Lower Secondary Integrated Science Curriculum Innovation in the Caribbean: A Personal Perspective

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Especially with science teachers in mind, this article suggests the need for a clear concept of current science education, and puts forward a philosophy of a curriculum. In the belief that teachers must evaluate the curriculum they follow, there is an attempt to provide a knowledge of the origins of the lower secondary curricula. The account of curriculum activity in individual countries and in the region since 1966 is evaluative. Finally, the article questions not only the classic model of curriculum development but also the value of such activity. Attention to the development of teachers and the dissemination of research is thought to be more rewarding.

Introduction

Science curriculum reform in the Caribbean began with the lower secondary level in the middle 60s, expanded to energetic activity at that level in the first half of the 70s, and then shifted to the primary and upper secondary levels. It was almost as if a definitive and final lower secondary model had been created. The curriculum development projects of those days were invested with enough status to make many teachers, even today, believe that they have been absolved of decision-making responsibility. It is important that teachers should evaluate the resources with which they have been left; a knowledge of the history of those resources is required.

The big projects of the early years, all international ones, followed a classic formula of the time--headquarters development, trialling, workshops, feedback, publicity and diffusion. King (1985a) reflects these in his commentary and diagrams. Except for the Caribbean Examinations Council (CXC) strategy (a success story if there ever was one), national attempts at curriculum reform have also followed that classic formula. This paper suggests that the time has come to reconsider the wisdom of adopting that model in future movements towards curriculum renewal.
Lower secondary science in the Caribbean is now almost always called *integrated science*. A difficulty is that a concept of integrated science is a complex one; one which grows slowly, and communication gaps can arise. A teacher wishing to teach an up-to-date science curriculum may be at cross purposes with educationists if his basic concept is different from theirs. Educationists distinguish between *integrated* science and *general* science.

**General Science**

General science is a term used for a type of course once common but no longer acceptable. As a course of study, it was conceived in the early decades of the 20th century. It was intended to give a taste of biology, chemistry and physics\(^1\) to slow learners or young children who were not expected to be able to handle a more rigorous treatment of the *pure* sciences\(^2\). Little or no attention was paid to the nature of science "as a product of man's mind [representing] man's best efforts to formalize and organize his knowledge of the world around him." (Trowbridge, 1976, p. 31). In education, science was not yet seen as a discipline or form of thought with a unique set of characteristics. Memorization and verification exercises characterized the aims and methods of general science.

General science has commonly not been given equal rights with other components of the school curriculum. Even the most recent entrants to the teaching profession should be able to recognize the areas of neglect outlined below:

* The least experienced and least qualified teachers were normally assigned to general science with the lower forms. Unfortunate results included failure to provide a scientific education, failure to cater for the ways of learning of those children, and failure to provide even a minimal science background for those to whom this *science* was terminal.

* If the teacher had any science qualifications at all, they were likely to be in the life sciences, if not zoology. Not surprisingly, most of these teachers did not in fact teach a balanced curriculum.
Laboratories were sometimes treated as the private preserve of examination forms, whether or not for practical work. While the Form 5 teacher was having a theory lesson in the laboratory, the Form 1 teacher was at best *showing* in the classroom.

Instead of the provision of a spiral curriculum, preparation for O level/CXC began at Form 4 (Grade 10). Those first three secondary years were not considered relevant, so that anything would do for them.

I have referred to these problems in the past tense, because they antedate much of the dialogue in education in the Caribbean and almost all of the dialogue in science education. They were not (are not) peculiar to the Caribbean. But these mistakes are still being made. Violence is still being done to the learning needs of young secondary school children; to the integrity of science as a discipline, and to novice teachers who are expected to induct children into the discipline.

**Unifying Science**

Although the curriculum reforms of the 50s and early 60s in a number of countries began with physics and then chemistry and biology, it was not long before educators perceived a need to achieve a measure of unification, at least for some segments of the school population. One of the earliest programmes was in Britain, where the Nuffield Science Project took in Combined Science for the first two secondary years. This was followed by Nuffield Secondary Science, addressed to lower achievers of the next three years. At the same time, in the USA, a variety of innovative courses was developed, an early one of which was Integrated Science Curriculum Study (ISCS) in Florida. World wide curricula have been documented in the International Clearinghouse reports, the last being Lockard (1977).

*Integrated science* is a term that came into general usage after the Congress on the Integration of Science Teaching held in Varna, Bulgaria in 1968. This was not just a new term for what had been known as general science—it was a new concept of what was needed in a science curriculum. Those at Varna discussed the need to bring *school science education* closer
to *science* as it actually is. The emphasis was on the philosophy and sociology of science (though perhaps there should have been more attention to the psychology of science education). Still useful today are the aims identified by Layton (1972), which lie at the core of my beliefs about an appropriate science curriculum (however classified), and which may be summarized as follows:

1. **Science as a body of knowledge:** I see this as including, not only the facts and concepts, but also the humanistic aspect—a need to convey the body of knowledge, tentative still, as a marvelous achievement of mankind.

2. **Science as a way of working:** Process skills are clearly involved here, but they are only part of the scenario. Depending on their levels of maturity, children also need to develop appropriate *attitudes* in science, for example, curiosity and respect for evidence. Inquiry and problem-solving opportunities are required, as well as deliberate teaching which makes children aware of their progress towards acquiring scientific skills and attitudes. Perhaps science teachers would find it easier to reflect science in the classroom if they were conscious that scientific approaches to exploring the world are themselves a creation of humanity, begun only some 400 years ago.

3. **Science in its social context:** For younger children, the emphasis would be science in the home and in the neighbourhood. As the children mature, one would expect the curriculum to attend to wider issues of technology and society, together with certain skills and attitudes for life (for example, a critical approach as consumers and citizens). What other school subject, even social studies, is so well suited to such goals? It hardly needs to be said that the careers of future scientists and technologists would benefit as well from this kind of preparation in school.

We can see at once that such a curriculum would demand the most insightful and confident teachers.
The term *integrated science* was not a particularly happy choice, giving a misleading impression that sciences (biology + chemistry + physics) are mixed (allied?) together. Admittedly, the term was useful, at least in the early years, in leading to some rationalization of *content* in the curricula which were subsequently developed. For example, *Gases of the Atmosphere* was seen as an integrating topic which would bring the chemistry of oxygen and carbon dioxide together with photosynthesis and respiration. However, the term was unhelpful in communicating a fundamental philosophy. A more holistic concept might have spread throughout the profession if Showalter's (e.g., 1978) term *unified science* had been used. Others prefer the simple term *science*, in the sense of a singular study\(^3\).

We have seen, then, that integrated science was intended to be almost diametrically opposite to general science, but that today, over twenty years after Varna, progress has often been insignificant. To reiterate: A major causal factor may have been a difficulty in grasping the different concepts.

However, it would be misleading to treat *integrated science* as a linear concept, one which grows longitudinally. While most science education specialist have few problems in communicating with one another, there have been a number of variations on a basic idea. Blum (1973) and Brown (1977) each attempted to classify various conceptions of integrated science in the first decade of the innovations. Somewhat later, Haggis and Adey (1978) reviewed trends and the diversity of curricula, worldwide as far as was possible, and uncovered a great variety of interpretations and applications.

Nevertheless, the trends which Haggis and Adey claim to have detected would all be consistent with a shift away from general science and towards the ideals of the innovators of integrated science. We in the Caribbean would easily be able to identify pockets of educational activity which conform to each of the trends listed in that paper. What must remain a matter for concern is that there are still so many of our teachers and other decision-makers who are lagging behind those trends. While conceding a value judgement, my thesis is that they are without up-to-date concepts of the aims and nature of the science curriculum.
Leaders of Innovation in the Caribbean

I risk an axiom by observing that a curriculum in science, like any other, should be created by indigenes of the society in which the innovations are to take place. In the foregoing section, I discussed the problems faced by teachers and administrators in implementing integrated science. Twenty years ago, there was another problem as well—the lack of Caribbean science educators in a position to lead the innovations which were necessary. Outside the schools, there was virtually no one with specialized knowledge about science education. Most school teachers themselves had not learnt of the brainstorming which had taken place on an international scale, though science teachers’ associations in Jamaica, Barbados and Guyana were doing splendid work in keeping science teaching refreshed. By the end of the 60s, the only science education officers in Ministries of Education were two in Jamaica, one in Barbados and eventually one in Trinidad and Tobago. Those in Guyana were not appointed until about 1975.

The situation was no better at the universities. While there was a flurry of internationally-funded projects from 1968 to 1975, the only established science educator by 1970 was at the University of Guyana. At UWI, Mona, the mathematics education specialist was obliged to field pressing science education problems, while at UWI, Cave Hill and UWI, St. Augustine, no posts were established until 1973.

Accordingly, the first integrated science innovations (say from 1968 to 1975) were necessarily led by expatriates recruited for short-term projects. Those recruited had, where possible, reasonable teaching experience in the Caribbean, or at least the Third World, and it was policy to involve local counterparts. Being short-term, the projects always faced a sense of urgency, and there was no time for formative evaluation, research, and the development of a feel for the region. The emphasis was on the speed of production of curriculum materials and their dissemination. The projects initiated as the 60s drew into the 70s were the following:

- **West Indies Science Curriculum Innovation Project (WISCIIP)** in Trinidad and Tobago.
- **Jamaica Science Education Project.**
- **UWI/Unesco/UNICEF/UNDP Teacher Training Project RLA142.**
UWI/CEDO Caribbean Regional Science Project (CRSP)⁴.

All of these projects centred around the primary/secondary interface, for reasons which will be explained later. The curricula they developed, like most of those developed in the Commonwealth about the same time, were largely reflections of the Nuffield Projects which had developed curricula in the 60s in Britain, from whence many of the project personnel had come⁵. As long as the lower levels of schooling were supposed to be primarily a preparation for GCE, the Nuffield slant was acceptable, for GCE itself was incorporating ideas from Nuffield as time went on.

From about 1975, however, the regional enterprise, the Caribbean Examinations Council (CXC), provided exciting new opportunities for influence to come from the West Indian science educators who were now in place in universities and Ministries of Education, as well as for a limited number of teachers. The development of the CXC Integrated Science syllabus (General Proficiency, Double Award) used a small number of these educators. The first syllabus reflected the panellists’ view that teachers were not ready for a guide to the examination which was organized in an unfamiliar way (even if most of the content was not new). Accordingly, the syllabus was divided into sections which could be readily matched with pure science syllabuses. However, in 1983 there was a radical restructuring of the syllabus, leading to a much more integrated statement (Caribbean Examinations Council, 1983a).

Meanwhile, the Examining Committee has always found ways of weaving the sections together to some extent as far as content goes; and there can be no doubt that the examination papers have reflected Layton’s aims for science education outlined earlier in this paper (e.g., CXC, 1983b).

The number of educators involved with CXC Integrated Science (Double Award) has never been large for several reasons, one of which has been the existence of well-known negative attitudes to integration. However, the introduction of five new CXC science examinations in 1985 and 1986 saw a substantial increase in the number of Caribbean science educators who had to make decisions in innovative situations in science education. As well as the leaders who developed the syllabuses and the examinations, there were also the Examiners and Assistant Examiners (mostly teachers) who were inducted, under circumstances which at last spoke
loudly and clearly to them, into trends in science education. Although only two of these five new examinations were in integrated science, the marking experience from all of them seems to have sent back to the classrooms many teachers who suddenly had much more understanding of what science education could be, and who had become much more enthusiastic about their profession. Hopefully, many of these disseminated their enhanced insights to the lower secondary levels which are the subject of this paper.

The Innovations at the Lower Secondary Level

The Setting

Perhaps the first attempt at innovation was one undertaken at UWI, Mona (published as a series of textbooks by Bishop, 1966). This was a fairly integrated approach which included some elementary earth science and space science as well as thumbnail sketches of famous scientists. Almost the entire text required children to find answers to questions, nearly always by practical activities. Apparatus and materials could be easily found. As an approach to learning science at the lower secondary level, it was in advance of general practice even today, more than twenty years after publication.

Although the series was adopted for the Jamaican junior secondary schools which opened a few years later, its impact was minimal. The teachers of the time wanted readers and found that their perceived needs were not being met. As well, it seems that none of the strategies for encouraging implementation, described in Reay (1976), were used, and the attempt at innovation might be seen as a visionary dream. It was to be followed by other disappointments.

It was in 1968 that generalized curriculum innovation in the Caribbean took off. Plans were laid at that time for considerable expansion of educational opportunity across the region. A new type of secondary school emerged. Whether (depending on the country and the date) they were called junior secondary schools, new schools or multilateral schools, these new schools tended to admit children who had not succeeded in gaining entrance to the selective grammar schools which were entrenched as exemplars of schooling. The new schools were expensively equipped by the prevailing standards, though many mistakes were made in the
design of the laboratories and the choice of science equipment. Consultative and financial aid were provided by several international agencies.

The grand design, then, was educational innovation; curricular innovation was inevitably a component. We may identify three factors which influenced the nature of the curricula developed in the early years:

1. The existence of international consultants (remember that 1968 was also the year of Varna Congress, and was soon after the publication of the first Nuffield projects in Britain).

2. More secondary places would require more secondary teachers. Most of these would have to be found at once from the body of non-specialists trained for primary schools\(^7\). It was believed by the curriculum teams that such teachers would need very specific guides, a view also held by the teachers. The fact that few, if any, teachers are known to have followed the guides closely casts doubts on the validity of this assumption.

3. Here was an opportunity to break the tradition of a secondary curriculum dominated throughout by the syllabuses of the GCE examining boards\(^8\).

Some may argue that there was a fourth factor: An awareness that the needs of the new secondary school population would be different from those of children in the highly selective schools. I would dispute this. The decision-makers of those days had almost no idea of the breadth of the spectrum from the top 20% (as they have since been quantified) who were the GCE achievers. Certainly, the region was without relevant educational research and very little was known about the children and about the cognitive demands of Nuffield-type curricula. (Nuffield, too, had been developed by educators whose experience was largely limited to the high achievers in English independent schools).
Early National Initiatives

Science curricular reform movements arose almost simultaneously in Jamaica, Trinidad and Tobago, and Barbados. In Jamaica, a committee established by the Ministry of Education developed a general science syllabus (including earth science and space science). This was soon afterwards used as the basis of the MONA integrated science curriculum developed by the UWI Science Education Project (part of this being published by Reay and Turner, 1975 and 1976). Like Bishop’s, published some ten years earlier, the curriculum emphasized inquiry and practical work. In this case, however, the Project tested the materials during its short life, and employed dissemination and implementation strategies. For various reasons, its influence never became widespread.

In Trinidad and Tobago, the Fifteen Year Education Plan 1968-1983 was published (Trinidad and Tobago. Government, 1968). In spite of the very wide implications of this plan, only one curriculum project was set up—a science project. This became known as the West Indies Science Curriculum Innovation Project (WISCIP), a joint enterprise of the University of the West Indies and the Ministry of Education. Williams (1973) outlined the problems he faced in persuading the Ministry to release even one local science educator (from a school of course, since there were none at the Ministry) to work with him. Another school teacher helped to develop some units, and some inputs on tree drawings and astronomy were solicited from relevant experts locally. In his report, Williams describes how he consulted the local teachers of the time, that is, the teachers of the selective secondary schools, and how they chose from the options he provided.

The eventual decision was that WISCIP would be an adaptation of what was at that time called Scottish Integrated Science (SIS). It should be noted, however, that SIS itself was at an early stage of development, and all that was available to WISCIP was a short policy paper (Scottish Education Department, 1969). Therefore the WISCIP team wrote all the detail themselves, and it could be misleading to describe the resulting curriculum as an adaptation.

WISCIP’s influence was to spread, not only throughout the Caribbean, but also to Botswana, Lesotho and Swaziland, where the materials
developed in the Caribbean underwent further adaptation. (The same international funding agency was behind WISCIP, Boleswa and other adaptations of SIS, such as the Malaysian one.)

WISCIP tested the first draft in some of the high schools, and for years after his contract ended Williams supplied evaluation tests and computer programmes for analysis. But almost none of this feedback was ever used. There was barely enough time to put the original stencils back on the duplicating machines for the Ministry’s crash courses for primary teachers, and for the adoption of what became the official curriculum in Trinidad and Tobago’s junior secondary schools for the next fifteen years. The Ministry’s textbook decisions were also unfortunate, and never helped teachers to understand the integration of science and the need for a local context.

As in Jamaica, the Barbados Ministry of Education set up a committee to review the science curriculum. The decision here was not to start from scratch, as Jamaica had done, but to adapt WISCIP to WISCIP/B as it came off the duplicating machine in Trinidad. As a national venture, this did not last very long, for the regional project outlined below came into being and happened to be based at the University in Barbados. However, the Barbados Ministry did develop a television series in the early years.

**Developments in the 70s**

In an attempt to meet the needs of the wider Caribbean, UWI/CREDO established the Caribbean Regional Science Project (CRSP) in 1970. CRSP was led by a person who, as a teacher, had been a member of the Barbados Ministry committee. He decided to continue with WISCIP/B as a first trial version, revising to WISCIP/C for a second trial, and then editing and publishing as the West Indies Science Curriculum (WISC), a set of three teachers’ guides (Adey and Lancaster, 1975-1976). Some 15 countries participated in this project, from Guyana to the Turks and Caicos but excluding Trinidad and Tobago, which was satisfied with WISCIP. By now, Scottish Integrated Science had published its worksheets, and a British publisher had brought out a parallel series of textbooks matched to SIS. Both of these were distributed to trial schools. The senior (part-time) consultant to CRSP was a co-developer of SIS and an author of the textbooks, so that it is not surprising that the flavour of SIS became more apparent in CRSP than in WISCIP.
CRSP was an ambitious project, and much attention was paid to dissemination strategies, including teacher re-orientation workshops and consultation with Ministries of Education. Science educators across the region shared in the waves of rewriting workshops which took place every year.

The project was evaluated, and there was also a comparative evaluation with the MONA Project. These evaluations are discussed by Reay (1977). The evaluations disobeyed a cardinal rule of summative evaluation—that it should be carried out by an independent agent (e.g., Bajah, 1979).

And once again a three-year project had been set up to develop a three-year curriculum. Any Third World educationist would respond wryly to the procedures in Florida described by Gadsden, Becht and Dawson (1979)—for example, four years there to develop a two-year programme, even without the problem of developing and diffusing it in 15 different Caribbean countries separated by sea! In retrospect, it seems that there was profound naivety among all who participated in the projects, beginning with the administrators who conceived them.

Anyway, all projects were completed. WISCIP became the official curriculum in Trinidad and Tobago; WISC became the official curriculum in Barbados and perhaps some other countries. It is difficult, though, to claim that real implementation followed. Even if any teachers reflected the basic philosophy, after three years the second-year programme was completed in few, if any, schools.

Jamaica rejected the short-term project approach to curriculum innovation. The Curriculum Development Thrust which was set up in the mid-70s took the view that curriculum development would be a long-term and continuous process. This meant that there were no plans for final publication of the materials; instead, guides for teachers and pupils would be typed on stencils and replaced from time to time. The guides, developed by members of the Association of Science Teachers of Jamaica at workshops funded by the Ministry of Education, were addressed to all types of schools. Again in retrospect, we can detect a different kind of naivety. While the New Secondary Schools did use the materials until the supply of stencilled Workbooks dried up due to budget cuts, the All Age Schools found the work difficult and the High Schools ignored the
materials, preferring to design their own programmes or, more usually, to be guided by a published textbook selected by the school.

In the 70s there were several other projects, national ones, addressed to the interface between primary and secondary schools. At that time, children who had not succeeded in securing entrance to any secondary schools were admitted to what were called post-primary classes in All-Age Schools or Intermediate Schools. The needs of these children were a subject of concern in some countries. A project in Guyana has already been mentioned. In Jamaica, another short-term project funded by the Organization of American States (OAS) provided kits of equipment, and many schools which had not previously taught science began to do so. In Belize, the Rural Education and Agriculture Programme (REAP), addressed to children at the primary/secondary interface, integrates beyond science into other areas of the curriculum and is obviously motivated by Layton’s third aim. However, a detailed account of curriculum development for this population is beyond the scope of this paper.

For similar reasons, the project RLA142 can receive only a mention here. A Teacher Training Project, this joint project between the regional university and United Nations agencies was designed to meet the needs of student teachers in the region being prepared to teach the 10-12 year old population, at the primary/secondary interface. Where other projects had attempted innovations in curricula which children were to encounter, using classic curriculum development procedures, RLA142 used an innovative formula for the curriculum development process itself. Naming its strategy The Unit Package Approach (Ibstedt, 1974), this teacher training project was committed to a self-instructional strategy for reforming teacher training and classroom practice at a single stroke. In workshops designed to re-educate them, teacher educators were provided with a package (TEU) which, inter alia, required them to develop a student teacher package (STU). And this STU package, as well as providing the content needed by the student teacher, required him to develop a pupil curriculum unit (PCU). This approach appears to have been highly programmed. STUs were prepared by teachers’ college tutors in workshops around the Caribbean (though, again, not in Trinidad and Tobago). At the close of the project in 1975, UWI was supposed to continue to supply printed materials in exchange for presses supplied at
Mona and St. Augustine. For some reason (lack of co-ordination perhaps) this did not happen and the supply of STUs dried up. In Jamaica, the science units were reprinted privately. The project never received an independent summative evaluation; and colleges probably now have few teacher educators who went through the TEU workshops. The Unit Package Approach is almost certainly now only a part of history.

The international projects for lower secondary level ended in 1975-1976. By then, attention was turning to the needs of primary schools: to a pilot project in integrated science for CXC, and, in Jamaica, to the needs of Grades 9 and 10 children who would not be candidates for external examinations.

For the most part, very little has been heard of further systematic attention to the needs of the lower secondary curriculum in any Caribbean country. It is likely, then, that at this level there is at least a ten-year lag in trends.

Retrospect and Prospect

We have seen that the curricula developed in the 70s filled a need of the time and were in tune with similar developments throughout the Commonwealth. If developed today, however, they would be at once judged to be out of touch with current perspectives in science education and in Caribbean education. The time has come for them to take their rightful place in the archives. Teachers have to understand this.

These curricula have become extinct. It is well known that once a curriculum is developed for implementation on a reasonable scale, commercial publishers move in. These firms hand-pick individuals as authors of textbooks as resources for children to complement the teachers' guides published by the projects; the teachers then abandon the guides. Although no textbooks were produced for WISCIP, WISC gave rise to several series, one of which soon became the determinant of lower secondary science curriculum throughout the Caribbean.

While it is true that these series were structured after the WISC teachers' guides, they cannot accurately be described as WISC. In some ways, they
are an advance on WISC, containing as they do the authors’ attempts to match the content to some of the experience of Caribbean children. But they lack something important: The professional message to teachers. What remains a source of frustration to curriculum developers and educationists is the persistence of teachers in using a reader for children as practically their only curriculum guide. King (1985b) has drawn attention to the relationship between teachers’ perceptions of aims and the ways in which they implement a curriculum. Though explicit in teachers’ guides, statements of aims are not usually given in school textbooks from British publishers. Therefore, while the science facts may still be more or less reflected in Caribbean classrooms, the flavour of the curriculum as conceived by the developers has been eroded. Each teacher’s interpretation of the reader becomes the curriculum as implemented.

In an article written interestingly enough by a major figure behind much Third World science curriculum development, Chisman (1987) comments on the profound influence of Britain and America. He criticizes the developed world view brought by western experts ignorant of the cultural environment of the pupils, and the assumption of complete transferability in content and methods. From his wide experience, he says, "to step into a school science lesson anywhere in the world is to move into an atmosphere of cultural neutrality". Although for CXC level classes this is less true now, I doubt that anyone would dispute Chisman’s statement in terms of most lower secondary classrooms in the Caribbean. That is the major concern of researchers, teachers, educators and insightful teachers in the region; we have somehow to find radically new strategies to help teachers share our critical approach to their aims and our confidence in their autonomy.

Towards that end, teachers need to be aware of the context of their curriculum in terms of its background and of their own influence on its implementation. While many will not admit it, Caribbean teachers are highly autonomous in their own classrooms. Although they may be required to keep within a broad content framework, the details of the content and all aspects of the approaches are left in their own hands. They are expected to make their own decisions and must therefore accept responsibility for interpreting and evaluating the resources they have at hand. They must recognize that they cannot shelve the responsibility by
claiming that they are following an officially approved curriculum. They are not.

Curriculum developers, too, must continue their search for a functional approach to curriculum development, beyond the classic model of the 60s and 70s. There is no evidence that I know of, in the Caribbean or elsewhere, that a curriculum developed from a centre has been successfully implemented on a large scale over a reasonable period of time. This is no surprise when one considers the variety of influences identified by King (1985b), most especially those at the local level. Although it is usually remembered that the teacher plays a key role, one has an uneasy feeling that curriculum developers have viewed the teacher as a servant of the curriculum, rather than in terms of his wide decision-making needs and powers.

We need a dynamic model, one which is designed to be adaptable to the most local of circumstances and also one which responds to change. In the Caribbean experience, only ten years will produce significant changes in knowledge from research and on-going evaluation, social circumstances and perceptions about emphases in science education, opportunities for teacher re-orientation, economic circumstances, and a variety of other influences on implementation. Our model must also recognize the mobility of the teachers, especially in particular Caribbean countries, as well as the constraints which arise from the realities of problems in Ministries of Education, and what seems to be an inflexible and practically universal determination of teachers to base their curriculum on a children’s reader.

So dynamic must be our model that it seems inconceivable that we can continue to speak of a curriculum, which implies a blueprint. Development of the blueprint demands huge investments of time, expertise and money. It is an investment which gives satisfaction and personal growth to members of the development team; however, its impact is likely to be negligible in the long term. There are too many countervailing influences.

A final criticism of the classic curriculum development model is based on its requirement for summative evaluation. Surely this implies that the curriculum is to be a static one. The reality is that even before the
evaluation has been completed, a mutation of the curriculum is already under way in classrooms, so that the evaluation becomes of historical interest only.

King (1985b) cites Connelly's thesis that efforts made to secure successful implementation would be better directed at re-educating teachers. And I say amen! We must be cautious, however, about the claim that this can be best achieved by involving teachers in curriculum development teams (a strategy used by RLA142, the Jamaican Curriculum Development Thrust and most primary projects in the countries of the region). I concede a profound impact on the limited number of teachers who can be involved; but question whether the effect is widespread enough to justify the expenditure of time and expertise (including editing at headquarters).

Indeed, I am not convinced that curriculum development is a fruitful activity for universities and Ministries of Education at all. More rewarding have been attempts to develop a large body of insightful and creative teachers through professional training programmes and outreach activities. Associations for science education have an important role, but a formula has yet to be found to keep them flourishing.

Findings from educational research are now coming to hand, and it is now appropriate to bring their significance to the attention of teachers. At the same time, teachers must be helped to realize that they are in fact the most influential of decision-makers.

Notes

1. Earth science and space science came in later, starting in the United States.

2. Professor Trowbridge (1976) has given an informative account of emphases in school science in the USA since 1800. Natural philosophy (now known as physics) appeared about 1800, and chemistry about the same time. Biology did not appear until 1905, and general science was first begun in 1910.

4. There was another project at the University of Guyana, directed towards the upper levels of All-Age schools, though I am unclear whether this was a purely local arrangement or whether an international agency was involved.

5. RLA142 was an exception. This project's science educators came from Belgium, Sweden and the USA, and took somewhat different approaches. That fact does not seem to have made any difference to the chances of survival of their work.

6. In retrospect, it is instructive to reflect on the congruence of plans and actions of the various governments of the region around that date, as well as on the kinds of aid received from international agencies, such as Unesco, World Bank, CEDO/British Council and others including voluntary service organizations of Canada and the USA. Six years after the emergence of the first independent Caribbean states, there was still a lot of dependence on First World expertise as well as on financial aid.

7. In due course, most countries (not Trinidad and Tobago) added junior secondary programmes to teachers' colleges. Trinidad and Tobago subsequently appointed a sizable proportion of university graduates to the junior secondary schools.

8. Note that this is not the same thing as saying that the boards themselves dominated the curriculum. One of the greatest mistakes made by teachers is to assume that they are obliged to provide a curriculum which has the same sequence as the examination syllabus.

9. The translation of the acronym is not important, since CREDO soon became CEDO, which was then absorbed into The British Council.

10. WISCIP/J, a relatively minor modification of WISCIP/B, was the first version tested in Jamaica.


12. I have not overlooked the fact that curriculum development these days will be undertaken by educators who belong to the country or region and who give their time free. The budget for expenses is likely to be a burden, and their time is taken at the expense of other work they could be doing.

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