that have no apparent application; and identifying those which can be implemented directly. To distinguish between such a development program and an applied research project may appear to be difficult. The development program generally begins where the applied research leaves off; but again on occasion the intermediate step may be by-passed. This sort of development work is normally shown in models as a part of the research-development continuum which may be spread out to include such steps as: hypotheses; design; laboratory testing; field trials; dissemination or diffusion (demonstration, adoption, etc.) and integration with provision for assessment and evaluation. Here development beginning after the main research endeavour has been completed is aimed at producing an hypothesis for testing in actual situations, and generally through field endeavour. It is a full-scale trial normally continuing through several cycles, a costly undertaking in equipment and personnel.

Most everyone is familiar with two sorts of statements which have relevance if we are to put greater emphasis on development. The first is to the effect that we could improve education greatly if we concentrated on implementing those things which research studies have already found -- some even go so far as to suggest that there should be a moratorium on research until this is done. The second states that the time from discovery to implementation is 50 years, more or less. Without considering the truth claim, or irresponsibility of either of these, the fact remains that they do point to some of the main reasons why this paper has been directed towards the need for designing and establishing machinery for development.

2. A second sort of development is that exhibited in the undertaking of special developmental projects, including such large scale ones as Head-Start, Na-Start, special education projects, and one might include some Royal Commissions involved with education -- where the educational research content may be fairly loosing -- and range from projects with education as the main concern and research

the chief approach, to situations where research is ancillary. These studies use research techniques to obtain factual data which provide answers to problems which have arisen. Some of them are under the direction of the provincial education system, while others are undertaken by professional education associations, the Federal Government, private groups, etc. Most of them are directed towards filling a gap in services provided, or in rectifying situations considered inadequate. Predicting the extent of this sort of endeavour, which varies greatly from year to year, is difficult, but the closer education comes to meeting society's demands, the less need will there be for voluntary organizations and others outside the establishment to take the responsibility of providing such services. Yet society often finds this a good way to draw attention to newly recognized needs, and through conducting successful pilot projects is in a position to demand services.

3. The number of development projects concerned with instructional design, the development of curricula and the design of models for production-oriented R & D is on the increase. Among these are attempts to improve the school offering through systematizing and instrumentalization of the instructional process. Qualitative planning procedures and assessment need to be related to education units or systems in which the goals are set out, most appropriately in behavioural terms. The role of the researcher in these projects is generally supportive with research and assessment built into the design.

Development of curricular materials has passed beyond the authoritarian stage where someone in authority, often with the approval of university faculty members in the discipline concerned, determined the content of a course and the time units for what should be taught each year. Other developmental stages included the scissors and paste, job analysis, functional analysis, consensus reached among successful teachers, emphasis on functionalism, preparation for university requirements, spiral curricular design or those using some other emphasis. Unfortunately most models now in use assume design and implementation by edict, with little or no provision for field testing, successive modification, and assessment or evaluation beyond that of opinion.

4. Somewhat related developments are to be found in the preparation of hardware and software. Much of this has gone on with a minimum of consultation between producers and consumers, but with manufacturers and publishers preparing materials and bidding for contracts, or selling materials directly to school boards. Recent amalgamation of large firms producing hardware and software has made it possible for some firms to offer packaged deals, or even whole systems, with the picture continuing to change rapidly. In this confusion, boards, having much greater choice than ever before, but with little objective data to go on, feel a greater need for this sort of product research, and the equivalent of consumer reports and research results covering the competing materials. The need for consultation between producers and consumers, for the pilot studies, and for more research, is increasing year by year. There is also a need for good models in this area, with provision for involvement and action.

5. To provide for certain varieties of products and packages which can be purchased for adoption in the schools, members of institutes, private industry, etc. can prepare units designed to cover sections of one or more disciplines or other units related to social studies, health, etc. for use in the schools.

These units can be made up of software including tapes, films, microfiche, and hard copy as books, reports, questionnaires, tests, etc. It is likely that there will be an increase in the variety of such packaged units available in addition to increases in the usual media as this approach appears promising.

6. Other development programs which to date have attacked piecemeal rather than in total, situations where much greater efforts must be made. They relate to the selection and training of researchers as technicians and professionals. Concern is with entrance requirements, courses given, the sort of experiences to be provided, the number and variety of diplomas and degrees available, and the opportunities for work after graduation. It has also to do with the entrance of members of other disciplines into the field, provision for interdisciplinary and other team efforts, and, last but not least, for providing money for research. Considering predicted needs for research and development personnel, and the inability of the current establishment to meet those needs, this must be given high priority.

It should be stressed that the sorts of development programs discussed above are in addition to the normal development or changes which occur in every school, for schools are dynamic -- the majority will likely forge ahead, some will develop laterally, and a few will fall behind. Not that schools advance regularly, for innovative accomplishment is contingent largely on the board, administration, teaching staff, and students, each of whom to some extent can determine the degree to which improvements will be effected.

To some, as already noted, research and development are looked at as poles which may appear to be far apart and with little or no relationship. Where research is divided functionally the relationship appears to be different. Generally basic research is not closely related to development although in exceptional cases basic research findings can be incorporated directly. Applied research is a big step closer to development activities and field-induced research is closer still. When we consider institutional research, the research is generally of a somewhat lower order experimentally, considering internal and external validity (validity of instruments and sampling), more closely related to the situation and often almost inseparable from development. In fact some will consider the R & D conducted to effect improvement in operations as a single entity which could well be called developmental research. Product research may be exploratory, field research, or development, but most of the time it is developmental.

Programs Designed to Introduce Innovation

In this era of change even the "establishment" accepts the sort of thinking that says what was good enough for my father is not good enough for my son, and is inclined to associate change with improvement and at times climb on one bandwagon or another. Those realists who suggest a policy of testing before adoption are likely to find themselves classed as conservatives. Changes are being introduced in greater numbers year by year as new hardware and software appear on the market. Word of mouth, the grapevine, professional magazines, conferences and even the press spread new ideas from school to school, district to district. The innovations range from minor differences introduced in one class by a subject matter expert or teacher to major upheavals in procedure using electronic aids, or structural reorganization in the school.

The new may be introduced from above by school law, school board edict, request of a principal or wish of a teacher -- possibly even from below by pressures from student power. Changes may be introduced on an experimental basis as part of a research project. Where this occurs there will be a hypothesis postulated, controls maintained including a control group, and there will be provision for assessment of the experimental factor. If introduced as developmental activity there will be provision for functional assessment, and the controls will be more lax so that changes in procedure may be introduced at any time it appears that some adjustment might yield better results. This scarcely provides for replication.

This raises an interesting question as to how much preparation should be undertaken before an experiment is begun. Normally we speak of identifying problems, formulating an hypothesis, designing an experiment with controls, valid instruments, suitable statistical techniques, and carrying it through as planned. Yet because of the number of variables in some instances, often at some stage it is discovered that either some of the instruments are not holding up, variables which now appear important were ignored, or for some reason or another new problems have arisen which could be met if procedures were changed. The choice is between throwing out or changing the controls and invalidating the experiment or carrying on imperfectly. To prevent such impasse, pilot projects are often used which to a great extent may resemble developmental procedures. Where a survey or experiment runs into money this is a safeguard that should be used. However, in considering models for R & D it would seem as appropriate to provide for developmental activity before research in addition to developmental activity once research findings are available.

The initial stages of development activity may begin in the laboratory or classroom and be undertaken by a researcher, developer or teacher. At this stage there will probably be a simple conceptual design which is subject to alternation or change in efforts to remove the "bugs" or to improve it generally. Possibilities for spreading misinformation are great at this stage, as any improvement found may be due to the Hawthorne effect, enthusiasm of the instructor, calibre of the students, etc. If it appears successful, then it should be tried in a number of different situations where the study unit, program, or product can be tested in experimental control groups representing high, average and low ability, possibly male and female, etc. Next, if warranted, the third stage might be a carefully controlled experiment in operation for a long time and with a wide variety of subjects and variety of situations to be of general application if successful. Replications of developmental projects can add to the validity or invalidate conclusions.

Developmental activity here can range rather widely as noted from work undertaken in Sweden, Israel and elsewhere. What these approaches have in common is a systematic approach to the introduction of change. Since the possibility of failure is great and changed procedures seldom live up to expectations whether in streaming, team teaching, socialized recitations, project methods, etc., subjecting innovations to systematic appraisal appears highly desirable. Such an approach should prevent much disillusionment, distrust, feelings of futility, and frustrations which can affect sensible progress. Change introduced without proper investigations, in-service training and such may fail or succeed contingent on success in retraining the staff. It may fail for lack of the necessary spade work or because it should not have been introduced in the first place in a specific situation.

Whether or not an innovation may be successfully introduced into a school system may depend in part on: the disruption it will cause; the support it receives at all levels; the extent of opposition; the groundwork done; and on the climate of the institution at that time. Minor innovations may be introduced by a teacher but the chance of success is determined largely by the support from above. Other innovations, some of which may require considerable groundwork and teacher preparation, may be introduced at the school unit level. Or changes may be introduced by school law for a province, some of which should have had months of preparation before being introduced.

Getting an innovation launched is but part of the battle where the goal is improvement. Even assuming that the innovation considered for implementation has been found successful elsewhere and is strongly recommended, it should not be introduced without provision for assessment and evaluation. It is not enough to casually survey teacher opinion, or for that matter student reaction. There is need for objective measurements. One should not expect significant improvement from most changes. The experimental evidence would seem to suggest that where the criteria is success with factual examinations and with a premium on information, there is hardly a shred of evidence to favour one method of instruction over another at the high school or college level. There is a surge to education that carries it on and to which innovations must be superior. Instruments for assessment are limited and a roadblock to much research.

This could be interpreted to mean that we might as well forget about trying to effect improvements. But there are outs. We know that the Hawthorne effect can produce good results. We also realize that we must assess more than information. It may well be that there is no one best method, but that various methodologies could be recommended although not necessarily for all situations. The problem may be compared with cooking. Cake recipes are tested and approved but no one suggests that everyone should want or make just one kind of cake. A seal of approval on various methods with specifications as to their adequacy for various situations could be helpful. But as with cakes, not all recipes are suited to all cakes, all cooks, or all tastes.

Experimentation and developmental activity preceding implementation could be undertaken by the Departments of Education through setting up a unit, by contracting the work out to an institute, faculty of education, or to larger units. Because of increasing pressures for change, the Departments would be well advised to take the initiative in providing suitable strategies, setting up the machinery necessary for this and for providing resources so that the work will be completed. Undertaking this is a necessary concern of organizational theory which we can no longer afford to neglect. We must increase the efficiency of our country's largest business endeavour. No attempt has been made here to list the sort of developmental research, or assistance with innovation that can best be undertaken by the Department, faculty of education, larger school units, private industry, etc. These are issues that should not be shelved. The Department could well take the initiative in deciding what it would like to see done, who should be responsible for various segments, and how best to tackle each of these.

An Institutional Base for the New Development Function

So far in our discussion we pointed first to a dire need for providing paths to bridge gaps between producer and consumer. Second, we accepted the need for programmatic research inclusive of field testing, demonstrations and strategies of intervention for improved programs, products and packages. Third, we noted a

need for better and more comprehensive testing and evaluation. We indicated a role for research endeavour and a complementary role for development. As a home for research activity we identified faculties of education, institutes, associations, and other centres. It is equally important that we attempt to specify where development should be undertaken, the strategies that might be used and the sorts of development projects that might well be undertaken in each of these centres.

Much educational development to date has depended at least in part on intuition, value judgments and opinion, both in the selection of topics and in assessment. Headless arrows may hit the target, and where there are almost innumerable moving targets to aim at, huntsmen can hardly be blamed if they shoot first and aim later. Yet we have been much more successful than chance would warrant.

As an alternative approach, on occasion something similar to a production line assembly has been used as in the manufacture of commercial products in order to develop and incorporate various products into the education stream. Again as with teaching machines, language laboratories, reading pacers, etc. there have been some hits but more misses. The results have generally been good or bad, according to the total impact of the changes attempted. In this the systems approach would seem suitable to perfect a mode of behaviour and remove bottlenecks. Its contribution is essentially in the streamlining and shortening of the path between two points, its success depends largely on the adequacy of the goals set, the input selected and the output wanted. We have already utilized logic, intuition, common sense and an adaptation of industrial methodology -- it is unlikely that another shortcut can be found to be necessary. Therefore, it is probably expedient that we begin with some appreciation of the whole complex educational process, determine some priorities and focus on these using the most reliable yet appropriate methods, and checking the outcome.

Our next step could be to decide as to where the various development projects should be undertaken, to discover whether or not our present establishment is adequate, and if not, what sort of new institutions should be provided. The Colleges of Education are presently responsible for the training of teachers, for undertaking research of which a part is related to graduate work, including advanced degrees, and to some extent at least for acting as an information and documentation centre. Can the responsibilities for development be added to all this with reasonable expectations that development activities will not receive short shrift, not as a matter of intent but chiefly because of competition, interest and habit. Development is on the firing line and aimed against the enemies of efficiency. In its ranks are diffusion, demonstrations, implementation, assessment and communication. The related strategies are almost infinite. Faced with limitations of time, money and expertise, the only sensible recourse is to set recruiting priorities from time to time for selection among the worthy and important possibilities while concentrating on reaching solutions in selected areas which can have important effects on the education process.

As some of the problem areas are large, some small, some general and some peculiar to a limited area or group, this should be taken into consideration when deciding what can be undertaken best by the various units available for developmental research activities. This would probably result in some large scale projects of fairly general application, possibly in some of the following areas:

1. Strategies concerned with introducing innovations including demonstration, in-service training, assessment, etc.;

2. Development of new courses including field testing and covering the whole area of curricular development;

3. Refining and assessing new programs, methods, etc. such as self-instruction, independent personel instruction and team teaching;

4. Perfecting of newer methods and newer media, some related to the computer;

5. Efficient use of automated education, hardware and software, etc.;

6. Problems of the disadvantaged child, effects of poverty on learning, school and vocational adjustment, early childhood education and work in the inner city, suburbia, marginal rural areas, etc.;

7. The whole area of vocational-technical education including pre-employment training, up-grading, refresher and rehabilitation courses;

8. Orientation procedures at all levels and for all types of institutions;

9. Community involvement in education;

10. Administration and organization of schools, instructional management, systems approaches;

11. Systematic development and progressive adaptation;

12. Institutional developmental research activity related to inner functioning of the process in an institution;

13. Teacher education and training;

14. The teaching of languages, the first, second, and a third or more. Canada is particularly interested in having her population bilingual. In addition some should use a third or fourth language.

These and other areas provide ample challenges for researchers and developers for the next decade. Their importance suggests some concentration to prevent dissipation of efforts. It also suggests large scale projects as well as small and the coordination of these.

Much development becomes the systematic adaptation of knowledge and technology to educational use through designing models and prototypes, modification of materials, technologies, strategies and systems to achieve specified goals.

Diffusion and Dissemination

This section of the pamphlet is concerned with ways of communicating research results intelligibly to decision makers, practitioners, and other consumers of research. Some would argue that good research can be counted on to find its own way into the classroom; others, that it is the old problem of having a horse and water but inability to get the horse to drink; and still others would contend that the administrative establishment by its very nature must be opposed to innovation and change. Despite wide differences of opinion, one thing is certain: more thoughtful educationists are throwing their weight behind those favouring increased planning and developmental activity and are looking for effective systematic means of utilizing these.

There is a real problem in translating research findings into programs or activities which find their way into the ongoing activity of a school system. The time lag between the conception of an idea and its later implementation into the schools may extend to years and the chances of the process even being completed are not high. Where research studies depend on regular publication in professional journals, before schoolmen read the report, if they do, two or three years have lapsed. Conferences can speed up the process, but actually we have little knowledge of the relative effectiveness of any of the usual lines of communication.

To provide for better means of communication some educationists have suggested that we use middlemen who would maintain liaison between producers and consumers. Providing for demonstration centres, experimental schools and classes, utilizing modern media in communication systems, using travelling demonstrations, in-service training programs, and printed and illustrative materials provide other possibilities.

Some suggest that in seeking to find models for reducing the time lag between theory and practice we should look for help to those areas where considerable progress has already been made in modernizing production and producing better products for the money invested. Agriculture is often given as a shining example of what can be done, and we are also invited to look at business, industry and health. Without examining these thoroughly, although we could undoubtedly benefit from so doing while helping to clarify our problem, the fact remains that the education situation is unique and educators must develop their own solutions.

Agriculture has made good use of experimental stations to develop new grain strains and to improve accepted varieties, and has made this known through inviting visits by farmers, preparing brochures and other publications for distribution, providing radio broadcasts, films, and employing "ag reps" to consult with farm personnel and advise them. They also depend largely on farmers talking shop and the agriculture grapevine. Motivation is largely economic but prestige and satisfaction play a large part. In passing, it can be noted that R & D in agriculture is directed towards two ends, the one improving what we now have, the other that of developing something new.

In business R & D is used in a variety of ways. It includes projects designed to break new ground, some aimed at improving present commodities and others concerned with sales promotion. Most businesses make use of advertising.

Some introduce annual models. All try to increase man-hour production and increase the sales of products or services. Automobile manufacturers, for example, plan new models several years ahead. Petroleum companies budget so much risk capital for exploration, additional amounts for the development of new products and for improvement of those already on the market. Advertising appeals to sex, prestige, snobbishness and other social desideratum which the use of modern media is increasing here and throughout industry. Packaging and low and high pressure salesmanship are employed on occasion in the hopes of creating artificial demands and raising the standard of living, but basically they are aimed at increasing profits.

Medicine may use the appeal of humanity to man when money is needed for R & D. Through using professional salesmen, magazine advertising and exploiting public interest, it has been successful in increasing our life span and making "break-throughs" in producing pharmaceutical products. It has also been reasonably successful in obtaining money for research.

There are a variety of other strategies which might be considered, and it may be that one or other of these will be found to provide linking mechanisms which appear most promising. Some of them would require the establishment of additional units or the hiring of specially trained personnel. Others could be done through a re-aligning of duties but would still necessitate many man-hours and specialization.

Perhaps this is enough to suggest ways and means used in areas where the incentives and problems are different from education, but where the need is no greater. When we turn to education to ask why R & D has generally been left to the voluntary efforts of university personnel, with the exception of researchers in industry, a few school boards, Departments of Education, etc., we find a highly complex system where motives are mixed, expectations are founded on wishful thinking, with little agreement as to where education is going or how it will get there. There is a strong North American tradition of belief in education which is, however, rather amorphous, related somewhat to snobbishness, idealism and culture, to getting ahead and to practicality. As the aims are unclear there has been little scientific evaluation, and we have failed to take advantage of having ten different provinces for research. Certainly assessment is difficult in a diversified milieu of human beings; but surely not impossible. Change and modernization have been stepped up, but many changes are still speculative and any evaluation before and after introduction is based largely on acceptability and subjective opinion.

The "tried and true" methods of communication upon which we have depended in the past include directions and memoranda from chosen, professional magazines, books, including paperbacks, pamphlets, newsletters and leaflets, conferences, workshops, lectures, summer schools and the in-service training. More recently closed circuit television, simulated programs, film strips and such have been used and some efforts have been directed towards providing on-line, random access, information systems and data banks.

For too long we have ignored the gap between research and implementation. Researchers have been prone to blame the practitioners for not anxiously grasping each new research finding and incorporating it into their work. Practitioners have considered research findings as generally not relevant, as couched or lost in professional jargon, and as the conceptions of ivory-tower sophisticates who

are blithely ignorant of what goes on in the classrooms and of the important problems that require solution. Though strongly acclaimed at times, neither position is defensible. Researchers should neither expect research to be translated directly into practice since this would be possible only in exceptional cases, nor for teachers to be constantly shopping around for better mousetraps. Practitioners should not expect researchers to be concerned with helping them to do a better job with their classes, except incidentally. This is the task of a developer with the attack being undertaken cooperatively.

If we have neglected efforts to utilize research findings in practice, we have done little insofar as sensible evaluation is concerned, being satisfied with teacher opinion and examination results, as we shrug off complaints from the business world. Public apathy may seem surprising, considering the bill for education, the proportion of the G.N.P. it absorbs (about 9 per cent) and the numbers involved, but it is only recently that various public groups have become concerned as to what they are getting for their money, what their teachers are doing to Mary and Johnny, and what student and parent unrest is all about. They are not satisfied with newspaper accounts of the tiresome politics of education, of the increasing costs, and personalities, but want more on aims, programs and evaluation. If research conducted in the faculties of education of the universities is to get into the classrooms in, e.g., Gopher Prairie, then we should consider providing linking mechanisms.

An AERA Committee on Research Utilization pointed out that research can be transmitted, translated or transformed for implementation. Since research findings come from carefully controlled laboratory conditions they can be transmitted directly to the classroom: they may have to be translated into practical measures or they may be implemented directly. Much of this is a fairly long and expensive process if the "bugs" are to be removed and the transformation fairly extensive. Neither practitioners nor the researchers are by nature or training particularly prepared for this sort of undertaking, but practitioners should be involved in it.

Diffusion of ideas throughout any system may be ordered by edict, sold by high or low pressure salesmanship or introduced more democratically where implementation is left in the hands of the school administrator or teacher, and this applies to most innovation -- the main aim is to create awareness and to provide opportunity for assessment. This may be done through telling, demonstration and salesmanship, but there should be an absence of what Guba has aptly described as hucksterism, which should have no place in the dissemination of education products -- we are all aware of high pressure salesmanship or the soft sell to get products into the schools. The procedures or strategies to be employed must be related to the product to be introduced. Most require involvement and some require considerable training before practitioners feel at home with them. Most of the following are recommended approaches to ensure greater diffusion: written or verbal description; demonstrations or films; assistance in acquiring familiarity with products and active involvement in their introduction; a training period to acquire new habits; opportunity for discussion before decisions are taken, and new methods of evaluation.

In business and industry most firms consider that it costs from 5 to 10 times as much to develop a product as to produce the basic idea. In education we suggest that 20 per cent go to basic research and 80 per cent to developmental research and related activities. Business depends largely on packaging, displays,

advertising, salesmanship, to create a need and to have one product favoured over others. In education where the motive is not profit and where competition is not economic, it is suggested that other strategies be used and that products introduced be those which stand up under careful assessment and evaluation.

To ensure better implementation some educationists favour the use of middlemen similar to the "ag-reps" in agriculture and professional salesmen in medicine. Other suggestions are that experimental or demonstration centres be provided to set a good example, as in agriculture, or that each school unit have a research unit. The last alternative is favoured in this report although not to the exclusion of demonstration centres, experimental schools and experimental classes. There is no great objection to the use of middlemen, Providing for them, however, can be given a lower priority than SRU's for they could contribute best where such units were established. One cannot but ask whether some of the functions of middlemen cannot be accepted by superintendents or their assistants in rural areas.

Development studies can and have been carried on in a variety of settings, under many different auspices and for many purposes. Industry conducts developmental research in its laboratories and in the field. University faculties likewise conduct developmental projects on the campus and in the schools. Recently both have prepared package programs for field trials. Governments have been somewhat lax in developmental endeavour but have cooperated with university faculties and schools and through regional commissions have accomplished something tangible.

A few of the larger school systems, and some colleges, have provided for institutional research and development programs. With more professionals attached to school boards and greater powers delegated to the boards by the provincial governments, and the possibilities for a wide variety of innovations, it would seem that the trend will be towards the development of school research units. Establishing such units is probably the best way of introducing new methods and assessing the program. Such units, however, must have the backing of administration and the cooperation of the instruction staff, if they are to succeed.

CHAPTER IV

THE DESIGNING OF CONCEPTUAL STRUCTURES

The sketching of diagrams designed to set out the whole of the R & D montage, and the designing of structures which could influence the systematic operation of education institutions and contribute to the governance of educational institutions, has received too little attention. There have, however, been some noteworthy attempts to formulate a simplistic scheme showing how the gap between theory and practice could be bridged. Perhaps the best known model is shown as a linear progression from idea, through design, research, field trial, implementation and institutionalization. A good example of this is the Guba-Clark linear model (which is similar to those proposed by Floyd Robinson and others in Canada). It suggests a simple straight-forward logical design with R & D being a top-down procedure; with ideas, generated mostly by the research fraternity, delimited to become manageable, then subjected to rigorous research techniques which provide an hypothesis and delimit the design for attacking problems. If the research findings have been validated the results can provide a basis for a new hypothesis for applied research designed to find suitable applications in practical situations. Next, successful findings must be disseminated and finally integrated into the program. These models, like most models, sacrifice accuracy for simplification. It is also recognized that the actual process will seldom be an orderly progression following step after step, as some steps will have to be repeated and communication will go up as well as down.

In many ways this design seems to resemble the process found in industry where its effectiveness is well recognized. But the similarity is somewhat forced, since in business there is a line of command which determines what research is to be undertaken and what innovations or changes among the variety of approaches which have been used should be adopted. Yet, despite such criticism it should be an important segment of our overall research design since it provides the framework for much basic research, which is necessary if we are to achieve long term dividends. Developmental research will in part result from basic research findings but can be instigated at all levels and by researchers or developers in all segments of education. Our conceptual framework should provide for devising and testing innovative practices in all units, encourage teachers to participate in effecting changes and assessing their programs, using action research, and undertaking a variety of studies and investigations. It must recognize that the number of problems that arise is such that all the research personnel in Canada, if conscripted and turned loose on the problems readily identified today, could not come up with answers during this generation. If one adds that most research studies turn up more possible, additional, relevant studies than are investigated, it becomes clear that the total responsibility for R & D must be spread rather widely. It is equally clear that consideration must be given to establishing priorities since only important matters can be considered as topics for research.

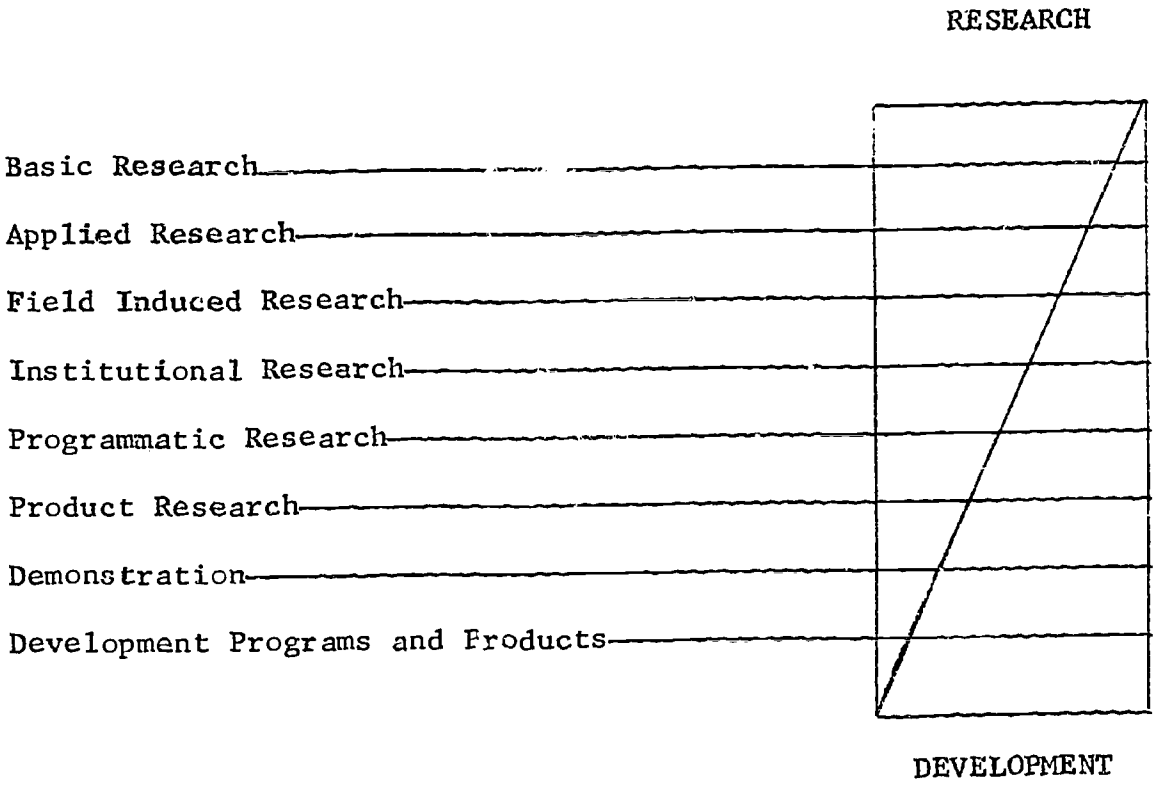
A second approach, that of Gideonse, as found in the Sixth Annual Conference on Educational Research, considers research as activity to generate new knowledge; development as activities designed to provide new materials, techniques, processes, hardware and organizational structure to accomplish specified objectives; and operations as the process of the educational system. He provides for all of these to operate independently, but for some activities to work in pairs or all together. His diagrams come closer to depicting what normally happens in the education system. The top-down linear model could be a part of the Gideonse model, but would not be separate from overall interactions.

Models for R & D in Education

Let us now consider some diagrammatic representations showing considerations to be taken into account in any attempt to harness and direct R & D in Canadian education. We normally look for certain attributes in a diagram while recognizing certain weaknesses in using this method of presentation. In this instance we would hope that the diagrams will meet three requirements. First, that they will identify what is meant by R & D. Second, that they will identify the bodies, associations, etc. which are contributing to R & D. Third, and most difficult, that together they will attempt to show relationships among the involved bodies.

Normally diagrams should be simple and easily understood while reflecting conditions fairly. Simplification is usually effected by showing only the most important lines of communication, which could be misleading and never complete. Despite this and other omissions, diagrams, models, paradigms, etc., when successful, do convey meaning more readily and faster than can be done through any other method.

As has been pointed out, drawing a line of demarcation between research and development in certain areas is extremely difficult, if not impossible -- for example, those in which the activity is developmental research. Basic research is and can well be practically free from developments, and similarly some development projects which do not use research methods or research findings directly can be easily separated out. But between these two extremes we find various mixes of R & D. Diagram 1 attempts to show this but should not be taken too literally. This applies equally to the other diagrams which follow.



The next diagram is intended to give some idea of the sorts of bodies involved and the areas that can properly be included under R & D. What is shown here depended a good deal on the definitions accepted. If we consider research as well ordered activity aimed at discovering causal relationships between variables, then we would restrict the sort of projects and studies included. If we look for correlational relationships, numbers of times certain relationships occur, and try to quantify qualitative characteristics, then what we include is much more extensive. Our definition has been quite broad, otherwise much of what has been included could have been classed as ancillary or supplementary. For example, the majority of theses undertaken in pursuit of higher degrees could not be included if we insist on adequacy in sampling, high reliability and validity of instruments, replicability, and selective statistical treatment. For purposes of simplification we can consider adequacy of sample and internal validity as being the two criteria for categorizing adequate research endeavour. Projects which have universal coverage or an adequate random sample and use only reliable and valid instruments and appropriate statistical treatment will be classed as experiments. Those which have some of these attributes but fall short of the necessary validity in sampling, measurement or control have been classed as investigations. Some of these may have internal validity but use an inadequate sample. Among the descriptive projects many will be valid from the viewpoint of sampling whether using the whole universe to be treated or a random sample and they can be classed as surveys. The instruments used are usually questionnaire forms or interviews, neither of which generally have high validity. Where the surveys fall short on sampling they would be classed as studies in the paradigm.

This is not intended as a mere academic exercise in classification. Nor is it undertaken to suggest that any of these be written off as unworthy or undesirable. Experiments can be found in basic and applied research, and developmental projects may on occasion qualify although they are not undertaken to add to theory. It is an interesting question as to whether or not carefully constructed surveys can provide more information for educational theory than experiments. There is no argument as to the need for good descriptive research. It has an important place in R & D.

Likewise there is a place for investigations and studies. The investigations should be adequate for degree requirements, for pilot studies and for developmental research as a basis for decision making and action. It is not necessary that a solution be applicable everywhere, only that it have relevance for a certain school organization if that is what is needed. But care should be taken in reporting success or failure so that it is not touted as having general application. For some instances the findings may be as true as if they met rigid experimental qualifications, but a report should be required to meet those before it is published as valid everywhere, or wherever the hypothesis applies.

Studies are also important. The case study method, for example, has produced findings suitable for hypotheses for basic research in some instances, and in others, hypotheses for studies in school systems. Historic studies would fall in this category as would others concerned with school administration, some test development, and product developmental applications. Critical logical analysis and philosophic studies may act as governors, ballast, breaks or accelerator.

INVOLVEMENT IN EDUCATIONAL R & D

Contributors — Foundations, business firms, Government departments
Federal departments and Crown Corporations - Economic Council, DBS Census & Education, Manpower, Labour, Secretary of State, Rural Development, NRC, CBC, NFB, etc.
Provincial Departments - Education, Labour, etc.
National Education Associations - CEA, CTF, ACELF, AUCC, CUS, CAUT, CSTA, CHSPTF, etc., CCRE, CERA/ACCE, Provincial Research Councils, Provincial Education Associations - Teachers', Trustees', etc. School Boards, College and University Boards, etc.

EDUCATION OPERATIONS

Kindergarten - elementary - secondary - post-secondary - higher education

Special Education - trade schools - technical institutes - community colleges - out-of-school and adult education

Products - Tested innovations, packaged programs, education media, curriculum materials, CAI and other programs, language laboratories, organizational study results.

Process - Basic, applied, field-induced, product, institutional and other research.

Segments - Field and laboratory testing and test-development, demonstrations, information services.

Producers - Institutes, Faculties of Education, National and Provincial Educational Associations, Provincial and Federal Departments of Education.

SORTS OF RESEARCH INVESTIGATIONS

Experiments 1. Adequate sampling or universal 2. Valid and reliable instruments 3. Suitable statistical procedures 4. Logical inferences	Surveys 1. Tested instruments 2. Tested or random samples 3. Suitable statistical measures 4. Logical inferences
Investigations 1. Pseudo scientific experiments in that there is inadequate sampling and the instruments have not been validated 2. Exploratory attempts to discover relationships, use new techniques or develop new products	Studies 1. Historical 2. Philosophical 3. Case Studies 4. Pilot and developmental 5. A wide variety of exercises aimed at finding solutions to a wide variety of problems

Experimental research is conducted in controlled confines, laboratory or classroom. It is aimed at testing hypotheses and discovering causal relationships. Hence it is usually not conducted in a natural setting under normal conditions. How great a weakness this is is a matter of debate. There are those who think that we should devise new appropriate procedures for field experiments. Use of the computer appears promising in this.

Surveys are descriptive and normative. Where interviewers are used the returns may be subjective; where questionnaires are mailed out one seldom gets a 100 per cent response. The forms used vary widely in terms of adequacy, clarity and comprehensiveness. Too long forms will not be answered; too short ones fail to provide the information wanted. But we have not as yet exhausted the possible techniques or possible applications for projects in this area.

Variety in Research and Development Activity

Research techniques and procedures can be integrated into most educational activities. This is quite another thing from suggesting that either research or development personnel should take over the administration of any sectors of the education enterprise. The contribution of research is to provide a variety of methods appropriate to assist in systematically solving many education problems and of researchers to use these methods to expand knowledge and provide information on which decisions can be based. The section of this activity subsumed under speculative or basic research is concerned with generating new knowledge, whether making breakthroughs in new areas and validating or establishing principles or theory. The development part is concerned with effecting improvement in the

process or operations carried on through formal education whether through the devising and development of new curricula, or new programs, materials or organization.

The items included in the following outline give some idea of the sorts of activities which can contribute to the education enterprise. Many of these could be spelled out in greater detail. For example, the item "experiments" would cover the following and more: projects using single group design, parallel or equivalent group design, matched pair or matched group design; rotation group design, and counter balanced design; factorial design, multi-variate analysis, Latin and Greek Square, randomized blocks and confounding design; ex post facto efforts, and factor analysis.

R & D ACTIVITIES IN THE FORMAL EDUCATION PROCESS

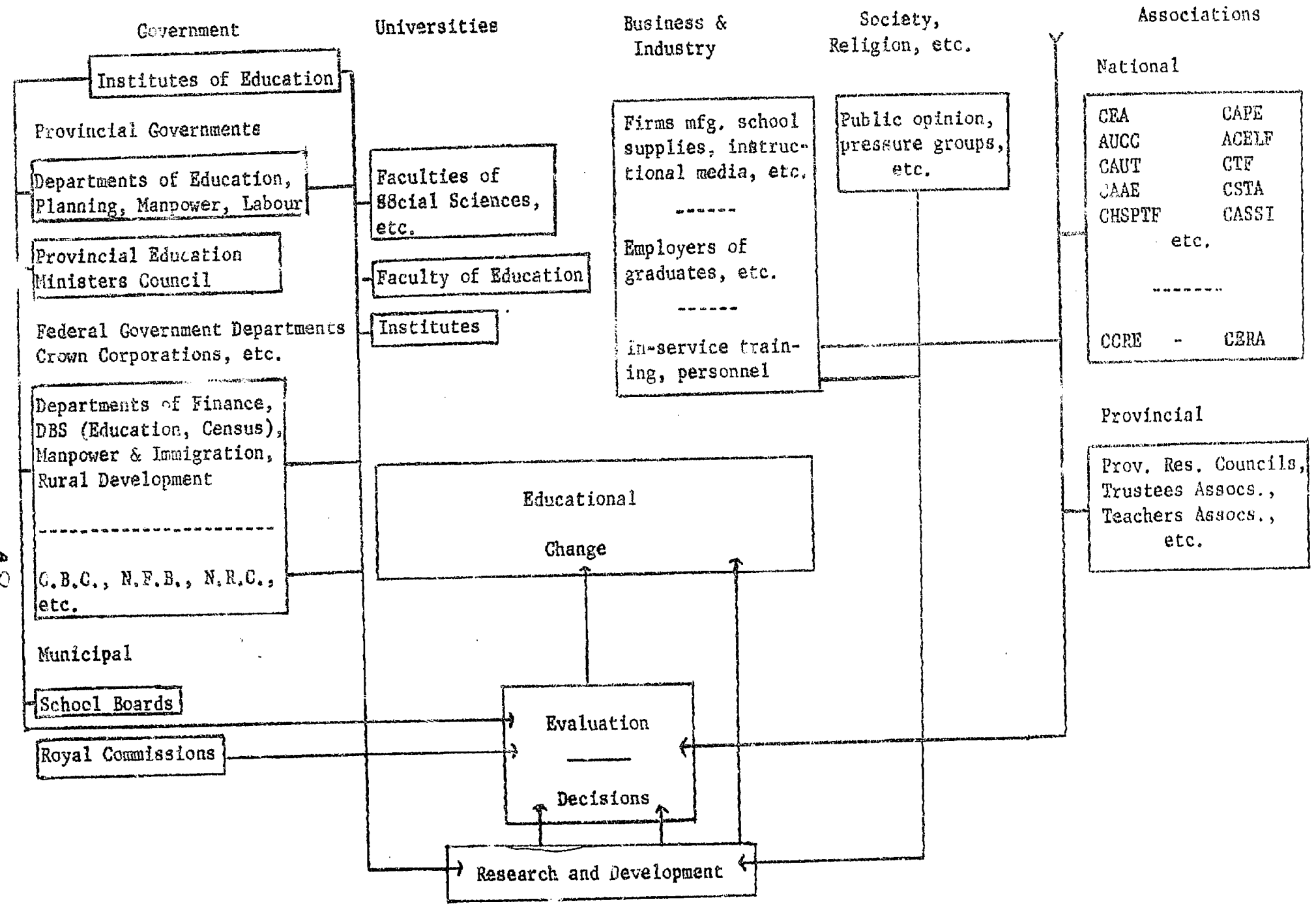
Types	Speculative or Basic Research	Practical or Applied Research		Development
Sub-types	Discovery - theory related	Applied and Field induced	Institutional and Product	
Activities or Units	Experiments - in laboratories - in school Surveys - total population - samples ——— Statistical theory development New experimental designs ——— Search of literature from - social sciences, etc. and - selection of findings	Studies - pilot - historic - case - analytic Investigations - action research - operations research - systems analysis - other Technical development	Curriculum construction hardware & software C.A.I. materials packaged programs other teaching materials	- School research units - Demonstration and experimental schools - Projects & programs for - disadvantaged - special education - guidance - other Building design Assessment and evaluation

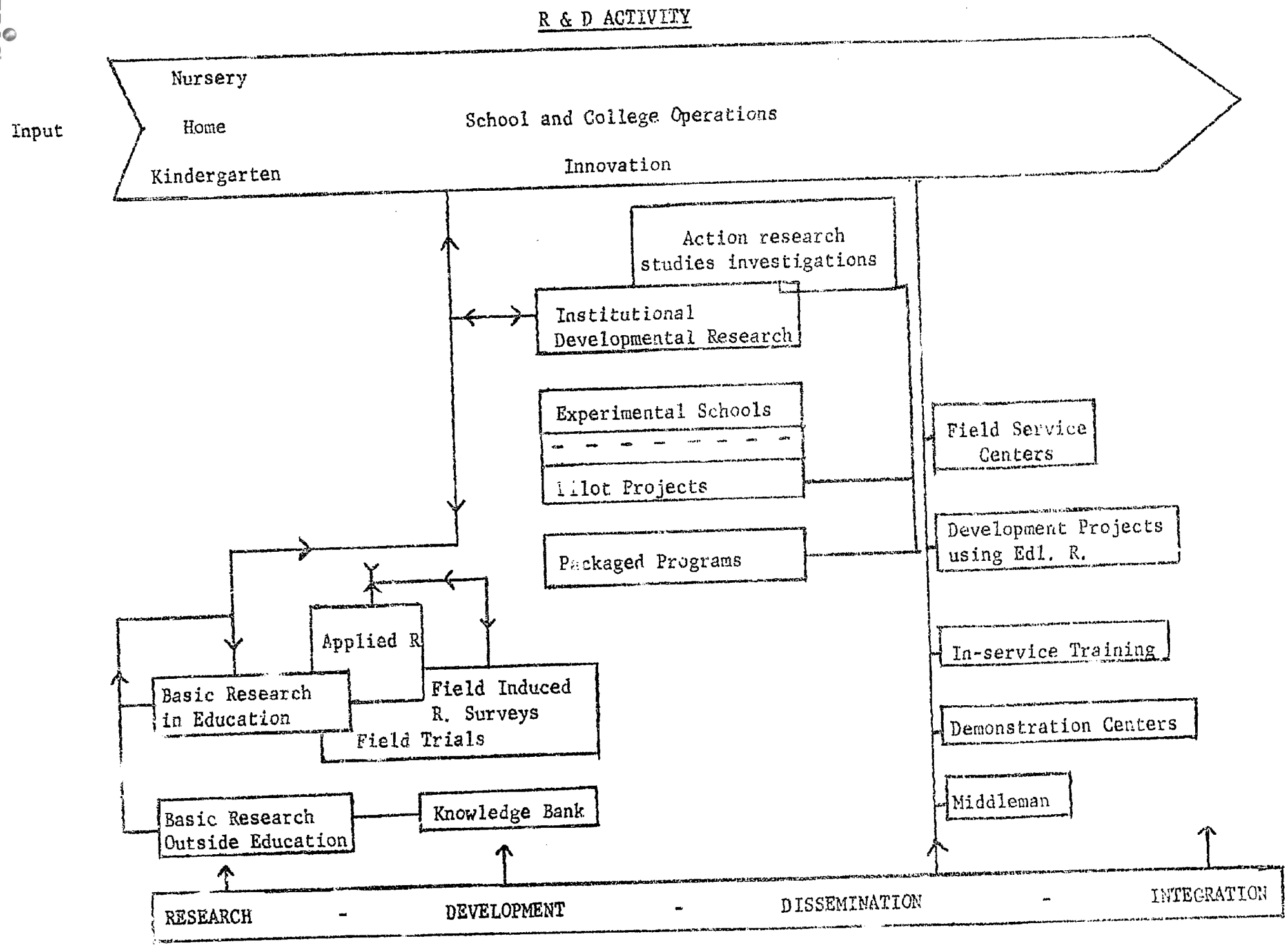
Involvement in Educational R & D

Research and development activities may well be conducted at all stages of the educational ladder and beyond. There is some evidence that educational or social activity can affect pre-natal growth; considerable evidence that the first few weeks are extremely important; and some evidence to indicate that subconscious activities during sleep may influence what is learned. The cradle to grave philosophy appears to be gaining in acceptance although no one has clearly set out the implications of adopting such policy. Assuredly it would affect what is taught, how and when. It would change our attitude to dropouts, to graduation, to academic year, certification and holidays. Here we limit our consideration first to those bodies and foundations whose decisions concerning money and grants affect the amount of research which is undertaken as well as the sort of projects that are undertaken. In addition most professional education associations and other bodies support research in principle if not financially, and the majority provide at least some information or research services. To all of these, research and development are important.

The products of developmental research are finding their way into the school. Most of these require several sorts of research ranging from engineering and communications to field testing. Where they relate to hardware, the lack of appropriate software has at times reduced their value. Introducing newer media into a school situation before it has been tried out in average school situations, and before the teachers have become thoroughly at home with it, may slow down its introduction and use.

THE CONTEXT IN WHICH EDUCATIONAL INNOVATIONS OCCUR




R & D ACTIVITY
Input
Nursery
Home
Kindergarten
School and College Operations
Innovation
Action research studies investigations
Institutional Developmental Research
Experimental Schools
Pilot Projects
Packaged Programs
Field Service Centers
Development Projects using Edl. R.
In-service Training
Demonstration Centers
Middleman
Applied R
Basic Research in Education
Field Induced R. Surveys
Field Trials
Basic Research Outside Education
Knowledge Bank
RESEARCH - DEVELOPMENT - DISSEMINATION - INTEGRATION

CHAPTER V

ON SETTING OUT PRIORITIES FOR R & D IN EDUCATION

The title of this section was not selected with a view to deceiving anyone. If any person hopes to find a made-to-order listing of those things which have to be done and the order in which the problems listed should be attacked, he will have to look elsewhere. What is to be attempted is rather some discussion of certain of the considerations which are important if we are to introduce more order into the research and development activities now being undertaken. Such a reordering and designing of plans for expansion appear most desirable at this time. With our resources limited, our efforts leave much to be desired and dissatisfaction is rampant since there is no general agreement on a plan of action designed to achieve something better. The position taken herein is that any attempts to establish a listing of priorities would not only be premature; but it is hard to conceive of formulating a simple list which would be adequate for such a complex educational organization as is found in Canada. Yet our multi-centered organization demands endeavour to overcome the current dissipation of efforts with too little accomplishment. There is nothing wrong with research personnel attempting to find answers to interesting queries which intrigue them except that it is a luxury we can ill afford.

Not only is there no one person knowledgeable enough to produce such a blueprint for R & D covering the next five years, but before such a structure could be created a good deal of clearing and cultivation of the ground would be desirable, with appreciation of those patches under intense cultivation, the many shallow ploughed patches, some areas already gone to weeds and some hardly surveyed or assayed.

Minutes of CCRE meetings have for some time noted that there is great need for a reasonably comprehensive survey of the present state of R & D in Canada. Such a survey would include a stock taking and make recommendations for further efforts. It would not, however, produce a policy which would provide a blueprint for the sort of structure which would be semi-permanent and meet all needs. Actually our aims and plans are something which should be examined and revised year by year. Yet a plethora of crying needs and insistent demands seems to compel us to make some attempt to set priorities since their sheer number and urgency is producing a situation which some find scary. Time is not on our side; matters that could previously afford to be left as subjects of academic interest have now become serious practical matters related to the preservation of the good in our society, which represent the work of enlightened scholars over many decades.

The setting out of lists of recommended research projects would not be new. Over the years certain prominent educationists have taken the time and trouble to prepare appropriate listings of questions suitable for research, subjects for theses topics, or problem areas where answers were most wanted. Although some of these have influenced the policy of one or more institutions and some candidates for higher degrees, none of these lists has been generally accepted as a plan of action by researchers. Whether this was due to a preoccupation with their own endeavour by researchers, some of whom would consider such lists as just one more academic exercise, or whether they did not agree that research should be ordered, is hard to say. Today the situation is changing. It is doubtful that researchers in the academic community can escape the necessity of relating their work rather directly to the education process; and there is some risk that the pendulum will swing too far away from the situation which existed some two decades ago when research was the prerogative of truth seekers and personal efforts.

The setting out of priorities could be considered as an academic exercise, as a blueprint for action or as a guide to action. Not all of these approaches appear to be either relevant or suited to the Canadian situation. Let us look at them one at a time in the hopes of discovering some guidelines which have the best chance of acceptance in Canada.

Considering the establishing of priorities as an academic exercise seems to infer that the logic would be irreproachable but that the purpose would not be to introduce the design into the real situation. This could be interpreted to mean that the list was available for consideration, but that it need not be applied since it would not take account of such matters as cost, personnel available, current programs and a host of other variables that would be affected or be road-blocked if such plan were implemented. This does not suggest that such a listing would be superfluous in establishing a plan of action, only that one must check to see that all other necessary considerations would be included.

Approached as an academic exercise, emphasis could be placed exclusively on a review of the literature, logical organization, and the use of the scientific approach. This could contribute to our knowledge and to our search after truth, while at the same time providing a classification and ideal models. It need not concern itself with practical financial and other limitations, acceptance, salesmanship or public relations. As such it could be considered as a valuable contribution to information -- but it would not provide solutions.

There is much to be said for the effectiveness of a blueprint if agreement is reached on end products and process. However, a blueprint tends to be authoritarian, systematic and rigid, establishing guidelines and milestones. Such a plan seems most acceptable in a totalitarian state. Democratic societies which allow for considerable individual initiative seldom favour nice, detailed designs similar to travel tours with fixed schedules which detail vehicles, speed, ports of call, stopovers and destination. In Canada where we have more than 10 distinct education systems as well as private schools and a wide variety of other formal and informal education, we will have to find a more typical complex Canadian solution.

The third approach, which is something of a compromise, maps out the area, recommends highways and byways, suggests a suitable destination, yet makes allowance for exigent circumstances. Just as one can probably see the most through using a tight schedule designed by travel experts, so the least would normally be seen if everyone set out with their own ideas of going somewhere, and with few services but with various obligations. A compromise here, however, may or may not fall between the two, since much of the terrain is not mapped and exploratory journeys must be undertaken.

As a matter of expediency our problem is to decide how far Canadians will go towards concerted action. Can we reach general agreement on the sorts of research organization that is desirable for Canadians in all provinces, or even parts of provinces, and rank needs in broad categories, so as to determine what research and development is most useful? Can we provide a communication system, or systems, which will keep everyone concerned in touch with what is going on? And can we find the money necessary for this?

The framing of a policy for R & D in Canada would appear to be necessary, and time is short. Yet the statement when prepared will probably be brief and general. Perhaps we must ask ourselves whether what we want isn't a general overall statement for Canada with additional statements for departments of education, faculties and institutes of education, professional educational and other associations interested in R & D in education, and for private bodies and industrial firms. Can we agree on a sort of research design that seems best for the provinces which provides a ranking of needs to which we should direct our attention and learn from each province how it could best contribute to an overall program? Can the thrust of research be sharpened, directed and speeded up with basic and other research stimulated, studies undertaken to coordinate research efforts and energies amassed and directed in accordance with agreed-on policy? If this can be accomplished, then Canada's education will move ahead rapidly and surely.

In trying to discover how research has modified the educational process to date, one might decide that it was difficult if not impossible to pinpoint causal relationships, in part because of the interaction of multiple variables and in part because the decision making process comes between research and practice. The line from theory to practice is often tenuous, broken or even imaginary. Even though you are sure that such a relationship exists, it is hard to identify. There is seldom a straight line between a major discovery and wholesale implementation. More often a barrage of research findings contribute to a decision for change. Certainly innovations designed to provide for individual differences, the teaching of language and such fall in that category.

Some thoughtful educationists have decided that the results of research are cumulative and that when the weight of findings reaches a critical point for the situation, changes are made. Systematic investigations, though conducted in a desultory manner, have affected prevailing views and will continue to aid in progress Whether we can afford to continue trusting to luck -- that is to dedicated scholars and the generosity of those who could find dozens of other uses for their money -- is a question we should face. There is no question but that a laissez-faire approach can be counted on to produce results, but whether or not this is the approach we should adopt is a real issue.

Increased demands for information, rapidly increasing costs which are absorbing a greater percentage of the G.N.P. and an increased complicity in what the schools are attempting and expected to do are bringing more and more thoughtful persons to an acceptance of the need for planning and of harnessing research and development in order to increase efficiency, to provide direction, to discover the best procedure in teaching and learning, and generally to ensure quality education.

Before making any attempts to establish priorities or design models perhaps we should try to select the best approach to be adopted in attacking our educational problems. On paper there are several possible approaches or combinations of these which could be tried. First, there is a cumulative free-wheeling course where all researchers pursue problems that they have identified and which interest them, and stockpile the findings. Here we trust to the good will and good sense of those who conduct research, using analytic and synthetic procedures and distilling the result. It is assumed here that systematized or random efforts on occasion will produce major new concepts, some of which appear unexpectedly and which will eventually affect the education process.

An extreme laissez-faire position would necessitate removing all present restrictions to obtaining grants, meeting thesis requirements, publication etc., an impossible impractical alternative. The opposite extreme would consist of complete regimentation and a highly structured plan, with concentration on important areas on a fixed schedule. Such a scheme should ensure that R & D in education would receive a fair share of competent research personnel, money and services. That it would produce results in line with set goals seems incontrovertible. It would be more systematic and should be rational and objective. But it could not be recommended since it would be totally unacceptable in Canada and most researchers would question whether it is the best in the long run. Because of this sort of reasoning, we are looking for a compromise which will provide for at least some of the advantages of either extreme and one suited to our complex system, yet one which will provide for more organization and effort than we find in practice today.

Current practices for R & D which have grown up over the years can probably be best described as non-system. This is not too helpful, unless one adds that it is a mêlange of the good and the questionable, and can separate these out. The new institutes are concerned with policy and with determining how best they can contribute to advance education. But each is unique and its areas of competence are set according to its administrative policy. One institute actively engages in R & D, others provide aid for researchers in and outside the universities, thus influencing priorities for R & D. The faculties of education vary equally. In some, research effort is limited to helping students meet thesis requirements for graduate degrees, and to research efforts by professional staff who must undertake this in addition to their teaching, administrative, consultative and other duties. Some of the faculties are so small that not more than one or two are concerned with research and provision for training researchers is limited to one or two courses. Outside the institutes and universities faculties, research generally consists of developmental and descriptive projects or product research.

Although professors of education theoretically can undertake any research they wish, in actual practice they are limited by the availability of expert help, equipment, assistance and time. A great many of them are turning to field-induced problems where money is available and publication possibilities are often as good or better. This is not necessarily a bad thing, but it would be too bad if we did not ensure that certain outstanding professors had their research supported and that they were relieved of some other responsibilities so that they might pursue specific exploratory basic research endeavour in which they are interested. The institutes normally provide a safeguard as to work undertaken in that each researcher must justify his approach to his peers. It would be too bad if this safety device backfired and promising projects were suppressed. There must be risk capital invested in basic research in education as elsewhere and the chances of good returns on the investment over the years are probably better here than in many other areas since education so far is a relatively neglected field.

Where it is suggested that more R & D be integrated into the education process, for some this would seem to have serious implications. For them it follows that guidelines would determine the research to be undertaken, and the possibilities for initiating projects limited greatly. Developmental research could also be limited to the program of the school or college. This would be a most undesirable exaggerated form.

Professionals with a bent towards development will welcome or accept membership in a loosely organized team of which the efforts are directed towards improving education; but researchers who are concerned with adding to knowledge cannot be expected to be preoccupied with practical problems. We should not deny the opportunity to basic researchers to pursue promising avenues of their choice, yet could hardly justify leaving choice of project to all individuals. Certainly many professional researchers have earned the respect of their co-workers and of the education community. They have won their spurs and as knight errants should be supported. Our problem is not as simple as determining whether projects are basic or developmental; there are both good and poor attempts in both of these.

Support of thesis projects raises equally difficult problems. These represent a prodigious use of scarce human and other resources. In recognizing the need for answers to education problems, most of which will not come from thesis-sized projects, perhaps the time has come for those who are or should be training researchers to get together to determine how best this can be done in small, medium and large faculties, and consider whether it is not time to update thesis requirements in the light of modern needs before "student unrest" focuses on the issue. Few students enjoy more than limited elbow room in undertaking a thesis where they must operate within restrictions of time, place, money and resources. They normally select a topic which allows for one-man endeavour, can be completed in a year or less, requires little cash outlay, and has the approval of the professor in charge. The present program is sometimes justified as a training exercise rather than as a genuine contribution. If this is true, then one may well ask whether there are not better ways of accomplishing this. From the viewpoint of contribution made, many of the best thesis are those which contribute a limited amount to a major area selected by a professor who then may suggest topics to candidates and will as time goes on accumulate a wealth of data on a topic and become an authority in that area.

R & D personnel must keep on asking not only what needs doing but what now needs doing most. They need also to ask how best the work can be distributed. There must be divided responsibility yet somehow the efforts should be coordinated All of this must go on in a societal complex where education is but one of the instruments and where the aim is to achieve something of a symphony which to all intents and purposes continues more or less indefinitely.

Educational researchers and developers are cultivating a field where not only they themselves can work and produce; but where members of other disciplines can find an arable soil, yet cannot be permitted to take over. The need for specialists of many disciplines and for their contributions becomes more pronounced year by year as our perspective rises and the horizon is moved further back. The scientific foundations of education, though weak in theory, are becoming increasingly firmer year by year as they add scientific knowledge about the human being, methods for predicting and controlling his behaviour and possibilities of changing the strain drastically. They are concerned with the structure of the society we have fashioned somewhat after man's nature, somewhat artificially, and possibly not a balanced construct to judge by the degree and extent of rebellion and change today. Similarly there is research and argument concerning the development of personality, the processes involved in human thought workings and our techniques for problem solving. To these problem areas scientists concerned with experimentation, prediction and control, provide ways of examining reality, better and more appropriate tools, methods of sampling, and more rapid ways of processing accumulated data.

From a practical standpoint, since education changes are designed to affect human behavior more after a decade or two than today, we may well ask which ideas and policy decisions are necessary at this time to produce the sort of educational structure, institutions and education programs by 1980 that will commence to turn out students by the 1990's, with the necessary knowledge and skills to cope with the sort of problems they will meet at the turn of the century, year 2000. Our concern must be with controlling pollution, discovering how peoples can live together, how many people the world can support in affluence and how the selection should be made. Education can affect this both indirectly and directly. It contributes a body of knowledge, skills and habits for those exposed to it and in addition has something to say about the sort of world we want this to become. Basic research has a contribution to make to this as to our understanding of the potentialities of human beings and how they can develop.

Topics for Basic Research

The United States Office of Education has stated that basic research should be supported to ensure long-term returns from education. It suggested the following as likely topics in basic research:

1. Basic research in molecular biology, or genetics, and the implication of findings in these fields for education;

2. The critical determinants of behavioral change;

3. The possibilities of altering memory and other elements of the learning process with the use of drugs; and

4. An understanding of the impact of home, community and other factors on those who are commonly called disadvantaged children.[1]

Certainly the family's contribution to the stimulation and growth of the mental, motor, emotional and social development of the young child through appropriate oral, aural, visual and manipulative experiences with concern for neural, psychological and dietary research projects, has high priority in Canada today. Research on the nature of development whether motor, cognitive or emotional at all stages of development is related to several potential development projects.

We have been commenting on a systematic investigation of the education process and research which provides understanding of learning theory and the fundamental biological, neurological and chemical processes related to learning, and is a basis for developmental research and related activities. It may be concerned with the school as a social system, the relationship among non-instructional and communication theory. For this, increasingly sophisticated experiments are being conducted in laboratory settings and outside. The following four were identified in The Journal of Experimental Education:[2]

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[1]Educational Researcher, American Educational Research Association, No. 4, 1968, p. 10.

[2]Conditions and Processes of Learning, The Journal of Experimental Education, Madison, Wisconsin, Vol. 37, No. 1, p. 1.

1. Controlled observations to infer thought processes;

2. Controlled experimentation in the laboratory to extend our knowledge of human memory;

3. Development of material and related research to nurture the creative abilities of school children;

4. Development of dependent measures to extend a motivational theory to school settings.

The Howard Centre for Cognitive Studies has been concerned with the following topics: How does the mind grow? How do we receive, store and retrieve information and get hold of it through the senses? How do thought and language interact? How does language shape perception, thought, memory, problem solving and the relationship of all these to the education process?

The University of California has directed research towards creativity and self-teaching devices; the number of relevant questions in problem solving for different levels; the number of ideas and hypotheses generated; the quality and originality of ideas and actual achievement in solutions. The California Technical Institute has been concerned with information processing, sensory perception and how people think.

This listing could be continued much longer but perhaps this is enough to indicate some of the basic questions that, if answered, would enable us to consider more precisely how education should be organized.

CHAPTER VI

CONCERNING THE TRAINING OF RESEARCHERS

An adequate policy covering R & D in education must have something definitive to say about the selection and training of researchers. At present there are comparatively few graduates being prepared exclusively for research and development activity in education. Most of today's researchers obtained their background statistics, sampling research design and thesis writing as a part of their work towards a doctorate; or they learned these in relation to other disciplines and then decided to work in the field of education. The number of educational researchers prepared annually falls far short of both need and demand. If we assume that each larger rural and urban school unit, each college and university, should have qualified research personnel heading up institutional research and development units, not to mention researchers needed by faculties, institutes, departments of education as well as national and provincial associations and industries manufacturing or publishing educational media, the number required is much beyond those qualified to do such work today. Or if we assume that one researcher should be employed for each two hundred teachers, as was suggested by O.E.C.D., again the number is far beyond the capacity of our faculties and institutes to produce in the next decade considering that only the graduate sections, among their other duties, prepare R & D personnel.

Projections of the current situation in educational research suggest that in 10 or 20 years there will be a serious shortage of professional personnel with deleterious effects on Canadian education as the numbers appear to be increasing at a low arithmetic progression rate, whereas our problems are increasing geometrically. If we look for help to our stockpile of research findings, we find they are as few and scattered as stars in the universe. If the alternative of greater effort through greater numbers is to be adopted, then immediately we must be concerned about the best use of additional resources. The sort of policy which should be adopted and the sort of organization which will ensure the best results through obtaining the cooperation of those involved and directing their efforts to reach agreed on goals.

Relevant issues for consideration in order to assure a sufficient number of researchers, include methods of recruitment, training programs, employment opportunities and provision for holding researchers and developers after they are on the job. There is considered criticism of the requirement that those entering graduate school in education must have a teachers' certificate and teaching experience. A good argument could be made that this prevail for those in charge of local R & D units, but hardly for those needing the master's or doctorate for positions in government, industry and education faculties. The argument against such provision, which is not demanded in other faculties, is that it keeps out many bright and ambitious, adds years to those who graduate while often being irrelevant for the work they do. Certainly teachers who have a flair for this sort of endeavour should be welcomed; but such requirements can be an obstacle for others.

Estimate of Full and Part-Time Professionals Undertaking Educational Research in Canada, and Numbers Needed

Where Located		Current Numbers	Numbers Recommended for 1980
1. Universities	- Colleges of Education	300	650
	Institutes of Education		600
	Members of other faculties in Education	150	600
	University Institutional Research		100
2. Government (Provincial & Federal)	- Departments of Education		70
	Other Departments of Government (Manpower, Labour, Armed Services)	100	400
	Crown Corporations, (Economic Councils, N.R.C., D.R.B., C.B.C., N.F.B., etc.)	40	200
3. School Boards	- Urban centres and larger units	50	900
4. Professional Education Associations	- National Provincial	30	200
5. Individuals and Private Concerns	- Inspectors, teachers, social workers, etc., private firms, etc.	150	500
6. Miscellaneous	- Special Education Technical Education Other	50	200
	TOTAL	870	4,420

NOTE: The majority of researchers in universities spend only from 20 per cent up of their time on research; those in institutes generally from 50 per cent up; in school boards, etc., it is closer to 100 per cent. The number of full time or man-year researchers would be but a fraction of the numbers shown, possibly one-third by 1980.

Considering the need for researchers, it would seem most unfortunate that the M.A. has been downgraded since competence at the Master's level in research would seem acceptable as preparation for many in charge of local units. How the image of the master's degree can regain its former status is a real problem, but not one that is insurmountable. It would seem also, in spite of certain opinions to the contrary, that two degrees at the doctorate level should be provided, the one essentially academic, the other professional. It is likely that most of those interested in developmental work would elect for the Master's or the professional doctorate.

This raises another issue worthy of consideration. Should we be speaking of one sort of training program for all researchers and developers, or of several, according to positions for which they will qualify the holder and the work he will do? Research not only requires professionals and technicians, but others concerned essentially with experimental studies, or applications, product research, or information, while still others will be concerned with improving programs, preparing program packages and kits and such. Later these will gravitate towards interest groups in one or more areas and will develop in these, the question is to determine when specialization should begin and what degrees of competency are needed in various segments of the field.

If Canada cannot produce researchers in the quantities demanded, then many will be brought in from other countries. It cannot be gainsaid that there are advantages in having researchers with various backgrounds and perspectives working together, but there is the possibility that the researchers from outside the country will congregate in pockets or be working alone with little contact with Canadian researchers. The whole matter should be faced, and decisions taken concerning numbers, dispersion, orientation courses and such.

The situation concerning members of other disciplines entering the field of education has so far caused little criticism since the numbers have been limited. If generous sums were made available, the situation for a while might change and conflicts of interest arise. At present economists, sociologists, anthropologists, engineers and others have been welcomed although educationists may neither agree entirely with the sort of research undertaken nor the conclusions drawn.

Whether or not bright youth are attracted, or professionals remain in educational R & D depends on such a variety of considerations as the opportunities to do worthwhile research, adequacy of support or help, equipment, publication possibilities, opportunities for sharing experience, the pull of financial rewards elsewhere, and such. Academic freedom is undoubtedly a consideration, if freedom be understood as opportunity for choice, while ruling out choices that are wayward, trivial or irresponsible. The opposite extreme would be where he who pays the piper calls the tune, where those who provide the money decide on the research to be undertaken, whether they be government officials, foundations, industry or institutions.

Providing money for research raises many problems. It is one thing to say that the amount provided in Canada is one-tenth what we would recommend, but quite another to suggest that we could use ten times as much either sensibly or wisely within the next year. Researchers and developers should ask for more money, but we have a responsibility for suggesting how that money might well be spent.

Some of it should be risk capital supporting discovery research projects; some should go for developing educational theory, but the larger part could be used in developmental research, a neglected area where more qualified personnel should be operating.

Similarly, setting up a training unit for researchers which provides for meaningful research experience, familiarity with a research atmosphere, theoretical concepts, appreciation of the methods of science, statistical techniques, sampling and evaluation is difficult. Only limited numbers can be expected to add to our knowledge bank supporting theory, but more can conduct developmental research projects aimed at some advance in current practices. There is both need and opportunity for developmental research aimed at designing models for training researchers that could well be developed in connection with research programs.

Post-Doctoral Research

Even a two or three day orientation course and the establishment of lines of communication could help a new staff member function better. But considering what is needed, although a Master's degree can be adequate for some tasks, a doctorate for many others, if education is to move ahead with authority, then there is need for provision for post-doctoral opportunities for more likely candidates.

The need for increasing our efforts to provide post-doctoral training is at least as great as is the need for better efforts at the pre-doctoral level. Not only are too many persons, because of the exigencies of the situation, operating beyond their experience and training, but many, though highly competent in laboratory psychology, business economics, industrial engineering, mathematics teaching and such, have neither been prepared by experience, courses nor reading for research and development in education. To expect professionals to learn on the job in a new area while performing as an experienced expert is unreasonable. Significant training at this level can rarely be incidental to the job. It would therefore seem desirable to provide collaborative work with a qualified investigator, post-doctoral traineeships, and grants to study. However, unless universities, institutes and such provide more than hospitality to post-doctoral fellows, not too much can be expected. A post-doctoral fellow spending a semester or school year at an institution in addition to adding to his technical competence can experience intellectual growth, while at the same time contribute to the output of the institution.

The Current Situation for R & D Activities

	Institutes	Education Faculties	Professional Associations	Departments of Education	Colleges & Schools	Private Industry	Other
% of Time for Research	up to 75%	often 20%	full or part time*	full or part time**	full or part time*	full or part time	varies widely
Type of Research	Basic, applied field studies historic	Basic, applied few field studies*** historic	Descriptive surveys etc. Occasional large projects	Mostly developmental assessment surveys etc.	Institutional related to program****	Product research	Descriptive, product, pilot studies Historic etc.
Development	about 20%	quite secondary	related to professional development	generally by contract etc.	mostly related to program****	considerable for products etc.	varies
Availability of Funds	reasonably good, seek other funds, make grants	some seek other funds	limited funds, make limited grants	make grants directly or indirectly, limited	must budget for funds	research funds are investment	solicit funds, budget for funds, etc.
Equipment, Supplies, etc.	good to fair or limited	fair to good	fairly good	fairly good	colleges good, schools good, fair & limited	good	varies widely
Publication Efforts for R & D	improving	good to meagre	fairly good	few outlets	limited	some	limited if any

* Usually the other part is in services or action research.
** Hard to separate from data collecti essment, etc. in some instances.
*** Usually under special centres or related institutes, etc
**** Much effort combines research with development.

CHAPTER VII

THE FINANCING OF R & D IN CANADIAN EDUCATION

We are concerned here with R & D activity that is harnessed in the education field to improve education and to serve our nation and its provinces. Increased investment in R & D, if properly directed, can have far-reaching implications for further changes in education in the light of society's needs today while making full use of advances in science.

Research and development can affect education and society both directly and indirectly. There is the general pervasiveness of a research mentality which could affect all concerned with education, and be related to the desire to improve education rationally through research, planning, innovation and exploration. There is also the possibility of concentrating efforts in some chosen line of activity aimed at change in program, organization, etc. It is also possible to select priorities intended to produce short-term improvement or to conduct basic research aimed at solving some of the fundamental questions concerning cognition, communication, memory, behaviour, and such. The research can be essentially psychological, sociological, economic, etc. or inter-disciplinary. It is the infinite variety of possibilities as compared with the limited resources that effectively compels us to think in terms of concentrating our efforts into directed channels. Cost is a primary consideration in this.

Those promoting R & D in education should be in a position to guarantee to administrators, that investment in these activities will produce increased efficiency to an extent sufficient to warrant the expenditure, while at the same time assuring teachers that the services they provide can be enhanced. There has been a tendency for some to intimate that R & D has paid ample dividends elsewhere and ask that the public coffers be opened wide to educational researchers. The case for R & D in education should, however, be made independently -- a task that should not be difficult. There is ample experimental evidence to indicate that pupils, when motivated, can learn more in less time, not to mention experience with crash programs, programmed instruction, special classes, as well as evidence from comparative education. Although we should not become preoccupied with increasing efficiency, possibly at the risk of hurting individual development, nevertheless it would seem that efficiency would be increased in one or more of the following ways:

1. Through improving the school offering we could shorten the number of years spent at school and graduate students who know at least as much as today's graduates. Care should be taken to ensure that positive results have not come because of the Hawthorne effect, halo, innovative enthusiasm and such, but will continue indefinitely. Having a three or four "semester" year or otherwise affecting attendance might have a similar result -- perhaps certain of these sorts of alternatives also need investigating.

2. By turning out a better product from the school through improving the process. There are plenty of suggestions for innovation readily at hand, many of which warrant testing in experimental settings.

3. By increasing the number of pupils per teacher. This is not too promising as most innovations end up by using more rather than fewer instructors. However, there is need to investigate the use of teacher aides, technological devices, etc.

4. Through employing better prepared teachers, through making use of pre-employment preparation, in-service training, and the hiring of more specialists.

5. By reducing the dropout rates. Investigations here would be concerned with special education, educational adjustment of the disadvantaged, individualized instruction and such.

6. By explaining systematically the possibilities of introducing automated education in an orderly manner. This is a big undertaking since new media are coming on the market at least monthly.

These are but a few of the possibilities that come readily to mind, and at that they may not be the major ones. A gain of 20 per cent in cost effectiveness is not impossible nor would it be a rash promise.

Evidence has convinced business and industry that investment in R & D is necessary for survival, and firms generally spend from three to eleven or a higher percentage of their total expenditures on research and development, much the larger part going for developmental activities. How much money should be invested in R & D in education? For some time those interested have been suggesting that a modest one per cent of the expenditure would be a reasonable figure at this stage of our development. Since this would be about five times what we now spend it is quite unlikely that we could spend more wisely immediately. However, this could well be raised to two per cent some five years later, if we are to receive maximum possible benefits.

Any suggestion that we should immediately and suddenly indulge in a research splurge to overcome the backlog of projects needed and find solutions to our many problems is hardly realistic. What is needed are goals, planning, an adequate research and development establishment, and sufficient experienced personnel to carry on appropriate projects. For this reason, a two per cent contribution, or ten times our present resources would challenge our ability to produce wisely, even though at present there are competent personnel with projects in all stages from the drawing board to those having weathered the pilot project stage. They are now waiting for resources to continue.

A CCRE estimate indicates that some $9,000,000 was spent on salaries, equipment, publication, etc. for research and related endeavour in 1968. This represents an appreciable increase over the situation in the fifties, essentially because of expansion in university education faculties and the amounts spent on or through the new institutes. Some idea of its relative size may be obtained by comparing it with an expenditure of $105,891,651 by the Federal Government on all research in 1967-68 (and $79,267,645 in 1966-67). Of this about 45 per cent went to the National Research Council and 20.5 per cent to the Medical Research Council. A relatively small percentage directly or indirectly was used in projects benefiting education. The gross expenditures on R & D represented about 1.31 per cent of the G.N.P. The current expenditures on R & D in Canada in 1965-66 amounted to more than 524.4 million dollars, and closer to 800 million dollars in 1967-68. The 9 million on education research (perhaps a total of 10 million counting the private sector) is about 1.25 per cent of the total cost. Considering that education costs represent about 9 per cent of the G.N.P., education R & D would appear to be the victim of political expediency. Raising the expenditure spent on educational R & D from 0.2 to 2.0 would right this imbalance and according to available knowledge prove to be a wise investment which would have a salutary effect on the G.N.P.

The bulk of the money for educational R & D in Canada comes from the provincial governments, with limited amounts from the Federal government, particularly for vocational technical and adult education and communication, some from municipal boards and some more from private firms. Foundation grants have made certain large surveys and other descriptive studies possible.

About 82 per cent of the total for R & D was reported by the institutes and faculties of education, 11 per cent by school boards, 3 per cent by governments, leaving 4 per cent for all others. As compared with business and industry it would appear that a much larger percentage is spent within the universities. It is not suggested that they spend less, but rather that research and development centres be increased to spend much larger amounts.

Figures for the United States Office of Education for 1967 showed the following distribution: basic research, 41.4 per cent; applied research, 42.3 per cent; development, 15.2 per cent; dissemination, 0.7 per cent and training, 0.4 per cent. If business and industry are right, since the cost of development is high it would seem that a 20-80 breakdown with the 80 per cent going to development would seem more advantageous. But the division should be determined somewhat according to definition of these activities. Canadian figures are even more out of line.

The following paragraph based on a paper of R. Louis Bright and Hendrik D. Gideonse of the U.S.O.E. suggest that 2.2 per cent of total expenditure for education go for R & D.

"The costs of educational research and development have grown from the original 1.7 million appropriated in 1957 to the present level of approximately 200 million. This represents less than one-half of one per cent of the total amount expended for education by all phases of our society, a figure which is far under the standards for research and development investments in most major industries. Clearly additional growth can be interpolated. The authors of this paper propose additional major expenditure in research and development amounting to some billion dollars annually, which would represent the still modest figure of approximately 2.2 per cent of the total expenditure on education."[1]

The situation in Australia is somewhat similar to that in Canada. In the Annual Report of the ACER the President, T.L. Robertson writes: "Overall it seems doubtful if more than a half million pounds was spent on research in 1966-67, about 0.15 per cent of the total expenditure on education."[2] He points out the amounts that would accrue from ½, 1 and 2 per cent of the total spent on education and favours the larger amount as being necessary.[3]

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[1]The Current Scene, Part V, Research and Development Towards the Improvement of Education, The Journal of Experimental Education, vol. 37, No. 1, p. 134, Madison Wis.

[2]Thirty-Eighth Annual Report, Australian Council for Educational Research, Frederick St., Hawthorn, Victoria, 3122.

[3]The figure of 2 per cent for research was proposed by M. René Maheu, Director-General of Unesco at the Williamsburg Conference, U.S.A., October 1967.

Despite greatly increased grants made to the Scottish Council[4] recently, they report that "even so, expenditure on educational research in Britain at present constitutes only 0.1 per cent of other educational expenditure". This is compared with 2.0 per cent at present and a projected 4.0 per cent for Sweden.

CCRE estimate of about $9,000,000 on research and development in Canadian education last year [illegible] about $12,570,000 if you add such related activities as data collection, curriculum studies and education commissions. This represents 0.15 per cent and 0.2 per cent of current expenditure for education, or 0.18 per cent and 0.25 per cent respectively of gross expenditure if R & D is used. This is a rough estimate and at best is a crude index of our effort. It does, however, provide something of a yard stick, but it fails to suggest the sort of contributions that should be made at various levels to reach the desired amount. There is need to set out the amounts allocated by school boards, universities and their institutions for institutional and other R & D in education; amounts contributed by provincial governments; amounts coming from the Federal Government coffers; amounts from industry and foundations; and amounts from various associations. These would show a wide variation from province to province, in part corresponding to total personal income of that province. Investment in R & D is expensive but not a luxury. Because it is essential to progress, there is need for some degree of equalization.

The Federal Government will have to accept responsibility if there is to be equalization, since no other body can. This could be done without infringing on the provincial prerogative in formal education. In addition a Federal contribution could be in basic research, product research, in facilities, and in such segments of education as vocational-technical, post-secondary education, etc., or as grants to the provinces for allocation to accepted projects.

Canada needs a grant system for R & D whether operated centrally or within each province. This is necessary if major projects are to be undertaken, if efforts are to be concentrated adequately, and if Canadian contributions to world knowledge are to be worthy of recognition and recognized.

Complex large scale experiments, surveys or development projects are costly but no substitute will provide the answers. Society has agreed to large expenditures for research in the field of health, commercial products, atomic energy, agriculture, etc. and could be persuaded to commit itself for education. The development of a new automobile or a rocket engine is a very expensive undertaking even though the basic materials used are fairly constant.

Considering that business and industry generally spend from three to ten per cent of total outlay for R & D including the development and testing of new products, many examples could be given which can be compared with expenditure in education. For example, according to an advertisement in a popular illustrated magazine, for one American designed "little car" it "took over forty million dollars, three years and one million man hours to get it to this page". In addition "we created a multi-million dollar production assembly line from scratch just to produce it". The initial $40,000,000 is the equivalent of Canadian

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[4]Research in Education, the newsletter of the Scottish Council for Research in Education, No. 2, May 1969, p. 2.

expenditure on R & D in Education for 5 years at the 1969 level, and man hours, at the present rate we would be well into the third year. The cost of the multi-million dollar assembly line could provide for experimental classes and pilot projects sufficient to make considerable impact on the education scene. Do we want one more "little car" but not better education?

In the social sciences, where behaviour is highly unpredictable, the costs can be expected to be higher, but social pay-off is stupendously more important. Yet our commitments to research suggest that we are trying to get by with investing an amount equal to about one per cent of the costs of developing a new aeroplane. If we want millions of highly enlightened citizens as much as we want a new model of aeroplane that will cut a few hours from our travel time to Europe, then we should be prepared to pay for it and attract experts to come up with answers.

The 2.0 per cent for R & D recommended herein would provide an estimated total of $200,000,000 ($150,000,000 in constant dollars) by 1975 as compared with a predicted estimate of $40,000,000 by the CCRE secretariat. If we assume that there should be one researcher for each 200 teachers, or each school unit, plus staffs for other institutions, faculties of education and institutes, government and private industry, the 4500 full- and part-time researchers required would suggest an amount of $33,300 for each researcher to pay his salary, provide for equipment, supplies, publication, etc. This is perhaps an unrealistically conservative figure, but it must be added that even this could not happen overnight.

While the Federal Government would find it expedient to provide monies for R & D in such areas as will not infringe on provincial rights in education, or in accordance with an agreement reached with the provinces, the provincial governments are free to determine how much they will invest in research and development and settle on the best way to do this. Among current practices in the provinces is the making of amounts for R & D available to the university faculties of education and institutes, and grants to research associations. The Departments may set up research units in the departments either independently or in conjunction with units concerned with examinations and assessment, forecasting and planning, or other services. The Departments generally support basic and developmental research and may make grants to school districts to set up research units.

Business and industry is interested in a variety of such factors as the efficiency of school operation, the product of the schools, an increased use of the newer media in the schools, and services provided extra-murally. It can invest in R & D through: (1) endowing chairs in universities, (2) making grants in response to research proposals for specified projects, and (3) in grants to research councils for specified or general purposes.

School boards and educational institutions will more and more provide for R & D personnel in local research units to be concerned with institutional, that is, program and action developmental research projects.

Generally he who pays the piper calls the tune. Those who provide the money may decide on the research to be undertaken or at least to limit the areas for exploration whether they be government officials, foundations, industries or institutions. Some may identify the sort of projects they will support and want a say in popularizing the results from the projects undertaken. Where

this occurs, well conceived and well designed projects could be shelved because of lack of support, while poorly designed ones may be accepted because they are in a favoured field at the time. Concerted action by researchers should be directed towards the selection and fostering of important projects.

Providing adequate money for research endeavour raises many problems. It is one thing to say that the amount provided in Canada is one-tenth what we would recommend, but quite another to suggest that today we would use ten times as much sensibly and wisely. Certainly, researchers and developers should ask for more money, but they have a responsibility for suggesting how that money might be spent wisely and well. Some of this should be risk capital supporting discovery research projects; some should be for developing educational theory, but the larger part should be used in developmental research, a neglected area where qualified personnel are in short supply.

Limitations to conducting good R & D may result from shortages of qualified experienced researchers, in financial and other resources, and from those in charge lacking time and opportunity to formulate and design worthy projects. Again we are not talking about a single sort of approach but of several. The criteria for good basic research, whether it be discovery or knowledge based is different from developmental, since the latter is concerned with contributing to educational improvement. The methodology may be similar or different. If we should agree with certain opinions to the effect that the use of experimental plus control groups is not the best procedure, but that we devise methods of field testing in real situations in ways that provide results that can be generalized, then the degree of overlapping between research and development would probably be even greater.

Cost-Benefit Analysis and Evaluation

Economists are making an important contribution to the study of school systems. Although the state of their art neither has reached a well-developed methodology nor consistent theory as yet, nevertheless it already provides a useful functional approach. The problems attacked are difficult and some educators may question certain of the assumptions they use. Yet on the whole the approach should be encouraged.

To economists, for the purpose of evaluation, education is an "open" system that reacts to the environment and has inputs, process and outputs. Its purpose is the development of human capital -- the developed productive capabilities of human beings. To assess this, economists have developed analytic procedures which enable them to calculate costs and benefits and estimate rates of return for education similar to those provided in manufacture. They have found expenditure on education to be a profitable investment. Most of their efforts to date have related to costs and benefits of the systems on a national and provincial basis. Their findings are therefore not particularly relevant for local decision making. It may be that the economist and expert in education will have to work together on this.

For rigorous cost-benefit studies it is necessary to have: sound, comprehensive comparable historical information relating schooling to income; information on post-secondary academic and occupational careers of students; information about unit costs of various programs, changing prices of inputs, inequality in ability to pay, and other relevant factors. Some of the questions

that might be attacked are: emphasis to be placed on pre-school and early childhood education, the restructuring of teachers' roles using aides, newer media, team teaching, etc., change in administration to provide for planning. With the costs of education rising rapidly and expected to rise still higher as larger numbers enter higher education, the demand for increased efficiency will encourage more cost accounting. Accountability for money expended in terms of assessment that are valid and accepted provide a challenge to test makers and data systems.

Compared with business where entrepreneurs are concerned with sales, costs and profits, evaluation in education has settled for examination results, cost per student, taxes and impressions. Although examinations are expected to divide pupils into successful and unsuccessful and to provide percentages for each, there is little agreement on the percentage to be failed or how to relate success to competence. Nor is there agreement on a desirable relationship between schooling and business or social success. New measures for assessing output are most desirable.

The schools can probably benefit greatly from more systematic approaches designed to answer pertinent questions. They will find value in cost-benefit and cost-effectiveness analysis in the allocation of limited resources and giving of high or low priority to various programs. Cost-benefit analysis provides a means of setting out the resources used in a specific project in juxtaposition with dollar benefits likely to be derived. Cost-effectiveness analysis is aimed at measuring the extent to which resources will accomplish behavioural objectives when expended on several competing alternatives. Neither of these need be applied narrowly, but measuring attributes other than factual information, habits and learned abilities is a challenge to test makers and to educators.

CHAPTER VIII

A RATIOCINATIVE APPROACH IN SUMMING UP

From a slave taking over certain of the responsibilities in child-rearing from parents, education has become a vast, complex, multi-million dollar industry, increasingly absorbing higher percentages of the G.N.P. and performing an important role in preparing its citizenry to meet society's needs. Therefore a sound research and development policy and planning are necessary.

What goes on in the classes in colleges and schools and the sort of behaviour that results must continue as a primary concern of many educators. Others will be concerned with educating and training pre-school youngsters or with post-school adults in vocational, academic, social, industrial, leisure time, aesthetic and cultural courses and classes. R & D can be harnessed to ensure that the education and training provided is the best possible for each of these situations.

R & D can provide the key to educational advance as it has in business, industry, the sciences, etc., granting that each is unique and requires different approaches. Yet only indirectly does research suggest the way to go, or point to actual potholes, bogs and dead-end trails along the road. More often its purposes are to add to knowledge and theory, to find better ways of achieving the aims as determined by others, and to improve what is now being done.

The primary responsibility for coordinating research and initiating research programs is properly in the hands of those accountable for the education structure, although administrators may delegate segments of this at all levels. A Provincial Department of Education is the logical agency in Canada to provide leadership in the coordination of education facilities within its boundaries and to assist in providing for R & D endeavour which can help in doing a good job of basic and developmental research activity. But as basic research is not bounded by geographical boundaries its sheer cost and demands warrant not only Canada-wide but international cooperation.

The part of the Gross National Product going to research in education has been woefully inadequate, if education is to perform the functions many expect of it. This is a short-sighted policy we can ill afford.

1. Context for R & D

Formal education structures are creatures of society. Education today is to be conceived as a continuing life-long process. Formal education, generally more limited in scope, is given in highly structured institutions and consolidated under what is known as the "establishment". Its function is to complement informal education through providing those experiences and instilling those desirable habits, skills and ideals through experiences and situations that will not likely be met vicariously, but that lead to realistic goals.

Educators strive to help in the self-realization and well-being of individuals; the integrity, with improvement, of our social institutions; the advance of our economy and a more equitable distribution of our affluence, national security and international understanding. Changes in schooling must keep pace with the demands of a new society and the needs of changing individuals in that society. Education should aim to produce rational, responsible, moral and effective

citizens. Its concern is being extended to the deprived, economically depressed, culturally, mentally, emotionally and physically handicapped. It should constantly aim to be more exciting, imaginative and relevant, yet at the same time more demanding and with higher expectations.

Informal education, or education outside the regular system, is growing, as is the demand for it. It can be vocational, academic or cultural. It too is concerned with the cultivation of the intellectual powers and the moral aesthetic and spiritual sensibilities of its citizenry whether at nursery school, in society at large, or in the factory.

A new role for education in our disturbed society must be determined with consideration of social unrest by minorities, needs of society and of the individual, yet with awareness of a burgeoning technology, swelling population, increasing pollution, and a changing social climate.

Unesco has pointed out that educators must become interested in the biosphere. Men must make peace with the universe, adapt and effect changes in it but not destroy it. Their concern extends to the societal super-structure which they have achieved and whichis now being questioned to a great extent by idealists and anarchists.

2. Aims for R & D

We should strive to achieve a balanced program of R & D essentially aimed at improvement in education. This necessitates both long and short term objectives; research and development endeavour, suitable emphasis on the several types of research, provision for dissemination, etc. Each task is not done until a good solution has been found and tested for an important problem, or until the research findings are institutionalized.

We should aim for an effective program. It is suggested that 20 per cent for basic and 80 per cent for developmental research to an amount equal to 2 per cent of the total expenditure on education should produce rewarding results. In the beginning perhaps 50 per cent of R & D should be undertaken in the university and institutes and 50 per cent outside.

3. Organization of R & D

Educational R & D has sometimes been characterized as fragmented, disjointed, largely university-based, part-time and casual. It has been largely theory-oriented in the psycho-statistical tradition with experimental emphasis and with inadequate funding. Minor threats for a takeover by economists, systems engineers, and to a lesser degree sociologists may be a good thing in moderation. Many problems require a multi-disciplinary approach and each of these disciplines can add to our body of knowledge.

Professional researchers are concerned with disciplined, systematic investigation conducted in such ways as to ensure that the hypothesis is strong and warrants pursuing, that the instruments are reliable and valid, that the proposed statistical measures are appropriate and adequate for the problem; that the inferences drawn are logical, after having considered sampling deficiencies; and that the relevant variables have been included in those measured or controlled.

Developers are concerned with determining what is useful and productive; with accelerating the implementation of proven ideas; with the development of new products; with what can be recommended in various situations; and with practical applications of what has been discovered experimentally. They believe that all innovations should be tested and evaluated.

Certain identified problems appear to be related to the need for strategies designed to: (1) overcome conservatism and generally opposition to change in the schools; (2) ensure professional staff of high competency; (3) utilize modern media, harness technology and test innovations before and after implementation; (4) increase the number of experimental schools and classes and pilot projects; and (5) provide for a continuous assessment of the product of the schools.

Current R & D lacks both good organization and direction. Decisions concerning this should be made by researchers and developers, but only after consultation with interested parties. There can be a reasonably clear separation of speculative and practical research -- a desirable distinction for purposes of theory and application. For many purposes it is expedient to subdivide research into basic, applied, field induced, institutional, product and service. The development function will include diffusion, dissemination, implementation and adoption, in addition to developing products, programmes, curricula and assessment tools.

The establishment and proper development of School Research Units could be the answer to speeding up and controlling change.

There is need for demonstration centres, experimental schools and classes. All schools can be somewhat experimental, seeking improvement, but radically new programs should be tested out as pilot projects.

4. Inadequate Money for R & D in Education

Canada is spending 0.18 per cent of her total educational operation on R & D. This is about one-tenth of the figure recommended. Expenditure by province is uneven; only one province comes anywhere near what is recommended. About 82 per cent was reported by institutes and university faculties, 11 per cent by school boards, 3 per cent by government departments, and 4 per cent by other sources. About 55 per cent of this goes for salaries.

Grant sources and structures for educational research and education are at present limited and hopelessly inadequate. Something needs to be done in this area and quickly.

5. Training of Researchers

Canada could use 4500 or more with advanced degrees, with masters' or doctorates in education, in undertaking research or development within a decade. Many of these would be part-time researchers, part-time instructors, etc. Lack of R & D personnel can be a bottleneck to progress in education.

The present establishment could not graduate anywhere near 500 a year. There is need for more and better programs to train researchers and developers and a much larger establishment (faculties and institutes) to do this. Canada should not count too heavily on recruiting R & D personnel from other countries nor even from other faculties. Those entering education from outside could benefit from orientation programs. There is need for programs to upgrade and update research personnel. Pilot or experimental efforts to determine how best to do this seem most desirable.

6. Models

There is need for considerable work on a theory for research and development. The gaps between invention and implementation, theory and practice, and producer and consumer of research should be bridged. This suggests a systematic approach to remove bottlenecks and to improve coordination.

Canada probably needs a variety of models such as the following: 1. An overall general model showing types of research and development needed; suggestions as to the bodies who can best do this and lines of communication; 2. A provincial model showing greater detail of research areas, producers of research, etc.; 3. In addition, each institution, faculty of education, etc. should produce a diagram indicating aims, processes and expected output; 4. There is great need for a suitable model for an R & D centre in a school system showing how the unit fits into administration, its relationship to teachers, students, etc., as well as for university and college institutional research.

Communication

Most Canadian journals publishing research reports were designed independently and before modern technology provided possible alternatives. They are doing a commendable job but there are gaps. Opinions differ as to what is needed but many researchers have suggested that there is need for a national authoritative journal with emphasis on basic research and valid surveys. There is also need for a popular but scholarly national journal with appeal to professionals and intelligent laymen. No one as yet has determined the best coverage for developmental research apart from a new magazine by OISE, Orbit, and an important share in the following:

A ready access communication system for selection, storage, retrieval and dissemination of research findings. The information most often asked for is: (1) research findings; (2) research in process; and (3) innovations implemented in schools with some idea of success and failure. The first is wanted most often by other researchers, administrators, teachers, etc., the second by other researchers, and the third by practitioners in the field.

The Role of Researchers

To researchers change must be accepted as normal and desirable, but they may well be concerned about keeping it within manageable bounds and determining its direction. They favour systematic procedures not only for research but for dissemination, demonstration, dispersion and implementation. They wish to reduce the time lag between discovery and implementation and hope changes will be made on the best evidence available.

They recognize their limited role and limitations. They are not decision-makers, can only undertake limited projects which are time-consuming and expensive, though not nearly as expensive as false moves on a grand scale.

They are jealous of their privilege and responsibility to undertake authoritative research and are disturbed when pseudo-research reports are published hurting their good name and education. Nonetheless nothing that is said here would preclude anyone from conducting formal or informal assessment of their work to see whether or not there was improvement, whether the results were due to novelty, the Hawthorne effect, personal bias or enthusiasm, selection of subjects or some other bias, or just an honest attempt to do something better in a unique situation. The reason for success is not too important if your concern is with results, so long as such success or failure is not treated as a pronouncement for all occasions, at all times, and with missionary zeal directed at potential converts.

Or again nothing should preclude competent individuals from conducting studies or investigations, whether philosophical, experimental or descriptive, within their competence, so long as their approach is professional and does not violate personal integrity.

Our concern is with the search after truth, our fear the abuse of tools and techniques. Men of goodwill in education should be able to agree on the proper role for R & D which must not only stand up pragmatically, but must meet with general acceptance if it is to make its optimum contribution.

Some Other Relevant Books and Reports

1. Brehaut, W. "A Quarter Century of Educational Research in Canada", Ed.D. Thesis, University of Toronto, 1958, Mimeo. Information Series No. 10, Toronto, Ontario College of Education.

2. Buswell, Guy T. and McConnell, T.R., Training for Educational Research, The Centre for Research and Development in Higher Education, 150 pp., 1966. 4606 Tolman Hall, University of California, Berkeley.

3. Crombach, Lee J. and Suppes, Patrick, editors. Research for Tomorrow's Schools - Disciplined Inquiry for Education, Colliers-Macmillan, 1969, 281 pp

4. Educational Research, Phi Delta Kappa Symposia on Educational Research, Annual Reviews beginning 1960. Phi Delta Kappa, Elizabeth and Union, Bloomington, Illinois.

5. Edwards, R. The Training of Educational Researchers. Paper presented to the British Psychological Society, Cambridge, 1967.

   Edwards, R. Educational Research and the Training of Researchers, Canadian Education and Research Digest, December 1968.

6. Guba, Egon G., Ed. Methodology, Its Impact on Learning. Theory into Practice. Vol. 5, No. 2, April 1966. College of Education, Ohio State University, Columbus, Ohio.

7. Jackson, R.W.B., Educational Research in Canada, Today and Tomorrow, Gage, Toronto, 145 pp.

8. Joly, J.-M., Research and Innovation: Two Solitudes?, Canadian Education and Research Digest, September 1967.

9. Lazarfeld, Paul F., and Sieber, Sam P., Organizing Educational Research, Prentice Hall, Englewood Cliffs, 1964, 113 pp.

10. Sieber, Sam P., and Cole, Jonathan R., The Organization of Educational Research, Project Memorandum No. 7. Bureau of Applied Social Research, Columbia University, 1965.

11. Symonds, P.M., "The Organization of Educational Research in the United States", Harvard Educational Review 1957.

12. CCRE Reports and publications, 265 Elgin Street, Ottawa 4:

    (a) Cheong, George S.C., Research into Research - A Review of the Theory of Education, 17 pp., 50¢, 1969.

    (b) Whitworth, F.E., The Road Ahead in R & D in Education, 1967.

    (c) Whitworth, F.E., Check and Double Check in Education, 1967.

    (d) Whitworth, F.E., Priorities for R & D in Provincial Education, 1968.

(e) Whitworth, F.E., On Organizing R & D in Education, 136 pp., 1968, $1.00.

(f) Reports of Canadian Conferences on Educational Research. Papers by R.A. Dershimer, F.G. Robinson, F.E. Whitworth, David L. Clark, D.E. Berlyne, W.M. Illing, R.B. Gwilliam and others in 1966 Report; by H.D. Gideonse in 1968 Report; Francis S. Chase in 1969 Report; and others.